ARCHITECTURE ENGINEERING PLANNING INTERIOR DESIGN COMMISSIONING

Material Specifications for:

Martin's Point Health Care

Medical Office Building

Portland, Maine

Project No. 08139

DATED: April 3, 2009

Issued for GMP (Progress Printing 3/20)

Volume 1 - Divisions 1 through 14

144 Fore Street | P.O. Box 618 | Portland, Maine 04104 | p 207.772.3846 f 207.772.1070 | ww.smrtinc.com

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SECTION 02000

SITE PERMIT REQUIREMENTS

PART 1 - GENERAL

A. Construction of this project must meet the terms and conditions of a State of Maine Site Location of Development Permit issued under delegated review by the City of Portland a City of Portland Site Plan Permit, and a Permit by Rule issued by the Maine Department of Environmental Protection.

B. Copies of the Permit Applications and Correspondence During Review of the Permits may be inspected during normal working hours at the office of:

DeLuca-Hoffman Associates Inc.
Consulting Engineers
778 Main Street Suite 8
South Portland, Maine 04106
(207) 775-1121

C. Any Contractor who desires to view the Permit Applications and Associated Correspondence must contact DeLuca-Hoffman Associates Inc. 48 hours prior to inspecting the information.

D. Certain conditions of the permits will be the responsibility of the Contractor. The specific condition for which the Contractor is responsible are expected to include:

1. MeDEP Site Location Permit: The City of Portland has Delegated Review Authority. The standard conditions of the Site Law apply. The Contractor will be expected to comply with:

   a) **Standard Condition 4.** Specifically, the Contractor shall provide a copy of the permit to any subcontractor.

   b) **Standard Conditions 8 and 9.** Specifically, the Contractor shall provide a copy of the permit to any subcontractors or bidders.

   c) **Special Condition 2.** Specifically, the Contractor shall take all necessary actions to ensure that its activities or those of its agents do not result in noticeable erosion of soils or fugitive dust emissions on the site during the construction and operation of the project covered by this approval.

   All other conditions of the MeDEP Permit are anticipated to be the responsibility of the Owner.

2. Local Permits:

   The Contractor will be required to secure a street opening permit from the City of Portland Public Works Department.

The Contractor is responsible for securing any permits not secured by the Owner pursuant to Condition 2 of the approvals.

PART 2 - PERMITS

Copies of the Permits received for the project follow this section.

END OF SECTION 02000

State of Maine Site Location of Development Permit
City of Portland Site Plan (Permit attached)
City of Portland Site Plan Permit Modification (not yet obtained)
and
Maine DEP Stormwater Management Law Permit

CITY OF PORTLAND, MAINE
PLANNING BOARD

David Silk, Chair
Shalom Odokara, Vice Chair
Bill Hall
Joe Lewis
Lee Lowry, III
Janice Tevanian
Michael J. Patterson

March 5, 2009

Ann Tucker
Martin's Point Health Care, Inc.
331 Veranda St.
Portland, ME 04112-9746

Dwight Anderson, P.E.
Deluca-Hoffman Associates, Inc.
778 Main St., Suite 8
South Portland, Maine 04106

RE: Martin's Point Healthcare Inc.
Application ID #: 2008-0123
CBL: 434 C001001

Dear Ms. Tucker,

On February 24, 2009 the Portland Planning Board considered the Martin's Point Healthcare proposal to construct a new Medical Office Building. The Planning Board reviewed the proposal for conformance with the standards for a Major Site Plan. The Planning Board voted unanimously (4-0) (Silk, Patterson, and Hall absent) to approve the application with the following motions and conditions as presented below.

SITE PLAN REVIEW

1. The Planning Board finds that the application is in compliance with the provisions of Division 26, Shoreland Regulations § 14-449 Land Use Standards (m) *General site plan feature,* subject to the condition of approval:

    i. The revised site plan that shows the Velocity Zone of the Floodplain map on the plan shall be reviewed for approval by the Zoning Administrator.

2. The Planning Board finds that with the imposition of conditions the plan is in conformance with the site plan standards of the City of Portland Land Use Code and under the Site Location of Development through the delegate review authority.

    i. Conditions of Approval:

        1. The applicant shall install a fully operational traffic signal at the Route 1/Main Drive intersection prior to issuance of a final Certificate of Occupancy. Signal activation shall be determined between the applicant and the Department of Public Services. The proposed pavement marking modifications identified in the signal design plans shall be reviewed and approved by the Planning Authority and Department of Public Services prior to installation of the traffic signal.

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2. The applicant shall develop a Travel Demand Management Plan and receive approval from the Planning Authority prior to issuance of a final Certificate of Occupancy.

3. The sidewalk on the south side of the site leading to the trail and the end islands in the parking lots shall be raised, unless the Department of Public Services finds the applicant's request for painted infrastructure is justified. If walkway is permitted, then the trail improvement will include additional wayfinding measures to ensure added adequate identification of the trail entrance and direction.

4. Prior to the issuance of a Building Permit, the applicant shall provide additional information on the anticipated interim parking deficit for review and approval by the Planning Authority and the Department of Public Services.

5. Prior to the issuance of a Building Permit the applicant shall receive approval of all stormwater management systems for compliance with Section V Stormwater Management Standards of the city's Technical and Design Standards and Guidelines from the Planning Authority and Department of Public Services.

6. The final design layout of the shoreway access trail in the area easterly of the proposed new building shall be approved by the Planning Authority and City Arborist. Prior to the issuance of a Certificate of Occupancy the applicant shall dedicate to the City of Portland the existing and proposed shoreway access trail from Veranda St. to the shoreline along the easterly and westerly ends of the site as a public recreational easement satisfactory to Corporation Counsel.

7. Prior to the issuance of a Certificate of Occupancy the applicant shall provide evidence of either non-applicability or conformance with Maine's Biomedical Waste Generator with the MDEP – Bureau of Remediation and Waste Management.

8. Prior to the issuance of a Building Permit the applicant shall obtain a letter from the Maine Historic Preservation Commission stating a finding of how the project will or will not affect the archaeologically sensitive area.

9. Prior to the issuance of a Building Permit the applicant shall receive a Certificate of Appropriateness from the Historic Preservation Committee.

The approval is based on the submitted plans and findings related to site plan review standards as contained in Planning Board Report #07-09 which is attached.

Please note the following provisions and requirements for all site plan and subdivision approvals:

1. The site shall be developed and maintained as depicted in the site plan and the written submission of the applicant. Modification of any approved site plan or alteration of a parcel which was the subject of site plan approval after May 20, 1974, shall require the prior approval of a revised site plan by the Planning Board or the planning authority pursuant to the terms of this article. Any such parcel lawfully altered prior to the enactment date of these revisions shall not be further altered

without approval as provided herein. Modification or alteration shall mean and include any deviations from the approved site plan including, but not limited to, topography, vegetation and impervious surfaces shown on the site plan. No action, other than an amendment approved by the planning authority or Planning Board, and field changes approved by the Public Services authority as provided herein, by any authority or department shall authorize any such modification or alteration.

2. The above approvals do not constitute approval of building plans, which must be reviewed and approved by the City of Portland's Inspection Division.

3. A performance guarantee covering the site improvements as well as an inspection fee payment of 2.0% of the guarantee amount and seven (7) final sets of plans must be submitted to and approved by the Planning Division and Public Services Dept. prior to the release of a building permit, street opening permit or certificate of occupancy for site plans.

4. The site plan approval will be deemed to have expired unless work in the development has commenced within one (1) year of the approval or within a time period agreed upon in writing by the City and the applicant. Requests to extend approvals must be received before the expiration date.

5. Final sets of plans shall be submitted digitally to the Planning Division, on a CD or DVD, in AutoCAD format (*,dwg), release AutoCAD 2005 or greater.

6. A defect guarantee, consisting of 10% of the performance guarantee, must be posted before the performance guarantee will be released.

7. Prior to construction, a pre-construction meeting shall be held at the project site with the contractor, development review coordinator, Public Service's representative and owner to review the construction schedule and critical aspects of the site work. At that time, the site/building contractor shall provide three (3) copies of a detailed construction schedule to the attending City representatives. It shall be the contractor's responsibility to arrange a mutually agreeable time for the pre-construction meeting.

8. If work will occur within the public right-of-way such as utilities, curb, sidewalk and driveway construction, a street opening permit(s) is required for your site. Please contact Carol Merritt at 874-8300, ext. 8828. (Only excavators licensed by the City of Portland are eligible.)

Philip DiPierro, Development Review Coordinator, must be notified five (5) working days prior to date required for final site inspection. The Development Review Coordinator can be reached at 874-8632. Please make allowances for completion of site plan requirements determined to be incomplete or defective during the inspection. This is essential as all site plan requirements must be completed and approved by the Development Review Coordinator prior to issuance of a Certificate of Occupancy. Please schedule any property closing with these requirements in mind.

If there are any questions, please contact Eric Giles at (207) 874-8723 or by email at egiles@portlandmaine.gov.

Sincerely,

David Silk, Chair
Portland Planning Board

Attachments:
1. Planning Board Report #07-09
2. Performance Guarantee Packet

Electronic Distribution:
Penny St. Louis Littell, Director of Planning and Urban Development
Alexander Jaegerman, Planning Division Director
Barbara Barhydt, Development Review Services Manager
Eric Giles, Planner
Philip DiPierro, Development Review Coordinator
Marge Schmuckal, Zoning Administrator
Tammy Munson, Inspections Division Director
Lisa Danforth, Administrative Assistant
Michael Bobinsky, Public Services Director
Kathi Earley, Public Services
Bill Clark, Public Services
David Margolis-Pineo, Deputy City Engineer
Jane Ward, Public Services
Keith Gautreau, Fire
Jeff Tarling, City Arborist
Tom Errico, Wilbur Smith Consulting Engineers
Dan Goyette, Woodard & Curran
Assessor's Office
Approval Letter File
Hard Copy: Project File

PLANNING BOARD REPORT #07-09

MARTIN'S POINT HEALTHCARE
331 VERANDA ST.
AMENDED MAJOR SITE PLAN
MARTIN'S POINT HEALTHCARE INC., APPLICANT

Submitted to:

Portland Planning Board
Portland, Maine
February 24, 2009

Prepared by:

Eric Giles, AICP, Planner
February 18, 2009

I. INTRODUCTION

This is a report to the City of Portland Planning Board regarding a request for site plan approval by Martin's Point Healthcare Inc. This proposal will amend a previously approved site plan by redesigning the Medical Office Building and the internal road network. The site plan is proposed on 11.5 acres and is being reviewed under Portland's Site Plan Ordinance and Site Location of Development Permit delegated review authority. The stormwater management permit is being reviewed under Portland's Ch. 500 Stormwater Management delegated review authority. The property is located in an R-P Residence Professional zone permitting healthcare uses.

The Planning Board held a workshop on January 13, 2009 and the applicant held a neighborhood meeting on February 12, 2009. Please reference A2 and B4.

Applicant:	Martin's Point Healthcare Inc.
Technical Assistance:	Dwight Anderson, P.E., Deluca-Hoffman Associates, Inc. Scott L. Benson, AIA, NCARB, SMRT, Inc.

A. Public Notice:

128 notices were mailed announcing this Public Hearing and the legal ad appeared in the Portland Press Herald February 17 and 18, 2009. As of the writing of this report no public comment has been received.

B. Site Location:

Proposed Site Plan Martin's Point Healthcare

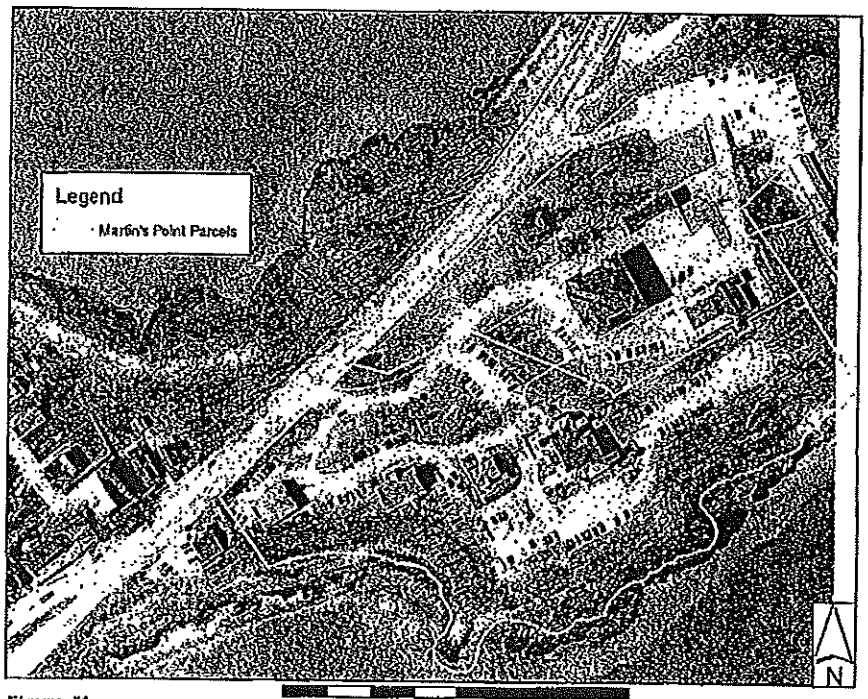


Figure #1

The site is located off Veranda St. (Route 1) and can be accessed via an internal driveway. The Casco Bay surrounds the property and residential uses are located to the west of the site.

C. **Existing Land Use:**

The current use of the property is a medical campus located on a peninsula that was developed by the U.S. military as the Portland Marine Hospital. The site consists of multiple buildings and pedestrian and vehicular entries arranged in a campus configuration. The Marine Hospital building was built in 1859 and has both historic and architectural significance as one of the last remaining marine hospitals in the country. It is a designated historic landmark, protected by both local and federal historic preservation regulations.

A site plan for the property was approved in 2006 which proposed a 2-phase development project. Phase I proposed renovating the existing Portland Marine Hospital and Phase II proposed constructing a new Medical Office Building and expanding the parking area. Phase I was completed in 2008. The applicant is now requesting to amend Phase II which includes the Medical Office Building and expanded parking area.

II. PROJECT DATA

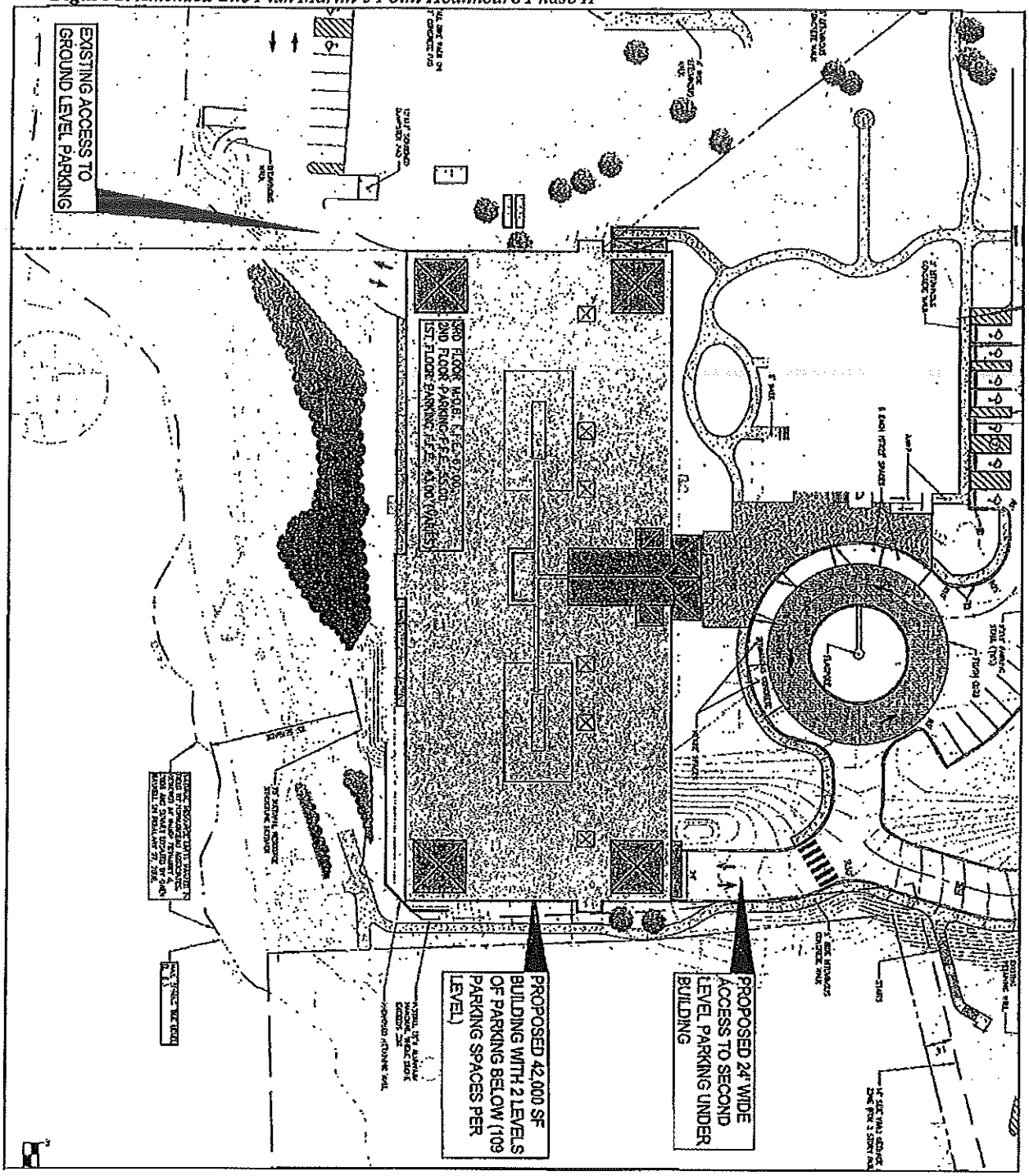
Zone	R-P Residence Professional
Parcel Size	11.5 acres
Parking Spaces	*Required:* 242
	Proposed: 442
Bicycle Parking	*Required:* 27
	Proposed: 28
Building Floor Area	*Previous Approval:* 54,000 sq. ft.
	Proposed: 42,000 sq. ft.
Building Height	*Maximum:* 45 ft.
	Proposed: 21-45 ft.
Adjacent Zoning and Land Uses	*North:* Casco Bay
	South: Casco Bay
	East: Casco Bay, Town of Falmouth
	West: R-5, Residential

III. PROPOSED DEVELOPMENT

The site plan includes two development proposals. The applicant proposes to redesign the Medical Office Building with underground parking and amend the internal road network to redesign the parking layout and allow for a second access onto Veranda St.

1. Medical Office Building: The 2006 site plan proposed a 54,000 sq. ft. 2-level Medical Office Building and a separate 3-level parking garage located on the southeastern portion of the site. The amended site plan changes the layout of the Medical Office Building and parking garage to one 3-level structure. The Medical Office Building is proposed as a single-story 42,000 sq. ft. building footprint with 2-levels of parking below (109 parking spaces per level). The underground parking is accessed from the front via a roundabout and the rear from an existing parking area. Please reference Figure 2 below.

Figure 2: *Amended Site Plan Martin's Point Healthcare Phase II*



2. Internal Road Network and Parking Layout: The 2006 site plan included an expanded parking lot on the northern slope of the site. The amended site plan eliminates the expanded parking lot in favor of utilizing an existing parking area on the northeastern portion of the site. Other changes include utilizing an existing access onto Veranda St. as a second access point from the northeast parking area. A traffic signal will be installed at the Main Drive/Veranda St. intersection. Please reference **Figures 3** and 4 below.

Figure 3: *Revised Parking Layout*

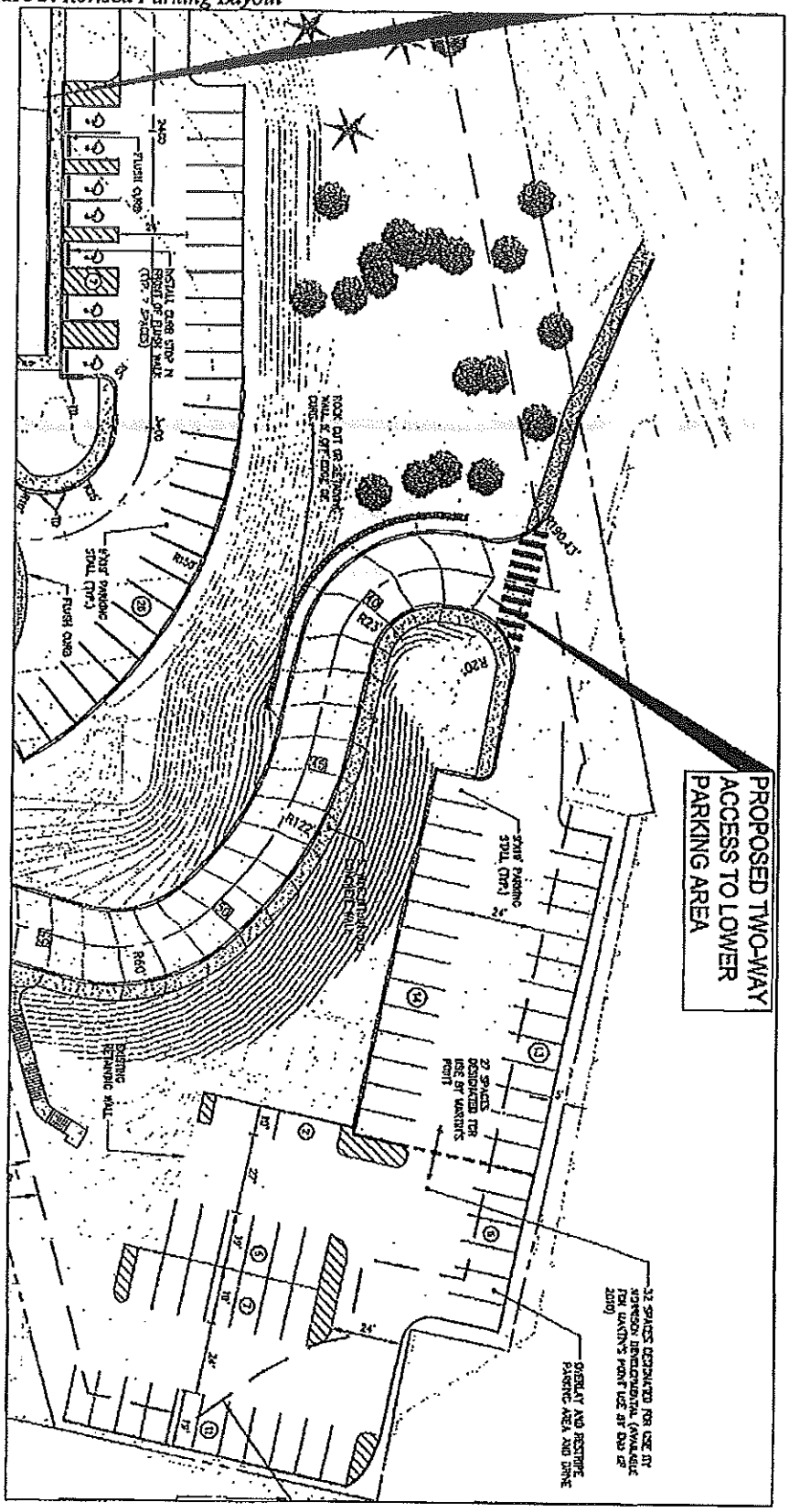
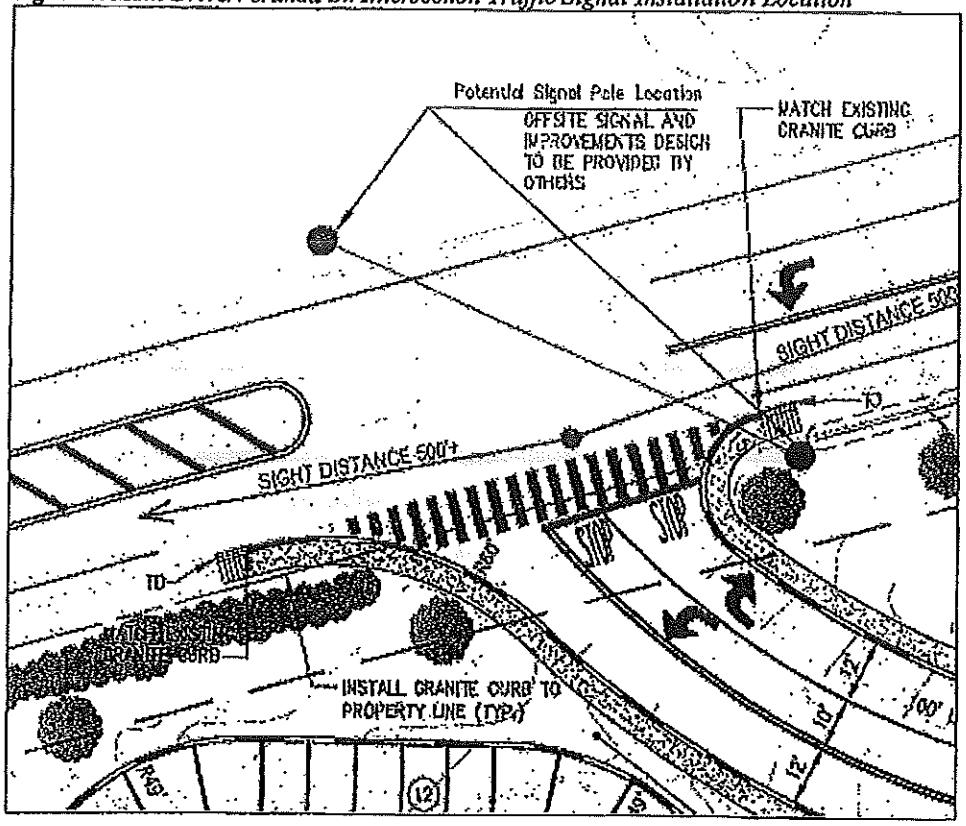


Figure 4: *Main Drive/Veranda St. Intersection Traffic Signal Installation Location*



IV. STAFF REVIEW

The proposed development has been reviewed by staff for conformance with the zoning regulations and review standards of the site plan ordinance. Agency comments are included in the relevant sections of this report.

A. ZONING

The project site is located in an R-P Residence Professional zoning district, Shoreland Overlay Zone and is mapped as Flood Zone C - An area that is determined to be outside the 100- and 500-year floodplains according to FEMA-FIRM Panel Number 230051 00008 B. The site plan has been reviewed by the Zoning Administrator for compliance with Chapter 14 Land Use, Article III Zoning of the City of Portland Code of Ordinances (Attachment 6).

1. The site plan is compliant with the purpose, permitted uses, dimensional requirements, and external effects listed under Chapter 14 Land Use, Article III Zoning, Division 8 R-P Residence Professional Zone, § 14-146--14-152 of the City of Portland Code of Ordinances.
2. Marge Schmuckal, Zoning Administrator, recommends that the Velocity Zone of the Floodplain map be shown on the site plan, rather than on a separate sheet, in order to confirm that the proposed structure is not impacted by the zone (Attachment 6).

B. SHORELAND ZONING GENERAL SITE PLAN FEATURES

The proposed site plan will disturb area within the Shoreland Zoning 75' setback for the purpose of creating a shoreway trail and constructing the southeast corner of the Medical Office Building. According to Section 14-449 (m) of the City of Portland Code of Ordinances, the Planning Board shall approve a site plan located within a Shoreland Zone if it finds that the following standards, in addition to the standards set forth in Section 14-526, are met:

1. The proposal will maintain safe and healthful conditions; The proposal will maintain safe and healthful conditions due to the fact the amended site plan minimizes encroachment of the Medical Office Building into the Shoreland Zone Setback, mitigates water quality pollution from stormwater runoff, and develops a public shoreway access trail for safe low-intensity recreational use.

2. The proposal will not result in water pollution, erosion, or sedimentation to surface water; The proposal will not result in water pollution, erosion, or sedimentation to surface water because the proposed site plan reduces the amount of impervious surface previously approved, installs water quality treatment units to mitigate stormwater runoff, and requires the implementation of a stormwater management and soil erosion and sedimentation plan.

3. The proposal will adequately provide for the disposal of all wastewater; As all structures will utilize municipal sewer and water utilities adequate disposal of wastewater will be provided.

4. The proposal will not have an adverse impact on spawning grounds, fish, aquatic life, bird or other wildlife habitat; Letters from the Maine Department of Inland Fisheries and Wildlife (*4/6/2006*), U.S. Department of Interior Fish and Wildlife Service (*2/28/2006*), and the Maine Department of Conservation state, neither significant wildlife habitats, rare botanical features nor any threatened or endangered species exist on the site. The Maine Department of Inland Fisheries and Wildlife recommended the applicant maintain a 75' buffer from the mean high water mark along the seaward edges of the project site. The proposed site plan maintains a 75' setback from the mean high water mark in accordance with the Shoreland Overlay Zone.

   GIS data produced by the USFWS Gulf of Maine Coastal Program show the proposed site plan to be an area with low overall habitat values for the 91 priority trust species of the U.S. Fish & Wildlife Service.

   The site is also a part of the Presumpscot River estuary. According to the 2003 Presumpscot River Management Plan the estuary was considered to be in a degraded condition. The degraded condition was attributed to upstream cumulative man-made impacts on the Presumpscot River ecosystem.

   The proposed site plan preserves shoreland vegetation, provides water quality treatment of stormwater runoff, and implements erosion and sedimentation control measures during construction. Therefore, the proposal will not result in further degradation of aquatic life or have an adverse impact upon wildlife habitat.

5. The proposal will conserve shore cover and visual, as well as actual, points of access to inland and coastal waters; The proposal will conserve shoreland in accordance with a vegetation preservation and construction management plan and provide pedestrian access to the shoreland however, no points of access to inland and coastal waters exist.

6. The proposal will protect archaeological and historic resources; Archaeological and historic resources will be protected because the applicant shall be required to consult with the Maine Historic Preservation Office prior to any construction activity and obtain a Certificate of Appropriateness from the City of Portland Historic Preservation Committee.

7. The proposal will not adversely affect existing commercial fishing or maritime activities; The proposed use of the site as a Medical Campus will not affect commercial fishing or maritime activities.

8. The proposal will avoid problems associated with flood plain development and use; According to FEMA-FIRM Panel Number 230051 00008 B, the project area is determined to be outside the 100- and 500-year floodplains. Therefore, the proposal will avoid problems associated with flood plain development and use.

9. The proposal is in conformance with the standards set forth in this section; The proposed site plan is in substantial compliance with the Land Use Standards of Sec. 14-449 (a)-(l) because the principal structure maintains a 75' setback from the normal high water line, no water structures are proposed, vegetative clearance in the resource protection zone is limited to the development of the shoreway access trail, an erosion and sedimentation control plan has been created in conformance with MDEP Best Management Practices, the structures can be established without creating adverse environmental impacts, no uses are proposed which discharge pollutants that will impair the Casco Bay, the applicant shall submit the proposed site plan to the Maine Historic Preservation Office for review, no public utilities are proposed to be installed within the shoreland protection zone, all new roads and driveways are setback 75' from the normal high water line, no new parking areas are proposed, the stormwater runoff control system shall be reviewed to be in compliance with the Portland Technical and Design Standards and Guidelines, and no agriculture uses are proposed.

C. SITE PLAN REVIEW

The proposed site plan has been reviewed by staff for conformance with the applicable review criteria under Section 14-526 Standards within Article V of the Site Plan Ordinance.

1. Effects on Public Health, Safety, and Environment

a. Effects on Traffic and Safety (14-526 (a)(1)(2))

i. *Traffic Access and Circulation:* Pedestrian and vehicular traffic access the site from Veranda St., a publicly maintained road. Existing sidewalks along Veranda St. provide pedestrian access to the site and extend into the Town of Falmouth. Two existing points of ingress/egress will be utilized for vehicular traffic access. The primary access point located at the Main Drive/Veranda St. intersection will be rebuilt to include a traffic signal and 34' wide access apron. A second access will be utilized for the northeast parking area and provide connectivity to the proposed underground parking.

The internal road network from Veranda St. will have paved 24' driveway widths to maintain adequate access onto public roads and create traffic circulation patterns sufficient for vehicular and pedestrian maneuverability and loading and unloading.

Thomas Errico, P.E., Consulting Traffic Engineer, reviewed the revised site plan (Attachment 7). He had suggested in his December memo that a pedestrian walkway on the south side of the site leading to the trail and the end islands in the parking lots be raised rather than painted. No changes were proposed to address this suggestion and Mr. Errico recommends raised sidewalk and islands, unless the applicant has supporting documentation to justify painting these features. Mr. Errico is requesting additional information to justify this request.

ii. *Traffic Trip Generation:* A Traffic Movement Permit (TMP) approved in 2006 concluded that the level of service (LOS) at the Main Drive/Veranda St. intersection operates below a Level 'D'. The 2006 conditions of approval required the applicant to install a traffic signal, develop a travel demand management plan, make a $1,000 financial contribution toward the installation of a supplemental stop sign, and install an advance "stop ahead" warning sign. The applicant has provided the Department of

Public Services the $1,000 contribution. In a 12/3/08 and 2/19/09 memos, Thomas Errico, Consulting Traffic Engineer to the Department of Public Services, reaffirmed the following (Attachment 7). :

a. The traffic signal requirement and the final review and approval of the pavement marking modifications on Route 1; and
b. A TDM plan shall be prepared and approved the City.

Based on comments submitted by Mr. Errico and the 2006 TMP, a traffic safety hazard exists due to the fact the existing LOS on Veranda St. functions below a Level 'D'.

Parking: The parking summary submitted by the applicant shows 268 existing off-street vehicle spaces and upon construction completion the site will have 442 off-street spaces. In a memo dated 1/5/09, the Zoning Administrator has determined 242 parking spaces are required to satisfy off-street parking requirements for the site. In Mr. Errico's review of the parking study, he notes there is a slight parking deficit in the long-term, which does not concern him. He is concerned about the parking supply deficit due to designated spaces for the Morrison Center until 2011. He recommends that additional information be submitted by the applicant to respond to the interim deficit (Attachment 7).

Based on the site plan standard approximately 27 bike spaces are required. The Board may reduce the required number upon review of evidence that the demand or usage for such spaces will be below that required due to unique characteristics of the development. The applicant has provided 28 spaces and stated only one employee rides a bike to work in the summer season.

b. Natural Resources Impact (14-526 (a)(8)(11)(20)(21))
   i. *Soil Erosion and Sediment Control:* Soil data from the USDA Natural Resources Conservation Service (NRCS) identify the following soils:

Soil Type	Symbol	Drainage Class Rating	Hydrologic Soil Group
Hollis fine sandy loam	**HrB**	**Somewhat Excessively Drained**	**C/D**
Hollis fine sandy loam	**HrC**	**Somewhat Excessively Drained**	**C/D**
Suffield silt loam	**SuC2**	**Moderately Well Drained**	**C**
Windsor loamy sand	**WmB**	**Somewhat Excessively Drained**	**A**

According to the NRCS, the site primarily consists of *HrB, HrC,* hollis fine sandy loamy soils with a Hydrologic Soil Group C and D. Group C soils have a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture.

The applicant has proposed an Erosion and Sedimentation Control Plan (ESCP) which is in accordance with the "Maine Erosion and Sedimentation Control BMP" manual and implements pre-construction, construction and post-construction mitigation measures. The proposed ESCP satisfies a portion of the Basic Standard requirements under the State of Maine Department of Environmental Protection (MDEP) Ch. 500 Stormwater Management Regulations.

ii. *Stormwater Management:* This project will be reviewed under the City's Stormwater Management Chapter 500 delegated review authority. As of the writing of this report the applicant's proposed stormwater management plan is under review with Dan Goyette, P.E., Consulting Engineer to the Department of Public Services. The applicant states new impervious area since 1975 results in 2.92 acres. The applicant proposes water quality treatment of pavement instead of roof area for a total of 2.20 acres. The stormwater management plan is presented as follows:

There are six categories of stormwater standards: Basic, General, Phosphorus, Flooding, Urban Impaired Stream, and Other. The standards applicable to this project are listed below:

1. Basic Standards: A project must meet basic standards if it disturbs an area of one acre or more. The proposed development will result in 2.92 acres of impervious surface therefore it must meet these basic standards. These standards require the applicant to address erosion and sediment control, inspection and maintenance procedures, and general housekeeping requirements.

   The applicant has submitted a Stormwater Management Plan which includes an ESCP and a plan for stormwater infrastructure inspection, maintenance, and housekeeping. All aspects of these plans are compliant with the "Maine Erosion and Sedimentation Control BMP" manual and satisfy the Ch. 500 Basic Standards.

2. General Standards: A project must meet general standards in addition to the basic standards, if it disturbs an area of one acre or more and results in any of the following:

   a. 20,000 sq. ft. or more of impervious area, or 5 acres or more of developed area, in the direct watershed of an urban impaired stream; or
   b. One acre or more of impervious area, or 5 acres or more of developed area, in any other stream, coastal, or wetland watershed.

   The development must meet the general standards since the project will create 2.92 acres of impervious surface.

   General standards require stormwater management systems to control the frequency and duration of runoff flows, provide for effective water quality treatment of pollutants, and mitigate potential temperature impacts to receiving waters. The approved methods to treat stormwater include wet ponds, detention structures using filters, infiltration systems, or vegetative buffers. The methods for treatment must control runoff from no less than 95% of the impervious area and no less than 80% of the developed area associated with the project.

   The applicant's stormwater management plan proposes water quality treatment for 11 areas of the site comprising of Storm Treat and Filterra Units and two vegetated filter areas. The applicant states new impervious area since 1975 results in 2.92 acres. The applicant proposes water quality treatment of pavement instead of roof area for a total of 2.20 acres.

   Flooding Standards: Under Ch. 500 Standards Section (4)(E)(2) Waiver of the flooding standard, a project is eligible for a waiver from the flooding standard

when drainage discharges to the ocean, a great pond or a major river segment. The applicant claims to be waived from the flooding standards because stormwater plan proposes discharging into the tidal waters of the Casco Bay.

iii. *Wetlands:* No wetlands exist on the site.

iv. *Groundwater Quantity and Quality:* The site is not located in an area of shallow groundwater. Groundwater quantity and quality will not be negatively impacted by additional usage or nutrient enrichment from inadequate wastewater treatment and stormwater management.

v. *Wildlife and Fisheries Habitats:* Letters from the Maine Department of Inland Fisheries and Wildlife *(4/6/2006)* and U.S. Department of Interior Fish and Wildlife Service *(2/28/2006)* state, neither significant wildlife habitats nor any threatened or endangered species exist on the site. The Maine Department of Inland Fisheries and Wildlife recommended the applicant maintain a 75' buffer from the mean high water mark along the seaward edges of the project site.

GIS data produced by the USFWS Gulf of Maine Coastal Program show the proposed site plan to be an area with low overall habitat values for the 91 priority trust species of the U.S. Fish & Wildlife Service.

The site is also a part of the Presumpscot River estuary. According to the 2003 Presumpscot River Management Plan the estuary was considered to be in a degraded condition. The degraded condition was attributed to upstream cumulative man-made impacts on the Presumpscot River ecosystem.

The proposed site plan preserves shoreland vegetation, provides water quality treatment of stormwater runoff, and implements erosion and sedimentation control measures during construction. Therefore, the proposal will not result in further degradation of aquatic life or have an adverse impact upon wildlife habitat.

vi. *Unusual Natural Areas:*

1. Bluff Stability: The Maine Geological Survey defines a bluff as a steep shoreline slope formed in sediment (loose material such as clay, sand, and gravel) that has three feet or more of vertical elevation just above the high tide line.

   Figure 5 below shows the relative stability of bluffs along Martin's Point coast line. The slope, shape, and amount of vegetation covering a coastal bluff and the adjacent shoreline are directly related to the susceptibility of the bluff face to ongoing erosion. The coastal bluffs along the southwestern shoreline demonstrate Unstable to Highly Unstable bluff hazards. The site plan does not propose development activities within the Unstable to Highly Unstable shoreline.

Martin's Point Healthcare Bluff Stability

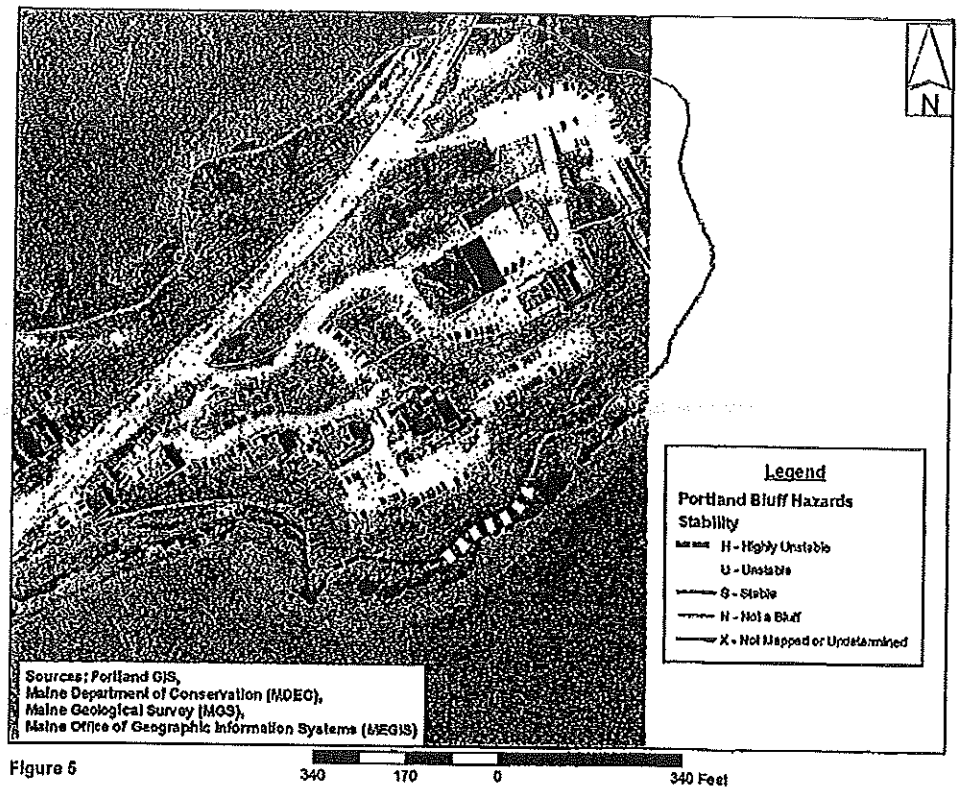


Figure 5

c. Public Facilities Impact (14-526 (a)(5)(10))

i. *Emergency Services:* The property is located in the vicinity of the East Deering and Munjoy Hill Fire Station which have operating fire engines with rescue tools and medical A.L.S. life-saving equipment. Capt. Cass of the Fire Department provided agency comments regarding concerns with fire access and hydrant flows. The applicant addressed these concerns in attachment B2 with fire truck access maps and hydrant flows from the Portland Water District.

ii. *Water and Sewer Capacity:* As of the writing of this report no water and sewer capacity letters have been submitted from the Public Services Department.

iii. *Storm Drains:* All stormwater runoff will be conveyed to privately maintained facilities and will not discharge to any public drains. The applicant has provided a maintenance agreement as a part of their ESCP.

iv. *Solid Waste:* Under the MDEP Ch. 900 Biomedical Waste Management Rules, a medical facility generating 50 pounds or greater of biomedical waste must register as a Biomedical Waste Generator. The staff recommends as a condition of approval, that the applicant submit evidence of meeting the State requirements.

v. *Schools:* The proposed use will not impact existing schools.

2. **Impact on Neighboring Properties**

a. Proposed Building Bulk, Location or Height (14-526 (a)(3)(4))

ft. from the property line.

4. **Other Requirements** – *None required*

V. MOTIONS FOR THE BOARD TO CONSIDER

On the basis of plans and materials submitted by the applicant and on the basis of information contained in Planning Report #07-09 relevant to standards for site plan regulations, and other findings as follows:

1. The Planning Board finds that the application (*is/is not*) in compliance with the provisions of Division 26, Shoreland Regulations § 14-449 Land Use Standards (m) *General site plan feature,* subject to the condition of approval:

    i. A revised site plan shall be submitted prior to the issuance of a building permit that shows the Velocity Zone of the Floodplain map on the plan for review and approval by the Zoning Administrator.

2. The Planning Board finds that with the imposition of conditions the plan (*is/is not*) in conformance with the site plan standards of the City of Portland Land Use Code and under the Site Location of Development through the delegate review authority.

    i. Conditions of Approval:

        1. The applicant shall install a fully operational traffic signal at the Route 1/Main Drive intersection prior to issuance of a final Certificate of Occupancy and that proposed pavement marking modifications identified in the signal design plans shall be reviewed and approved by the Planning Authority and Department of Public Services prior to installation of the traffic signal.

        2. The applicant shall develop a Travel Demand Management Plan and receive approval from the Planning Authority prior to issuance of a final Certificate of Occupancy.

        3. The sidewalk on the south side of the site leading to the trail and the end islands in the parking lots shall be raised, unless the Department of Public Services finds the applicant's request for painted infrastructure is justified based upon additional documentation from the applicant.

        4. Prior to the issuance of a Building Permit, the applicant shall provide additional information on the anticipated interim parking deficit for review and approval by the Planning Authority and the Department of Public Services.

        5. Prior to the issuance of a Building Permit the applicant shall receive approval of all stormwater management systems for compliance with Section V Stormwater Management Standards of the city's Technical and Design Standards and Guidelines from the Planning Authority and Department of Public Services.

        6. Prior to the issuance of a Building Permit the applicant shall dedicate to the City of Portland the existing and proposed shoreway access trail from Veranda St. to the shoreline along the easterly and westerly ends of the site as a public recreational easement satisfactory to Corporation Counsel.

7. Prior to the issuance of a Certificate of Occupancy the applicant shall provide evidence of either non-applicability or conformance with Maine's Biomedical Waste Generator with the MDEP – Bureau of Remediation and Waste Management.

8. Prior to the issuance of a Building Permit the applicant shall obtain a letter from the Maine Historic Preservation Commission stating a finding of how the project will or will not affect the archaeologically sensitive area.

9. Prior to the issuance of a Building Permit the applicant shall receive a Certificate of Appropriateness from the Historic Preservation Committee.

Attachments:

A. Planning Dept. Correspondence
   1. Planning Board Letter of Approval 5/02/06
   2. Planning Board Memo 1/13/09
   3. Tom Errico, Consulting Traffic Engineer 12/03/08
   4. Marge Schmuckal, Zoning Administrator 11/26/08
   5. Capt. Cass, Fire Chief 11/25/08
   6. Marge Schmuckal, Zoning Administrator, 2/18/09
   7. Thomas Errico, P.E., Consulting Traffic Engineer, 2/19/09
   8. Jeff Tarling, City Arborist, 2/18/09

B. Applicant's Submittal
   1. Application 11/20/08
   2. Applicant's Response to Peer Review Comments 12/30/08
   3. Final Site Plan Submittal 2/03/09
   4. Neighborhood Meeting Certification

C. Plan Set
   1. Final Site Plan 2/3/09

SECTION 02009

LAYOUT OF WORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The Owner has retained Owen Haskell Inc., licensed land surveyors, to establish a project benchmark, survey control points, and to establish the site property boundary. For the purposes of this specification, this shall be the limit of Owner-provided survey control to the contractor.

B. The Contractor shall employ a land surveyor licensed in the State of Maine to lay out the work from the established reference points and bench marks, base lines, and the coordinate system indicated on the drawings, and shall be responsible for all measurements in connection with the layout. AutoCAD 2009 files will be furnished to the Contractor upon written request. The licensed land surveyor shall certify in writing that the layout was performed under his/her direct supervision and is correct and meets the requirements of the contract documents. A copy of the certificate shall be furnished to the Architect.

The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Owner. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Owner until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Owner may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

C. The layout shall establish the locations of silt fence and areas of trees to be protected for review and approval of the Owner prior to clearing.

D. Establish and plainly mark center lines for the site work and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each structure, athletic fields, roadways, utilities, and parking lots, are in accordance with lines and elevations shown on contract drawings.

E. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work.

1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the Owner before any work is placed.

2. A detailed check of all coordinates, resultant pipe lengths, backslopes, and appurtenant locations shall be made by the registered land surveyor or civil engineer and provided to the Owner prior to starting utility lines.

F. During progress of work, the Contractor shall have line grades and plumbness of all major work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the Owner before any major items are placed. In addition, Contractor shall furnish to the Owner certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.

1. Elevations of all pavement areas and building pads.
2. Lines and elevations of sewers, storm drains, utility systems.
3. Lines of elevations of all swales and drainage areas.
4. Lines of elevations of parking area.
5. Horizontal and alignment of all access drives.
6. Record conditions of the stormwater management system.

After binder pavement is placed, the Contractor shall have the binder surface surveyed. A profile of each drive with elevations at 50 stations and location of spot grades shown on the grading and drainage plan including all frames and covers shall be obtained by the surveyor, recorded on the plans, and provided to the Engineer for review. Any areas not meeting the design requirements shall be corrected by the Contractor by removal of binder pavement and replacement at no cost to the Owner.

G. Record Drawings:

1. The Contractor shall record the following information for buried utilities including the location of all appurtenances and controls including control or shutoff valves, manholes, head holes, and inlets.
2. All information shall be identified on a CAD reproducible drawing by a number or letter with a schedule of locations by coordinates tied to the Maine State Coordinate Grid.

H. The location of catch basins and manholes shall be accurately located by a registered land surveyor. Catch basins and manholes shall be located from the layout data and established on the contract drawings.

I. Whenever approved changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to the Architect.

J. Changes in location, additions and appurtenant items such as, but not limited to, manholes, inlets, pipe lines and conduits shall be shown in same manner as on contract drawings (by coordinates or dimensions from buildings); however, if no such locations are shown on contract drawings, changes in locations of items shall be shown by a sufficient number of right-angled dimensions from the nearest building.

K. Contractor is responsible for all costs associated with layout of work and any costs associated with correcting non-conforming work or with restoring the landscape to its original condition.

L. The coordinates or data shown on the civil drawings for the building shall be for orientation only. Use the architectural and structural drawings for exact building dimensions and layout data for the building.

M. The survey data obtained for this section shall be incorporated into the project record drawings and profiles.

END OF SECTION 02009

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition and removal of designated site structures or other site features from the site.

B. Disconnecting and capping or removal of identified utilities which are not proposed to be used as part of this project.

C. Filling voids in subgrade created as a result of removals or demolition.

D. Removal and disposal of solid waste.

1.2 RELATED SECTIONS

A. Section 02100 - Site Preparation.

B. Section 02200 – Earthwork.

C. The work shall comply with the erosion control plan appended to the end of Section 02270.

D. Section 02227 - Aggregate Materials: Backfill materials.

E. Construction drawings.

F. Stormwater Pollution Prevention Plan.

1.3 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of capped utilities, and subsurface obstructions.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable local code for demolition of structures, safety of adjacent structures, dust control and runoff control.

B. Obtain required permits and licenses from authorities. Pay associated fees including disposal charges.

Permits, fees, and licenses shall be secured and paid for by the General Contractor. It is the General Contractor's responsibility and obligation as part of the contract to pay for all charges for containers, transport, tipping fees, and disposal of all solid waste generated during demolition and during the construction of the project. These fees shall be paid for by the General Contractor and included as part of the base bid. The Owner will not reimburse the General Contractor for these fees separately. The General Contractor shall provide the Owner with appropriate "bills of lading" demonstrating proper disposal of all waste.

The State of Maine Department of Environmental Protection Site Location of Development Permit for this project has specific requirements for the transport and disposal of solid waste. The General Contractor shall review these requirements and enter into a contract for the transportation and disposal of all solid waste in accordance with representations made in the permit application as well as the conditions of the permit. Solid waste generated by the project shall be hauled by a MeDEP department-licensed category A and B waste transporter to a department-licensed solid waste facility.

Any modification/revision to the representations made within the Site Location of Development Act Permit with regards to transport/disposal of solid waste requires the General Contractor to file an "Application for Project Modification" with the Maine Department of Environmental Protection under delegated review by the City of Portland. Any fees associated with preparing/processing of this application shall be the responsibility of the General Contractor.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Do not close or obstruct roadways or sidewalks without permits.

E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

F. Test soils around buried tanks for contamination.

1.5 JOB CONDITIONS

A. A large retaining wall requiring demolition exists in this project.

B. Owner assumes no responsibility for condition of items to be demolished.

C. Removed items of salvageable value to Contractor may be removed from the site with the Owner's permission except where noted on the Drawings to be salvaged or reused. Storage or sale of removed items on site will be permitted but shall not interfere with any other work in the contract documents.

D. Conditions existing at time of inspection for bidding purposes will be maintained by Owner in so far as practicable.

E. Explosives shall not be brought to site or used without written consent of authorities having jurisdiction. Such written consent will not relieve Contractor of total responsibility for injury to

persons or for damage to property due to blasting operations. The performance of any required blasting shall comply with governing regulations.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

Aggregate materials specified in Section 02227.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide, erect, and maintain temporary barriers and security devices at locations indicated.

B. Protect existing landscaping materials, appurtenances and structures which are not to be demolished. Repair damage caused by demolition operations at no cost to Owner. No trees are to be removed without prior consent by the Owner.

C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.

D. Mark location of utilities. Protect and maintain in safe and operable condition the utilities to remain. Prevent interruption of existing utility service occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities.

3.2 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent structures or pavements.

B. Cease operations immediately if adjacent structures appear to be in danger. Notify authority having jurisdiction. Do not resume operations until directed.

C. Conduct operations with minimum interference to public or private access. Maintain access and egress at all times.

D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

E. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.

F. Comply with governing regulations pertaining to environmental protection.

G. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.3 DEMOLITION

A. Proceed in the demolition and remove materials from site using methods as required to complete work within limitations of governing regulations.

B. Demolish concrete and masonry in small sections. Break up concrete slabs-on-grade and remove from the site. Remove complete building foundation and slabs regardless of depth.

3.4 FILLING VOIDS

A. Completely fill below grade areas and voids resulting from demolition using approved select fill materials consisting of stone, gravel, and sand free from debris, trash, frozen materials, roots and other organic matter.

B. Ensure that areas to be filled are free of standing water, frost, frozen, or unsuitable material, trash and debris prior to fill placement.

C. Place fill materials in horizontal layers not exceeding 8" in loose depth and compact each layer at optimum moisture content of fill material to proposed density, unless subsequent excavation for new work is required.

D. Grade surface to match adjacent grades and to provide flow of surface drainage after fill placement and compaction.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from site debris, rubbish, and other materials resulting from demolition operations. All demolished or removed items shall be disposed of in accordance with the applicable State, Local and Federal regulations.

B. Stumps and grubbings are to be transported to a MeDEP licensed facility in accordance with Local and State regulations.

C. Transport materials removed with appropriate vehicles and dispose off-site to areas which are approved for disposal by governing authorities and appropriate property owners.

E. The Site Location of Development Permit issued by the State of Maine for this project has specific requirements for the transport and disposal of solid waste. The Contractor shall review these requirements and enter into a contract for the transportation and disposal of all solid waste in accordance with representations made in the permit application as well as the conditions of the permit.

F. The permits issued for this project prohibit the placement of any material in areas not specifically shown on the Contract Documents.

G. Areas of any existing on-site solid waste shall be disposed of in accordance with applicable State, Local and Federal regulations. The Contractor shall review the site conditions to determine the quantity and composition of waste.

3.6 UTILITY SERVICES

A. Demolish and remove outside utility lines as follows:

1. Any utility which is to be abandoned and located within 36 inches of the final finish grade.
2. Any storm drain which is to be abandoned.
3. Any overhead utility which is discontinued.
4. Other abandoned lines which would interfere with performance of this contract.

B. Plug and seal any abandoned utility lines not scheduled for removal as follows:

1. All pipelines shall be plugged at any appurtenant opening or point of breakage which occurs during construction of the work.
2. The portion of the appurtenant utility structures which is more than 36 inches below grade shall be dewatered, all entry lines shall be sealed, and the void shall be filled with clean stone gravel or sand and compacted.

END OF SECTION 02050

SECTION 02100

SITE PREPARATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Clearing site of debris, structures, pavement, grass, trees and other plant life or site elements in preparation for site or building excavation work.

B. Protection of existing structures, trees or vegetation indicated on the contract documents to remain. Unless otherwise shown, the grading limit shown on the drawings is the work limit. The Owner reserves the right to adjust the layout or clearing limit to protect major trees. No tree removal is to take place without review and consent by the Owner.

C. Stripping topsoil from areas that are to be incorporated into the limits of the project and where so indicated on the construction drawings.

1.2 RELATED SECTIONS

A. Section 02000 - Site Permit Requirements

B. Section 02050 – Demolition

C. Section 02200 – Earthwork

D. Section 02270 - Slope Protection and Erosion Control

E. Construction Drawings

F. Geotechnical Report

An erosion/sedimentation control program has been prepared for this project and is a part of the Project Permit Applications. The program is appended to Section 02270, Slope Protection and Erosion Control, of these specifications. Scheduling constraints, stabilization of disturbed areas, and the other requirements of this program shall be strictly adhered to. Any and all penalties which are imposed on the Owner for the failure to comply with these provisions shall be paid by the Contractor.

A subsurface geotechnical investigation of the site was undertaken as a part of this project. A copy of the geotechnical investigation is being provided as part of the bid documents. This document was obtained only for the Owner's use in design and interpretation of the data for purposes of construction is the responsibility of the Contractor. The report is being made available for information purposes, but is not a warranty of subsurface conditions. Bidders shall visit the site and acquaint themselves with

existing conditions. Refer to the General Conditions as amended for limitations to the use of the geotechnical data.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Construct temporary erosion control systems as shown on the plans or as described in the erosion control report appended to Section 02270, and as required by the Permits to protect adjacent properties and water resources from erosion and sedimentation.

1.4 JOB CONDITIONS

A. Conditions existing at time of inspection for bidding purposes will be maintained by the Owner in so far as practical.

B. Variations to conditions or discrepancy in actual conditions as they apply to site preparation operations are to be brought to the attention of the Owner prior to the commencement of any site work.

PART 2 - PRODUCTS

Off-site materials shall be transported to the project site using well-maintained and operating vehicles. Once onsite, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that existing plant life and clearing limits are clearly tagged, identified and marked in such a manner as to insure their safety throughout construction operations. Mark the clearing limits for review by the Owner.

3.2 PROTECTION

A. Locate and identify existing utilities that are to remain and protect them from damage.

B. Protect trees, plant growth and features designated to remain as final landscape.

C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain access and egress at all times and clean or sweep any roadways daily or as required by the governing authority. At such times as deemed necessary by the Owner, dust control shall be provided with sprinkling systems or equipment provided by the Contractor.

D. Protect benchmarks, property corners and all other survey monuments from damage or displacement. If a marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, by the same.

E. Provide traffic control as required, in accordance with the U.S. Department of Transportation "Manual on Uniform Traffic Control Devices" and the state highway department requirements. The Contractor shall be responsible for preparing, submitting and receiving approval of a traffic control plan, if required, from the Maine Department of Transportation and the City of Portland for all work within the public right-of-way.

3.3 CLEARING – GENERAL

A. The Contractor shall identify by means of flagging or other suitable measures the proposed work clearing limits for approval by the Owner prior to clearing activity. Clear areas required for access to site and execution of work.

B. Unless otherwise indicated on the drawings or modified by the Owner, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by clearing and grubbing operations are to be filled to subgrade elevation to avoid water ponding. Satisfactory fill material shall be placed in horizontal layers not exceeding 8" loose depth, and thoroughly compacted per fill requirements of this section and Section 02200.

3.4 TOPSOIL EXCAVATION – GENERAL

A. Strip topsoil from areas that are to be filled, excavated, landscaped or re-graded to such a depth that it prevents intermingling with underlaying subsoil or questionable materials. It is very important to avoid intermixing topsoil with underlying material.

B. Cut heavy growths of grass from areas before stripping and remove with the rest of the cleared vegetative material.

C. Topsoil shall consist of organic surficial soil found in depths of not less than 6". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 1" in diameter, weeds, roots, and other objectionable material. It shall not be reused on the site unless augmented as necessary to meet the minimum organic content of the specification for topsoil.

D. Stockpile topsoil in storage piles in areas shown or where directed. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Stockpiles shall be stabilized in accordance with the Erosion and Sedimentation Control Report, appended to Specification Section 02270. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by Owner. Excess topsoil shall be removed from the site by the Contractor unless specifically noted otherwise on the Drawings.

3.5 SITE PREPARATION: BUILDING PAD ZONES

Building pad fill zones for all buildings are defined to extend from a point of 5'-0" from the perimeter building wall at the finished ground surface and extending downward and outward at an imaginary slope of 1 horizontal to 1 vertical to the native soil surface after grubbing.

Site preparation in the building pad zone shall include complete removal of all surface vegetation, topsoil, rootmat, tree stumps, organic soils, or any softened or disturbed soil or to the layer of material suitable for subbase gravel. The removal to subgrade shall be completed with a smooth-edged backhoe bucket to limit the amount of subgrade disturbance.

3.6 SITE PREPARATION – PARKING AREAS AND PAVED DRIVES

All areas directly below paved areas should be cleared and grubbed. The final subgrade shall be shaped with a backhoe bucket with a smooth edge to avoid disturbance to the subgrade.

3.7 SITE PREPARATION – OTHER AREAS

Areas where the depth of fill exceeds 4 feet for final grade shall be cleared. Grubbing is not required when the fill depth exceeds 4 feet, the location is not under pavement, buildings, utility lines, toe of fill slopes or detention pond embankments.

3.8 SPECIAL SAND AND DRAINAGE LAYERS IN EMBANKMENTS - VACANT

3.9 PROTECTION OF PREPARED AREAS

Prepared areas of the site shall be protected with erosion control measures. Positive surface drainage away from prepared subgrade areas shall be maintained throughout the period of construction.

END OF SECTION 02100

SECTION 02180

SUBSURFACE INVESTIGATIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

Related documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions apply to work of this Section.

1.2 DESCRIPTION OF WORK

Contractor shall review the geotechnical report and supplement prepared for the project by S. W. Cole Engineering. This geotechnical report and supplement are appended to the project manual specifications. During the Bidding Process, the Contractor may conduct his own subsurface investigations after requesting and receiving prior approval from the Owner. The request for approval shall be accompanied by a plan indicating the location and type of investigations to be undertaken by the Contractor. The Contractor is encouraged to verify Owner's subsurface investigations and shall notify the Owner in writing prior to the bid date of any discrepancies.

PART 2 - PRODUCTS

2.1 REPORT

A. Subsurface conditions have been investigated by test pits, borings and probes. Locations of the test pits are shown on the contract drawings. Logs of the explorations are appended to this project manual.

B. A report of subsoil conditions has been prepared by S. W. Cole Engineering, Portland, Maine that is based on subsurface explorations. Said subsurface investigations are not warranted to show the actual subsurface conditions except at the location of said test pits or investigations, and at these points are subject to inaccuracies inherent in methods used and to variations in the classification and interpretation of soil layers.

Subsurface information is included only as an aid to the Bidder and it is the obligation of the Bidder to draw his own conclusions of subsurface conditions from his own investigations prior to submitting his proposal. The Contractor agrees, in signing his Contract, that he will make no claims against the Owner or Architect or Engineer, if in carrying out the work he finds that the actual conditions encountered in performing the work do not conform to conditions presented, discussed, or anticipated prior to the commencement of work, the Contractor shall notify the Owner immediately of such differences in the conditions.

PART 3 - EXECUTION

3.1 REPORT REVIEW

A copy of the subsurface investigation report is appended to the project manual and shall be considered part of the Contract Documents.

END OF SECTION 02180

GEOTECHNICAL ENGINEERING SERVICES
PROPOSED MEDICAL OFFICE BUILDING
AND PARKING GARAGE
MARTIN'S POINT HEALTHCARE
VERANDA STREET
PORTLAND, MAINE

05-0927.3 **March 5, 2009**

PREPARED FOR:

Martin's Point Healthcare
Director of Support Services
Attention: Ms. Ann Tucker
331 Veranda Street
Portland, Maine 04104

PREPARED BY:

S.W.COLE ENGINEERING, INC.
17 Chestnut Street, Suite 1A
Portland, Maine 04101

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S.W.COLE ENGINEERING, INC. • Geotechnical Engineering • Field & Lab Testing • Scientific & Environmental Consulting

05-0927.3

March 5, 2009

Martin's Point Healthcare
Director of Support Services
Attention: Ms. Ann Tucker
331 Veranda Street
Portland, ME 04104

Subject: Geotechnical Engineering Services
Proposed Medical Office Building and Parking Garage
Martin's Point Healthcare
Veranda Street
Portland, Maine

Dear Ann:

In accordance with our Agreement Addendum dated January 19, 2009, we have undertaken additional explorations and geotechnical engineering services for the proposed medical office building and parking garage at your existing facility on Veranda Street in Portland, Maine. This report summarizes our findings and geotechnical recommendations relative to foundations, earthwork and pavement associated with the proposed construction.

We issued a geotechnical report, dated January 12, 2006, and geotechnical supplement, dated March 29, 2006, for a previous development concept at your facility. This report incorporates the findings from our previous report and supplement; and supersedes the recommendations presented therein. The contents of this report are subject to the limitations set forth in Attachment A.

1.0 INTRODUCTION

1.1 Scope of Work

The purpose of our work was to explore the subsurface conditions at the site in order to provide geotechnical recommendations relative to foundations, earthwork and pavements associated with the proposed construction. The investigation has included

explorations, laboratory testing, compilation of previous geotechnical data, a geotechnical evaluation of the findings and preparation of this report.

1.2 Proposed Construction

Based on information provided by SMRT, Inc (project architect/engineer) and DeLuca-Hoffman Associates (project civil engineer), we understand development plans call for construction of a medical office building (MOB) atop a two level parking garage with associated access drives and paved areas. We understand the proposed building will be situated over the area of the former boiler building occupying a plan area of 130 feet by 310 feet. The proposed building will be cut into the existing slope of the site with a finished ground floor elevation of 43.0 feet (project datum), a second level elevation of 55.0 feet and a MOB finished floor elevation of 67.0 feet. Based on proposed and existing site grading, we understand the tapered fills approaching 8 feet will be needed for the southeast corner of the building and tapered cuts approaching 25 feet will be needed for the northern half of the building which will be cut into the existing slope of the site.

We understand the parking garage will be pre-cast concrete framed with a steel-framed medical office building above. We understand the ground floor is proposed to be asphalt paved. Details regarding the proposed structural loads were not available at the time of this report. Based on recent site grading information, the proposed construction will include at least one site retaining wall along the proposed new access drive north of the proposed building. Proposed and existing site features are shown on the "Exploration Location Plan" attached as Sheet 1.

2.0 EXPLORATION AND TESTING

2.1 Exploration

Sixteen test boring explorations (B-1 through B-16) and seventeen auger probes (P-1 through P-17) were made on November 17, 2005 and November 18, 2005. Twelve supplemental auger probes (P-18 through P-26 and P-29 through P-31) were made at the site on January 22, 2009; auger probes P-27 and P-29 were not drilled due to subsurface utility conflicts. The explorations were made by Great Works Test Boring, Inc. of Rollinsford, New Hampshire working under subcontract to S.W.COLE ENGINEERING, INC. The exploration locations made in 2005 were selected by S.W.COLE ENGINEERING, INC. based on the then proposed development concept.

The explorations locations made in 2009 were selected by Pizzagalli Construction (project general contractor) and DeLuca-Hoffman Associates based upon the current development concept. The exploration locations were established in the field by S.W.COLE ENGINEERING, INC. based upon taped measurements from existing site features. The approximate exploration locations are shown on the "Exploration Location Plan", attached as Sheet 1. Logs of the explorations are attached as Sheets 2 through 27. Logs of rock core obtained at B-2, B-3 and B-5 are attached as Sheets 28, 29 and 30. A key to the notes and symbols used on the log sheets is attached as Sheet 31. The elevations noted on the logs were estimated based on topographic information shown on Sheet 1.

2.2 Testing

The explorations were made using a combination of cased wash-boring, hollow stem auger, and solid stem auger drilling techniques. The soils were sampled in the test borings at 5 foot intervals using a split spoon sampler and Standard Penetration Test (SPT) methods. Where stiffer cohesive clay soils where encountered, we performed Pocket Penetrometer Tests (PPT) to assess unconfined compressive soil strength. SPT and PPT results are noted on the logs.

Soil and rock core samples collected during exploration work were visually examined and classified in our laboratory. Soil descriptions are noted on the logs. Where bedrock cores were obtained, we assessed Rock Quality Designators (RQD). RQD results are noted on the logs. The results of moisture content testing are noted on the log sheets. The results of four laboratory gradation tests are attached as Sheets 32 through 35.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Surficial Conditions

The site of the proposed construction is situated on the easterly side of the Martin's Point Healthcare Facility. The land reaches a high elevation of about 67 in the central portion of the site. The ground surface slopes downward in all directions to about elevation 34 feet at the limits of construction. The multi-story masonry building existing in the central portion of the site will remain. A paved parking area exists over the southern portion of the proposed building footprint varying from about elevation 40 to 45 feet.

Based on information shown on a site plan provided by DeLuca-Hoffman, the site is underlain by many utilities and contains several retaining walls and sloping access drives. A majority of the site is open and paved except for the southerly and northerly areas where trees and shrubs exist.

3.2 Subsurface Conditions

Based on the subsurface findings, the site of the proposed building is underlain by uncontrolled fill overlying stable deposits of stiff clay and dense glacial till overlying relatively shallow bedrock. The uncontrolled fills are generally silty sands with some gravel and appear to have been placed to level existing site areas for pavements or buildings. The test borings also encountered what appears to be blast spoil fill and/or highly fractured over-blast in several borings. Depths to bedrock generally follow the terrain of the site, increasing in depth over the southern portion of the proposed building area. Some of the refusal depths indicated on the logs may be within a weathered or disturbed bedrock zone.

Rock cores obtained at Borings B-2, B-3 and B-5 indicate that the bedrock at the site is a gray sulfidic pelite. In general, the rock core obtained on the southerly side of the proposed structure (B-2 and B-3) exhibit better quality than the core at B-5 (northerly side). Rock Quality Designator (RQD) values obtained from the cores were determined to be about 52 and 62 percent at Borings B-2 and B-3 respectively with fractures from 10 to 25 and 55 degrees from horizontal. The core obtained at Boring B-5 was much more fractured with an RQD of about 13 percent and fractures varying from about 10 to 75 degrees from horizontal. The high degree of fracturing at Boring B-5 may be due to previous blasting to install existing subsurface utilities in the area.

Refer to the attached logs for a more detailed description of the subsurface findings. Interpretive "Geologic Subsurface Sections" of the proposed building area are attached in Appendix A.

3.3 Groundwater

In general, the soil overburden was found to be moist. Free groundwater was not observed in the explorations during the short time that the explorations were open. It should be anticipated that groundwater will fluctuate seasonally and in response to precipitation and snow melt. It is likely that groundwater flows along relatively intact bedrock surfaces (where it exists) and flows through existing rock fractures.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings and our understanding of the proposed construction, it is our opinion that the site is suitable for the proposed building construction from a geotechnical standpoint. The principal geotechnical considerations are the presence of uncontrolled fills generally below the southern portion of the proposed building and shallow bedrock generally over the northern portion of the proposed building. With proper preparation of the building pad and foundation subgrades, the proposed building may be supported on conventional spread footing foundations.

Uncontrolled Fills: Beneath foundations, the uncontrolled fills will need to be removed and backfilled with compacted structural fill. Beneath paved areas, the uncontrolled fills must be proof-rolled with a vibratory roller compactor. Areas that become soft or continue to yield after proof-rolling must be removed and replaced with compacted structural fill.

Shallow Bedrock: Based on the subsurface findings and proposed grades, bedrock appears to be near over above the elevation of footings and the ground level parking pavement in the area of the proposed building. The bedrock is relatively hard and will require blasting for removal.

4.2 Excavation Work

In general, excavation work at the site will encounter shallow bedrock, particularly in the central and northern portions of the site and uncontrolled fills and native stiff clay or glacial till overlying bedrock in the southern portions of the site. The fills that will be encountered are primarily granular soil, including blast spoils, or native soils that were disturbed due to construction activity over the years. Stiff clay and dense glacial till will be encountered below the fills in some areas. Excavation of rock will likely encounter undisturbed, relatively hard, intact rock; softer, weathered rock; and highly fractured rock that was likely disturbed from previous construction activity. The highly fractured rock will likely be encountered around existing buildings, structures and along subsurface utility routes as well as within the existing lower, southerly parking lot. Based on the findings at Boring B-1, it appears that either overblast occurred and/or blast spoils were used as fill in the existing lower parking lot.

Excavations will encounter varying bedrock and soil conditions at the site. Some bedrock faces, exposed during excavation may be unstable after excavation due to fracturing, steep dips and weathering of the bedrock, particularly under saturated conditions. We recommend that observations of bedrock slopes be made during construction to evaluate rock slope stability.

Excavations must be properly shored or sloped to prevent sloughing and caving of the sidewalls during construction. Temporary, unsupported soil excavations should be sloped back to 1V to 1½H or flatter. Temporary unsupported rock excavations should be benched and/or sloped back in order to create a stable condition. The degree of benching or sloping will depend on rock fracturing. All excavations should be consistent with the OSHA trenching regulations.

It should be anticipated that there will be seepage from the soils just above the bedrock in lower elevations and from exposed bedrock faces, both during construction and after site development. The amount of seepage will vary depending upon the size and orientation of the intercepted fractures, time of year and amount of recent precipitation.

Groundwater will likely be encountered during excavation work, particularly along the northerly side of the existing lower parking level and within deeper cut areas. Based on the limited groundwater information available, it appears sumping and pumping dewatering techniques should be adequate to control groundwater within foundation excavations.

Based on proposed finish grades and depths to refusal surfaces, drilling and blasting will be required to achieve subgrade elevations. We recommend that an experienced drilling and blasting contractor be engaged to provide rock removal and the contractor be required to submit qualifications, references and a blasting plan prior to commencement of excavation. The blasting contractor should also be required to complete pre-blast surveys of surrounding structures and drinking water wells within 2000 feet of the proposed blast zone. An owner coordinated preblast survey should be conducted at all structures and wells located within a minimum of 500 feet of the blast area. Vibrations due to blasting should be monitored during construction by qualified personnel. S. W. COLE ENGINEERING, INC. is available to provide these services as part of construction testing and special inspection services.

4.3 Subgrade Preparation

Based on the subsurface findings, we anticipate that subgrade conditions will generally range from intact or blasted bedrock on the higher elevations transitioning to native soil (stiff clay and dense glacial till) midway down the slopes and uncontrolled fills in the lower elevations. These variable subgrade conditions are described below. Details of the transition between bedrock, native soil and uncontrolled fill subgrades within the building footprint are depicted on Sheets A-1 through A-6 attached in Appendix A.

Bedrock Subgrades: Where loose, fractured, rock is encountered from previous construction activities or blasting is needed to achieve proposed grades, all loose rock should be excavated to sound, intact rock. For column and wall footings, all loose rock should be removed and the subgrade prepared with a 6-inch thick layer of 3/4-inch crushed stone thoroughly compacted to work the stone into the fractured surface in order to fill voids. For slab and pavement areas, all loose rock should be re-compacted and choked with a 3/4-inch crushed stone to fill voids prior to placing compacted granular or structural fills.

Native Soil Subgrades: For footings founded on stable native soils, we recommend excavation be made using a smooth edged bucket to a depth of 6 inches below footing subgrade. We recommend native soil subgrades below footings be protected with 6 inches of crushed stone overlying a woven geotextile fabric, such as Mirafi 500X.

Uncontrolled Fill Subgrades: Uncontrolled fills were generally encountered in the southern portion of the proposed building footprint. Beneath footings, we recommend over-excavating the uncontrolled fills to expose stable native stiff clay, dense glacial till or bedrock. The lateral limits of overexcavation should extend at least 1 foot laterally away from the edges of footings for each foot of excavation depth. The overexcavated areas should be backfilled with compacted structural fill.

Beneath slab areas, we recommend removing the uncontrolled fills to a depth of 4.5 feet below finished grade. The remaining uncontrolled fill must then be proof-rolled and densified with a vibratory roller compactor weighing at least 10 tons. Areas that become soft or continue to yield after proofrolling must be removed and backfilled with compacted structural fill. The approximate limits of uncontrolled fill to be removed beneath the building footprint is shown on Sheet A-1.

Outside the proposed building footprint, we anticipate uncontrolled fills may be encountered, particularly considering past developments on the site. We recommend that all soil subgrades outside the proposed building area be proof-rolled and densified with a vibratory roller compactor weighing at least 10 tons prior to placing new site fills, gravels for pavement or constructing site retaining walls.

S. W. COLE ENGINEERING, INC. should be engaged to observe proofrolling and subgrade preparation prior to placing new fills, structural backfill, crushed stone or concrete.

4.4 Foundation Design

The design freezing index for the Portland, Maine area is approximately 1250-Fahrenheit degree-days. We recommend footings in unheated areas be cast at least 4.5 feet below finish grade to provide frost protection. Footings bearing on bedrock, may be cast 2.5 feet below finished grade for frost protection. For footings bearing on properly prepared subgrades, as presented herein, we recommend the following geotechnical parameters for foundation design:

• Net Allowable Bedrock Bearing Pressure	5 ksf or less
• Design Frost Depth on Bedrock	2.5 feet
• Net Allowable Soil Bearing Pressure	3 ksf or less
• Design Frost Depth on Soil	4.5 feet
• Base Friction Factor (tan δ)	0.40
• Passive Lateral Earth Pressure Coeff. (K_p)	3.0 (compacted Structural Fill)
• Active Lateral Earth Pressure Coeff. (K_a)	0.33 (compacted Structural Fill)
• At-Rest Lateral Earth Pressure Coeff. (K_o)	0.5 (compacted Structural Fill)
• Total Unit Weight of Backfill (γ_t)	130 pcf (Structural Fill)
• Seismic Soil Site Class	C (IBC 2006)
• Estimated Post-Construction Settlement	¾ inch (total and differential)

An approximate delineation of footings anticipated to bear on bedrock and footings anticipated to bear on soil is shown on Sheet A-1. Retaining walls that are restrained from rotation (such as the parking garage basement walls) should be designed considering at-rest lateral earth pressures. Foundation and retaining wall design must also account for lateral loads due to traffic, backslopes and compaction.

4.4.1 Rock Anchors

Although no structural loads have been provided, we anticipate that rock anchors may be needed beneath certain foundation areas to counteract uplift loads. Design of the rock anchors will need to assume buoyant rock conditions. We recommend that a total bedrock unit weight of 150 pcf and buoyant unit weight of 87 pcf for intact rock be considered for design. We recommend that a 30° cone (measured from vertical) be considered for rock pull-out for intact rock. An ultimate bond stress between sound rock and anchor grout of 250 psi can also be considered, depending upon specified grout strength. Consideration will also need to be given to anchor bar spacing where a line or groups of anchors are needed. We recommend an anchor testing program including performance, proof and creep testing be specified.

4.5 Foundation Drainage

We recommend that a perimeter foundation drainage system be provided for the proposed building structure and behind all retaining walls. All underdrains should be placed at least 4.5 feet below finish grades and 4.5 feet behind retaining walls for frost protection. Where footings are cast on bedrock shallower than 4.5 feet, rigid foundation insulation must be installed to protected the underdrains from freezing. Rigid, 4-inch diameter, perforated foundation drainpipe with perforations of ¼ to ½ inch should be utilized. The foundation drain pipes should be enveloped with at least 6 inches of crushed stone bedding and the entire crushed stone layer should be wrapped in a non-woven geotextile filter fabric, such as Mirafi 140N. The foundation drains must have positive gravity outlets protected from freezing and/or clogging. Other drains such as roof drains or parking deck drains should be provided in separate, non-perforated pipe, also protected from freezing.

4.6 Slab-on-Grade Floors

We understand the elevator and stairwells may have slabs on grade in heated spaces, but the remainder of the lower level parking will be asphalt paved. We recommend floor slabs in heated areas be underlain by at least 12 inches of 3/4-inch compacted crushed stone overlying bedrock or 12 inches of compacted structural fill overlying properly prepared soil subgrades. Concrete slab-on-grade floors in heated spaces may be designed using a subgrade reaction modulus of 200 pci (pounds per cubic inch) provided that the slabs are underlain by at least 12 inches of compacted base overlying prepared subgrades.

A vapor retarder to limit the upward migration of moisture vapors should be considered beneath floor slabs covered with moisture sensitive flooring. The vapor retarder should have a permeance that is less than the floor covering being applied on the slab. We recommend consulting flooring manufacturers relative to selection and installation of acceptable vapor retarder systems for use with their products. The vapor retarder should be underlain with a non-woven geotextile fabric such as Mirafi 160N to help protect the vapor retarder from puncture by the underlying fill materials.

We recommend that control joints be installed within floor slabs to accommodate shrinkage in the concrete as it cures. In general, control joints are typically installed at 10 to 15 foot spacing but the structural engineer should determine spacing. Floor slabs should be wet-cured for a period of at least 7 days after casting as a measure to reduce the potential for curling of the concrete and excessive drying/shrinkage. We recommend that consideration be given to using curing paper installed over the cast-in-place concrete and that the curing paper remain in place as long as possible to improve the quality of the completed floor. In lieu of curing paper, a curing compound may be utilized; however, care must be taken to prevent scuffing of the compound from the floor during the curing period.

4.7 Entrances, Sidewalks and Exterior Slabs

Entrance approaches, sidewalks, and exterior slabs should be designed to reduce the effects of differential frost action. We recommend that exterior concrete slabs be underlain with compacted crushed stone overlying bedrock or Structural Fill to a depth of 4.5 feet below finished grade. The thickness of crushed stone or Structural Fill may be reduced if sound, intact bedrock is encountered at depths shallower than 4.5 feet, but should be at least 18 inches in thickness. The crushed stone or Structural Fill should extend the entire length and width of entrances, sidewalks, and exterior slabs. The bottom of the crushed stone or Structural Fill adjacent to exterior foundations, below entrance slabs, sidewalks, and exterior slabs, should transition up to adjacent pavement subbase at a 1V to 3H slope or flatter. This is to help avoid abrupt, differential heaving. The lower layer of crushed stone or Structural Fill should be hydraulically connected to the foundation drainage system. All adjacent paved and grassed areas should be sloped to promote drainage away from the buildings.

4.7.1 Lowest Level Parking Garage Pavement

Protection against frost action is particularly critical in situations with limited overhead clearance, such as in parking garages. The proposed lowest level on-grade parking is underlain by frost-susceptible soils and will be exposed to freezing temperatures. Given these conditions, we recommend the Standard Duty pavement section presented herein be underlain by: a) at least 6 inches of crushed stone working into fractures bedrock surfaces where bedrock subgrades exist, or b) 3 feet of Structural Fill over prepared subgrades where soil subgrades exist. Alternatively, the Standard Duty pavement section (asphalt/base/subbase) may be underlain with a 2-inch thickness of high-density, high-load, rigid, extruded, closed-cell, polystyrene insulation rated for pavement applications overlying prepared subgrades.

4.8 Backfill and Compaction

The blasted rock generated from mass excavation activities can likely be crushed and blended with granular soil for reuse as compacted granular borrow or structural fill beneath building and paved areas. The existing uncontrolled fills may be suitable for reuse in landscape areas or as granular borrow beneath paved areas outside the proposed building.

Granular Borrow: Compacted fill to raise site grades in pavement areas outside the proposed building footprint should be sand, silty sand or sand and gravel meeting the requirements of MDOT Standard Specification 703.19 "Granular Borrow" as given below.

MDOT 703.19 Granular Borrow	
Sieve Size	**Percent Finer by Weight**
6 inch	100
#40	0 to 70
#200	0 to 20

Structural Fill: Backfill placed below footings, the lowest level parking pavement, adjacent to foundations, backfill for basement and site retaining walls, and base gravel below floor slabs should be a clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below.

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
#40	0 to 30
#200	0 to 5

Crushed Stone: Crushed Stone used below footings and as foundation drainage aggregate should meet the gradation requirements of Maine DOT (MDOT) Standard Specifications 703.22 "Underdrain Backfill Type C".

MDOT 703.22 Underdrain Backfill Material Type C	
Sieve Size	**Percent Finer by Weight**
1 inch	100
¾ inch	90-100
⅜ inch	0-75
#4	0-25
#10	0-5

Placement and Compaction: Fill and backfill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building and paved areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557.

4.9 Slope Construction

Fill slope faces should be constructed as level benches, which are built beyond finish surface grades to facilitate compaction. The soil slope face should be graded by cutting back into the compacted core. Fill slopes are susceptible to surface erosion, slumping and sloughing, particularity during heavy rain and freeze/thaw events. Where vegetated surfaces are to be constructed, loam and seed should be installed, as soon as practicable, to create a vegetated mat over the entire surface of the slope. For slopes steeper than 2H: 1V, we recommend the use of rip-rap. The rip-rap should be underlain with a non-woven geotextile fabric such as Mirafi 160N where soil subgrades exist. Fill slopes steeper than 2H:1V typically require geogrid reinforcement. In areas where

surface water is concentrated and discharged over the slope, we recommend covering the slope with small diameter rip-rap placed over a layer of crushed stone and a non-woven geotextile fabric.

4.10 MSE Walls

We understand that MSE (Mechanically Stabilized Earth) Walls varying in height from about 2 to 8 feet are proposed. We recommend that MSE Walls bear on at least 12 inches of crushed stone base overlying bedrock or dense, undisturbed native soils. Where subgrades consist of soil, the crushed stone base should be underlain within a non-woven geotextile fabric, such as Mirafi 140N. At least 4.5 feet (horizontal measure) of free-draining, non-frost susceptible Structural Fill will be required behind the face of the wall to control potentially adverse frost action. For MSE Walls constructed on properly prepared subgrades, we recommend the following geotechnical parameters:

- Net Allowable Bearing Pressure = 3.0 ksf or less
- Foundation Soil Base Friction Factor = 0.4
- Reinforced Zone Backfill Unit Weight = 130 pcf (Structural Fill)
- Reinforced Zone Internal Friction Angle = 30 degrees (Structural Fill)
- Retained Soil Unit Weight = 130 pcf (Granular Borrow)
- Retained Soil Internal Friction Angle = 30 degrees (Granular Borrow)
- Geogrid Reinforcement Length = at least 70 percent of wall height

Note: Internal friction angle and gradation of wall backfill must be determined with laboratory testing prior to placement of material.

We understand that MSE Wall design will be completed by others including analyses of bearing capacity, overturning and internal stability of the wall (including, but not limited to, vertical spacing of geogrid, geogrid lengths and connection of the wall facing to the geogrid soil reinforcement). MSE Wall design must also consider appropriate embedment considering potential nearby rock faces, positive backslopes behind the wall and loads due to surcharges, guardrails, and light poles on top of the wall. S.W.COLE ENGINEERING, INC. should be engaged to perform a global stability analysis of the MSE Walls prior to construction.

4.11 Pavements

We anticipate traffic loading to consist of passenger vehicles and light delivery vehicles. As such, we recommend the following pavement section based on our experience with similar construction.

FLEXIBLE (ASPHALT) PAVEMENT		
Pavement Layer	Standard Duty	Heavy Duty
Maine DOT 9.5 mm Superpave, (Standard Specifications for Highways and Bridges)	1.25 inches	1.25 inches
Maine DOT 12.5 mm Superpave, (Standard Specifications for Highways and Bridges)	1.75 inches	---
Maine DOT 19.0 mm Superpave, (Standard Specifications for Highways and Bridges)	---	2.75 inches
Maine DOT Crushed Aggregate Base 703.06 Type A, (Standard Specifications for Highways and Bridges)	3 inches	3 inches
Maine DOT Aggregate Subbase 703.06 Type D, (Standard Specifications for Highways and Bridges)	12 inches	15 inches
Non-frost Susceptible Structural Fill (Lowest Level of Parking Garage, see Section 4.7.1)	36 inches	N/A

The bituminous pavement should be compacted to 92 to 97 percent of its theoretical maximum density as determined by ASTM D-2041. Tack coat should be applied between successive lifts of asphalt, as necessary. The base and subbase materials should be compacted to at least 95 percent of their maximum dry densities as determined by ASTM D-1557. Fill placed below the base and subbase materials must be compacted to at least 95 percent of ASTM D-1557. Design should consider sloping of the subgrade to enhance drainage to the periphery of the paved areas and/or to proposed foundations and retaining wall underdrains.

4.12 Weather Considerations

The uncontrolled fills, native stiff clays and dense glacial till soils on-site are easily disturbed during wet weather. Construction activity should be limited during wet weather and may require drying before construction activities may continue. The contractor should anticipate the need for water to temper fills to facilitate compaction during dry weather.

If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil and once placed, the concrete and soil beneath the structure must be protected from freezing.

In all cases, sitework and construction activities should take appropriate measures to protect exposed subgrades. This may require the use of temporary haul roads and staging areas to preclude subgrade damage due to construction traffic. Geotextile fabric may also be needed below haul roads and/or proposed paved areas to help stabilize subgrades for temporary construction traffic.

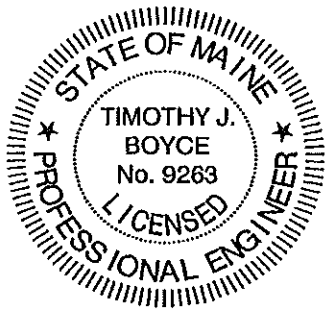
4.13 Design Review and Construction Testing

S.W.COLE ENGINEERING, INC. should be retained to review the final design and specifications to determine that our foundation and earthwork recommendations have been properly interpreted and implemented. A soils and concrete testing program should also be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE ENGINEERING, INC. is available to provide field and laboratory testing services for soil, concrete, steel, masonry, spray-applied fire-proofing, and asphalt construction materials, as well as to assist in conducting owner coordinated pre and post-blast surveys.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you as the design progresses and during the construction phase.

S.W.COLE ENGINEERING, INC.



Timothy J. Boyce, P. E.
Senior Geotechnical Engineer

c: Paul Ureneck / Boulos

TJB/PFK:ajh

P:\2005\05-0927.3_S_Martin's Point Healtcare, Inc_Portland, ME_Proposed Phase II Campus Improvements_TJB\Reports and Letters\05-0927.3 Report.doc

ATTACHMENT A
Limitations

This report has been prepared for the exclusive use of Martin's Point Healthcare for specific application to the proposed Medical Office Building and Parking Garage on Veranda Street in Portland, Maine. S.W.COLE ENGINEERING, INC. has endeavored to conduct the work in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

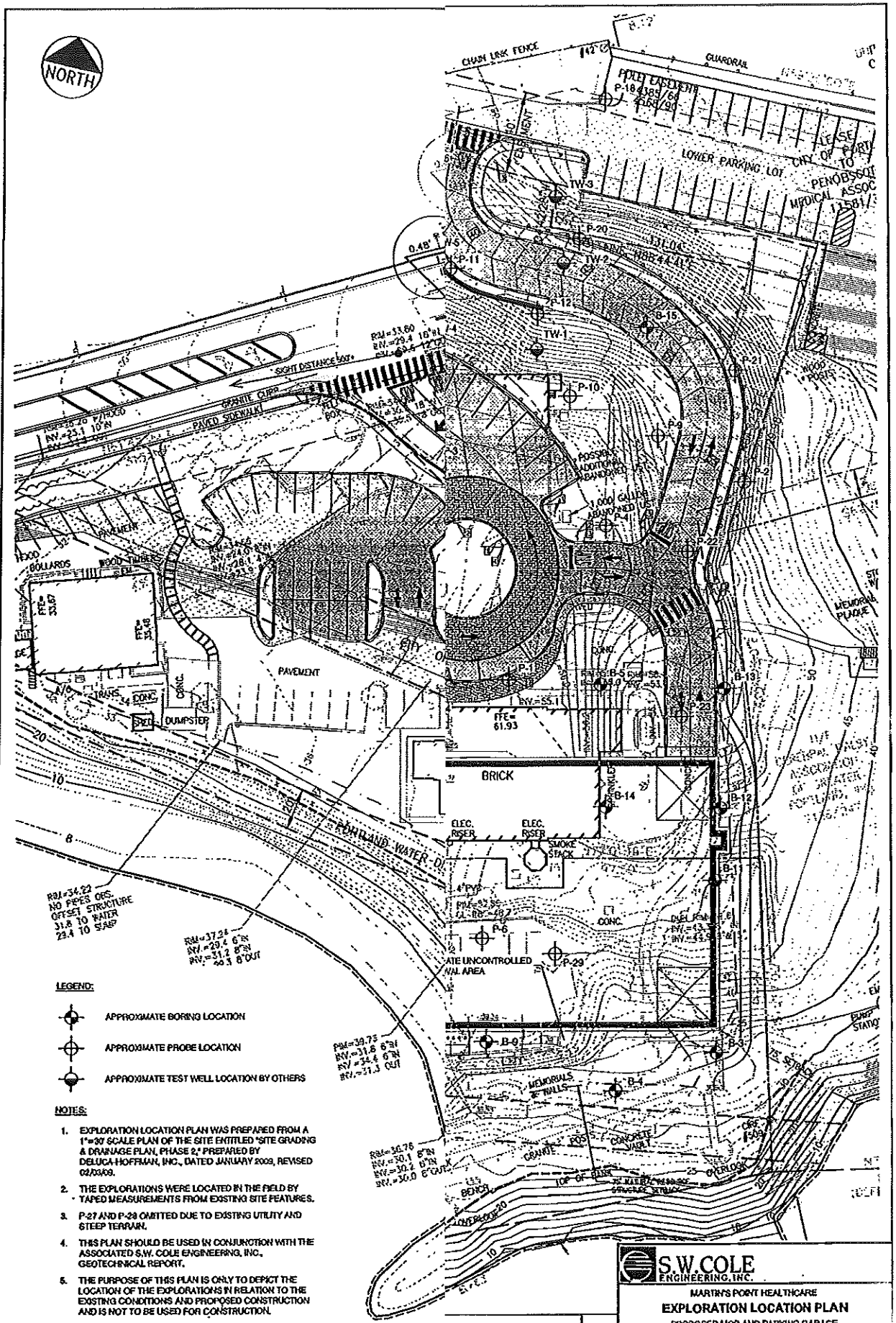
The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S. W. COLE ENGINEERING, INC.'s scope of work has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S. W. COLE ENGINEERING, INC. should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless S. W. COLE ENGINEERING, INC. reviews the changes.


NORTH
CHAIN LINK FENCE
GUARDRAIL
LOWER PARKING LOT
LEASED TO PENOBSCOT MEDICAL ASSOC
P-18 (88/66 & 68/99)
TW-3
TW-2
TW-1
P-20
P-11
P-12
P-10
P-21
P-22
P-1
P-2
P-6
P-29
B-5
B-15
B-19
B-14
B-12
B-11
B-9
B-3
B-4
SIGHT DISTANCE 500'
GRANITE CURB
PAVED SIDEWALK
PAVEMENT
WOOD BOLLARDS
WOOD TIMBERS
DUMPSTER
CONC.
BRICK
ELEC. RISER
SMOKE STACK
4" PVC
POSSIBLE ADDITIONAL ABANDONED
1,000 GALLON ABANDONED OIL TANK
MEMORIAL PLAQUE
PORTLAND WATER DI
RIM=34.22
NO PIPES OBS.
OFFSET STRUCTURE
31.8 TO WATER
23.4 TO SSED
RIM=37.24
INV.=29.4 6"IN
INV.=31.2 8"IN
INV.=30.3 8"OUT
RIM=39.75
INV.=31.6 8"IN
INV.=34.4 6"IN
INV.=31.3 OUT
RIM=36.76
INV.=30.1 8"IN
INV.=30.2 8"IN
INV.=30.0 6"OUT
ATE UNCONTROLLED
/AL AREA
MEMORIALS & WALLS
GRANITE POST
CONCRETE WALL
TOP OF BANK
OVERLOOK
RETAINING WALL
SEWAGE SETBACK
BENCH
LEGEND:
APPROXIMATE BORING LOCATION
APPROXIMATE PROBE LOCATION
APPROXIMATE TEST WELL LOCATION BY OTHERS
NOTES:
1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=30' SCALE PLAN OF THE SITE ENTITLED "SITE GRADING & DRAINAGE PLAN, PHASE 2," PREPARED BY DELUCA-HOFFMAN, INC., DATED JANUARY 2009, REVISED 02/03/09.
2. THE EXPLORATIONS WERE LOCATED IN THE FIELD BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
3. P-27 AND P-28 OMITTED DUE TO EXISTING UTILITY AND STEEP TERRAIN.
4. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S.W. COLE ENGINEERING, INC., GEOTECHNICAL REPORT.
5. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.
S.W.COLE ENGINEERING, INC.
MARTIN'S POINT HEALTHCARE
EXPLORATION LOCATION PLAN
PROPOSED MOB AND PARKING GARAGE
VERANDA STREET
PORTLAND, MAINE
SED FOR GRADING PLAN REVISION NOTE 1
CEM
DESCRIPTION
BY
Job No. 05-0927.3
Date: 01/27/09
Scale 1"=30'
Sheet 1

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-1
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/17/2005
DATE FINISH: 11/17/2005
ELEVATION: 42+/-
SWC REP.: PFK

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	300 LB	18"
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

WATER LEVEL INFORMATION
BLAST SPOIL DRAINED
UNDERLYING SOIL MOIST

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
HW									2"+/-	ASPHALT PAVEMENT
	S1	24"	10"	2.0'	9	12	15	11	2.0'	DARK BROWN GRAVELLY SAND WITH SOME SILT (FILL)
	S2	24"	10"	4.0'	9	7	15	12		BROWN SAND SOME GRAVEL, SOME SILT AND BLAST SPOILS (FILL) ~ MEDIUM DENSE ~
									5.0'	AUGER REFUSAL AT 5'+/- INSTALLED CASING TO 5'
									6.0'	WASH AHEAD TO 6' PROBABLE BLAST SPOILS (FILL)
	S3	24"	12"	8.0'	16	18	23	28	8.0'	BLAST SPOIL (FILL)
SSA									9.0'	PROBABLE BLAST SPOIL (FILL)
									13.5'	BROWN SILTY SAND WITH SOME GRAVEL (APPEARS TO BE NATIVE SOIL)
										REFUSAL AT 13.5' (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-1

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-2
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/17/2005
DATE FINISH: 11/17/2005
ELEVATION: 44+/-
SWC REP.: PFK
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	300 LB	18"
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
SSA/HW									2.5"+/-	ASPHALT PAVEMENT
	S1	24"	12"	2.5'	10	15	12	9		BROWN GRAVELLY SAND WITH SOME SILT (FILL) w = 9.5% ~ MEDIUM DENSE ~
									6'+/-	
										BROWN SAND AND SILT WITH SOME GRAVEL (FILL)
									10.5'	~DENSITY~
									12.4'	BROWN SILTY SAND WITH SOME GRAVEL (TILL)
									13.5'	ROLLER CONE 12.4' TO 13.5' PROBABLE ROCK
										ROCK CORE - GRAY SULFIDIC PELITE
	R1	60"	53"	18.5'					18.5'	RQD = 52% FAIR
										BOTTOM OF EXPLORATION AT 18.5'

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-2

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-3
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/17/2005
DATE FINISH: 11/17/2005
ELEVATION: 33.5+/-
SWC REP.: PFK
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	300 LB	18"
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
HW									12"+/-	BLACK ORGANIC TOPSOIL
	S1	24"	6"	2.0'	3	5	5	7		~ LOOSE ~
										BROWN SILTY SAND WITH SOME GRAVEL (TILL)
	S2	24"	16"	4.0'	13	12	10	13		~ MEDIUM DENSE BECOMING ...
										w = 28.2%
	S3	24"	21"	7.0'	9	12	14	21		... DENSE ~
	S4	24"	18"	12.0'	18	29	27	15		w = 33.1%
									15.6'	
	S5	7"	7"	15.6'	7	25/1"			16.5'	ROLLER CONE 15.6' TO 16.5' PROBABLE BEDROCK
										ROCK CORE - GRAY SULFIDIC PELITE
									21.5'	RQD = 62% FAIR
	R1	60"	60"	21.5'						BOTTOM OF EXPLORATION AT 21.5'

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-3

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-4
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/17/2005
DATE FINISH: 11/17/2005
ELEVATION: 33.5+/-
SWC REP.: PFK
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT : MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA			
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE #	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"+/-	ASPHALT PAVEMENT
	S1	24"	16"	2.0'	1	3	3	3		~ LOOSE ~ BROWN SILTY SAND WITH SOME GRAVEL (POSSIBLE TILL FILL)
									4'+/-	
	S2	24"	24"	6.5'	17	19	19	40		BROWN SILTY SAND WITH SOME GRAVEL (TILL) ~ DENSE ~
	S3	24"	18"	11.5'	17	23	27	29	11.7'	
										BOTTOM OF EXPLORATION AT 11.7' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-4

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-5
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/17/2005
DATE FINISH: 11/17/2005
ELEVATION: 59+/-
SWC REP.: PFK
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	300 LB	18"
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH ft.	STRATA & TEST DATA
HW									1.5"+/-	ASPHALT PAVEMENT
	S1	23"	14"	2.0'	13	13	13	50/5"		BLAST SPOILS WITH SOME SAND
	S2	10"	6"	2.8'	15	45/4"				TRANSITIONING TO MOSTLY BLAST SPOILS (PROBABLE FILL)
									5.4'	
										ROCK CORE - GRAY SULFIDIC PELITE
									10.4'	RQD = 13% VERY POOR
	R1	60"	60"	10.4'						BOTTOM OF EXPLORATION AT 10.4'
										NOTE: BORING NEAR EXISTING UTILITY. BORING MAY BE WITHIN BLASTED TRENCH AREA.

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-5

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-6
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 40+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6": 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"+/-	ASPHALT PAVEMENT
	S1	24"	10"	2.0'	10	12	12	10		~ MEDIUM DENSE ~ DARK BROWN AND BROWN GRAVELLY SAND WITH SOME SILT (FILL)
									4'+/-	
										~ HARD~ BROWN SILTY CLAY (DESSICATED)
	S2	24"	20"	7.0'	8	11	15	20		qp = 9+ ksf
									9'+/-	
										BROWN SILTY SAND WITH SOME GRAVEL (TILL) ~ VERY DENSE ~
	S3	24"	20"	12.0'	32	39	37	28		
									15'+/-	
										PROBABLE WEATHERED ROCK
									19.0'	
										BOTTOM OF EXPLORATION AT 19.0' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-6

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-7
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 43+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"+/-	ASPHALT PAVEMENT
	S1	24"	14"	2.0'	9	12	12	13		~ MEDIUM DENSE ~
										BROWN GRAVELLY SAND WITH SOME SILT (FILL)
									4.0'	W = 11.6%
										BOTTOM OF EXPLORATION AT 4.0' - AUGER REFUSAL
										(PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-7

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-8
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 41+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"+/-	ASPHALT PAVEMENT
	S1	24"	12"	2.0'	8	13	16	17		~ MEDIUM DENSE ~
									3.0'	BROWN SAND WITH SOME SILT AND GRAVEL (FILL)
	S2	24"	20"	7.0'	14	17	21	25		BROWN SILTY SAND WITH SOME GRAVEL (TILL) ~ MEDIUM DENSE TO DENSE ~
	S3	24"	16"	12.0'	15	14	11	21		
									21.0'	BOTTOM OF EXPLORATION AT 21.0' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-8

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-9
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 44+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT : MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"+/-	ASPHALT PAVEMENT
-	S1	24"	12"	2.0'	16	20	18	20		~ DENSE ~ BROWN GRAVELLY SAND WITH TRACE SILT (FILL)
	S2	24"	10"	7.0'	8	17	15	14	8'+/-	DARK BROWN SILTY SAND WITH SOME GRAVEL AND ROCK PIECES (POSSIBLE WEATHERED COBBLE) (PROBABLE FILL)
	S3	24"	16"	12.0'	11	15	21	33		~ DENSE ~ LIGHT BROWN SILT AND FINE SAND, SOME GRAVEL
									16.1'	BOTTOM OF EXPLORATION AT 16.1' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-9

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-10
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 64+/-
SWC REP.: MFB

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS MOIST

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"+/-	ASPHALT PAVEMENT
	S1	16"	8"	1.6'	10	36	44		2.75'	~ DENSE ~ DARK BROWN SILTY SAND WITH SOME GRAVEL (FILL)
										BOTTOM OF EXPLORATION AT 2.75' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-10

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-11
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 50+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									6"+/-	DARK BROWN ORGANIC TOPSOIL
	S1	24"	8"	2.0'	1	5	7	6		~ LOOSE TO MEDIUM DENSE ~
										BLAST SPOILS, BRICK PIECES AND SAND (FILL)
									4.7'	
										BOTTOM OF EXPLORATION AT 4.7' - AUGER REFUSAL
										(PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-11

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-12
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 52.5+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLES NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									12"+/-	DARK BROWN ORGANIC TOPSOIL
	S1	24"	10"	2.0'	3	3	3	5		~ LOOSE ~ . DARK BROWN SAND WITH ORGANICS
									5.0'	BOTTOM OF EXPLORATION AT 5.0' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-12

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-13
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 56.5+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT : MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"+/-	ASPHALT PAVEMENT
	S1	24"	8"	2.0'	3	7	5	5	2.5'	~ MED. DENSE ~ DARK BROWN GRAVELLY SILTY SAND W/ROCK PIECES (FILL)
										BOTTOM OF EXPLORATION AT 2.5' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-13

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-14
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 58+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLER NO.	SAMPLER PEN.	SAMPLER REC.	SAMPLER DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"+/-	ASPHALT PAVEMENT
	S1	24"	19"	2.0'	10	9	7	5		~ MEDIUM DENSE ~ WEATHERED ROCK OR BLAST SPOILS WITH SILTY SAND (PROBABLE FILL)
									5.0'	BOTTOM OF EXPLORATION AT 5.0' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:

X	DRILLER - VISUALLY
X	SOIL TECH. - VISUALLY
	LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-14

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-15
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 47+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									4"+/-	DARK BROWN ORGANIC TOPSOIL
	S1	24"	8"	2.0'	2	7	8	7		~ MEDIUM DENSE ~ BROWN GRAVELLY SILTY SAND (FILL)
									4'+/-	
	S2	24"	8"	7.0'	7	4	6	4	7.5'	~ MEDIUM DENSE ~ DARK BROWN SILTY SAND WITH SOME GRAVEL (POSSIBLE FILL)
										BOTTOM OF EXPLORATION AT 7.5' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-15

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-16
SHEET: 1 OF 1
PROJECT NO.: 05-0927 S
DATE START: 11/18/2005
DATE FINISH: 11/18/2005
ELEVATION: 48+/-
SWC REP.: MFB
WATER LEVEL INFORMATION
SOILS MOIST

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									6"+/-	DARK BROWN ORGANIC TOPSOIL
	S1	24"	10"	2.0'	1	2	2	2		~ LOOSE ~
										RUST BROWN SILTY SAND WITH SOME ORGANICS (POSSIBLE FILL)
									4'+/-	
										~ MEDIUM DENSE TO DENSE ~
	S2	24"	16"	7.0'	10	14	15	17		BROWN SILTY SAND WITH SOME GRAVEL (TILL)
									8.4'	
										BOTTOM OF EXPLORATION AT 8.4' - AUGER REFUSAL (PROBABLE BEDROCK)

SAMPLES:
S = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-16

S.W.COLE ENGINEERING, INC.

AUGER PROBE LOGS

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/MILL

PROJECT NO. 05-0927 S
AUGER PROBE SIZE O.D. SSA

PROBE NO. P-1
STREET NAME
GROUND ELEV. 61.5+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
2"+/-	ASPHALT PAVEMENT
5.5'	WEATHERED ROCK OR BLAST SPOILS
	AUGER REFUSAL AT 5.5' (PROBABLE BEDROCK)

PROBE NO. P-2
STREET NAME
GROUND ELEV. 67+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
2"+/-	ASPHALT PAVEMENT
4.0'	BLACK GRAVEL AND SAND POSSIBLE ASH (FILL)
	AUGER REFUSAL AT 4.0' (PROBABLE BEDROCK)

X	DRILLER - VISUALLY
X	SOIL TECHNICIAN - VISUALLY
	LABORATORY TESTS

S.W.COLE ENGINEERING, INC.

AUGER PROBE LOGS

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/MILL

PROJECT NO. 05-0927 S
AUGER PROBE SIZE O.D. SSA

PROBE NO. P-3
STREET NAME
GROUND ELEV. 65+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
2.0'	BROWN GRAVELLY SILTY SAND WITH PIECES OF BRICK (FILL)
	AUGER REFUSAL AT 2.0' (PROBABLE BEDROCK)

PROBE NO. P-4
STREET NAME
GROUND ELEV. 62+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
	BROWN SILTY SAND WITH SOME GRAVEL WITH PIECES OF BRICK (FILL)
4.2'	AUGER REFUSAL AT 4.2' (PROBABLE BEDROCK)

X	DRILLER - VISUALLY
X	SOIL TECHNICIAN - VISUALLY
	LABORATORY TESTS

S.W.COLE ENGINEERING, INC.

AUGER PROBE LOGS

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/MILL

PROJECT NO. 05-0927 S
AUGER PROBE SIZE O.D. SSA

PROBE NO. P-5
STREET NAME
GROUND ELEV. 44.5+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
2"+/-	ASPHALT PAVEMENT
	LIGHT BROWN FINE SAND AND SILT WITH SOME ROCK
4.0'	(POSSIBLE WEATHERED ROCK)
	AUGER REFUSAL AT 4.0' (PROBABLE BEDROCK)

PROBE NO. P-6
STREET NAME
GROUND ELEV. 45.5+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
2"+/-	ASPHALT PAVEMENT
	PROBABLE BROWN SAND SOME GRAVEL AND SILT (FILL)
5.7'	
	AUGER REFUSAL AT 5.7' (PROBABLE BEDROCK)

X	DRILLER - VISUALLY
X	SOIL TECHNICIAN - VISUALLY
	LABORATORY TESTS

S.W.COLE ENGINEERING, INC.

AUGER PROBE LOGS

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/MILL

PROJECT NO. 05-0927 S
AUGER PROBE SIZE O.D. SSA

PROBE NO. P-7
STREET NAME
GROUND ELEV. 65+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
4"+/-	BROWN ORGANIC TOPSOIL
	PROBABLE GRANULAR FILL
6.0'	AUGER REFUSAL AT 6.0' (PROBABLE BEDROCK)

PROBE NO. P-8
STREET NAME
GROUND ELEV. 48+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
4"+/-	BROWN ORGANIC TOPSOIL
	PROBABLE GRANULAR FILL
7.3'	AUGER REFUSAL AT 7.3' (PROBABLE BEDROCK)

X	DRILLER - VISUALLY
X	SOIL TECHNICIAN - VISUALLY
	LABORATORY TESTS

S.W.COLE ENGINEERING, INC.

AUGER PROBE LOGS

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

PROJECT NO. 05-0927 S
AUGER PROBE SIZE O.D. SSA

PROBE NO. P-9
STREET NAME
GROUND ELEV. 49.5+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
4"+/-	BROWN ORGANIC TOPSOIL
3.7'	PROBABLE GRANULAR FILL
	AUGER REFUSAL AT 3.7' (PROBABLE BEDROCK)

PROBE NO. P-10
STREET NAME
GROUND ELEV. 52+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
2"+/-	ASPHALT PAVEMENT
6.7'	PROBABLE BLAST SPOIL WITH SILTY SAND AND GRAVEL (FILL)
	AUGER REFUSAL AT 6.7' (PROBABLE BEDROCK)

X	DRILLER - VISUALLY
X	SOIL TECHNICIAN - VISUALLY
	LABORATORY TESTS

S.W.COLE ENGINEERING, INC.

AUGER PROBE LOGS

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/WILL

PROJECT NO. 05-0927 S
AUGER PROBE SIZE O.D. SSA

PROBE NO. P-11
STREET NAME
GROUND ELEV. 48.5+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
6"+/-	BROWN ORGANIC TOPSOIL
1.2'	PROBABLE GRANULAR FILL
	AUGER REFUSAL AT 1.2'
	(PROBABLE BEDROCK)

PROBE NO. P-12
STREET NAME
GROUND ELEV. 51+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
	BROWN SILTY SAND WITH SOME GRAVEL
10.5'	PROBABLE SANDY SILT (WET)
	AUGER REFUSAL AT 10.5'
	(PROBABLE BEDROCK)

X	DRILLER - VISUALLY
X	SOIL TECHNICIAN - VISUALLY
	LABORATORY TESTS

S.W.COLE ENGINEERING, INC.

AUGER PROBE LOGS

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/MLL

PROJECT NO. 05-0927 S
AUGER PROBE SIZE O.D. SSA

PROBE NO. P-13
STREET NAME
GROUND ELEV. 59.5+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
6"+/-	BROWN ORGANIC TOPSOIL
2.0'	PROBABLE GRANULAR FILL
	AUGER REFUSAL AT 2.0' (PROBABLE BEDROCK)

PROBE NO. P-14
STREET NAME
GROUND ELEV. 55+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
	BROWN SILTY SAND WITH SOME GRAVEL (POSSIBLE FILL)
5'+/-	
	(POSSIBLE TILL)
10.3'	
	AUGER REFUSAL AT 10.3' (PROBABLE BEDROCK)

X	DRILLER - VISUALLY
X	SOIL TECHNICIAN - VISUALLY
	LABORATORY TESTS

S.W.COLE ENGINEERING, INC.

AUGER PROBE LOGS

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/MILL

PROJECT NO. 05-0927 S
AUGER PROBE SIZE O.D. SSA

PROBE NO. P-15
STREET NAME
GROUND ELEV. 51.5+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
6"+/-	BROWN ORGANIC TOPSOIL
	PROBABLE GRANULAR SOIL
5.6'	
	AUGER REFUSAL AT 5.6' (PROBABLE BEDROCK)

PROBE NO. P-16
STREET NAME
GROUND ELEV. 59+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
6"+/-	BROWN ORGANIC TOPSOIL
	BROWN SAND WITH SOME SILT SOME GRAVEL
8.6'	
	AUGER REFUSAL AT 8.6' (PROBABLE BEDROCK)

X	DRILLER - VISUALLY
X	SOIL TECHNICIAN - VISUALLY
	LABORATORY TESTS

S.W.COLE ENGINEERING, INC.

AUGER PROBE LOGS

PROJECT: PROPOSED OFFICE BUILDING
CLIENT: MARTINS POINT HEALTHCARE
LOCATION: 331 VERANDA STREET PORTLAND, MAINE
DRILLING FIRM: GWTB DRILLER: JEFF/MILL

PROJECT NO. 05-0927 S
AUGER PROBE SIZE O.D. SSA

PROBE NO. P-17
STREET NAME
GROUND ELEV. 54+/-
DATE 11-18-05

DEPTH	STRATUM DESCRIPTION
4"+/-	BROWN ORGANIC TOPSOIL
1.0'	PROBABLE GRANULAR SOIL
	AUGER REFUSAL AT 1.0'
	(PROBABLE BEDROCK)

X	DRILLER - VISUALLY
X	SOIL TECHNICIAN - VISUALLY
	LABORATORY TESTS

S.W.COLE ENGINEERING, INC.

AUGER PROBE REFUSAL DEPTHS

PROJECT NO.: 05-0927.3
AUGER SIZE (O.D.) 4 1/2"
DATE: 1/22/2009

PROJECT: PROPOSED PHASE II CAMPUS IMPROVEMENTS
CLIENT: MARTIN'S POINT HEALTHCARE, INC
LOCATION: U.S. ROUTE ONE, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC.

PROBE NUMBER	DEPTH TO WEATHERED BEDROCK	DEPTH TO REFUSAL	NOTES
P-18	4.3'	4.3'	
P-19	2.5'	2.5'	
P-20	13.0'	13.0'	MOVED TO BENCHED AREA ON SLOPE - APPEARED TO BE FILL SOILS
P-21	3.0'	3.0'	POSSIBLE RELIC CONCRETE ENCOUNTERED BELOW ASPHALT PAVEMENT
P-22	1.5'	1.5'	
P-23	3.0'	3.0'	
P-24	6.0'	8.0'	PROBABLE WEATHERED ROCK AT 6.0'
P-25	4.5'	5.0'	PROBABLE WEATHERED ROCK AT 4.5'
P-26	2.5'	3.5'	PROBABLE WEATHERED ROCK AT 2.5'
P-27		N/A	DID NOT DRILL DUE TO UTILITY CONFLICTS AND DIFFICULT ACCESS
P-28		N/A	DID NOT DRILL DUE TO UTILITY CONFLICTS AND DIFFICULT ACCESS
P-29	7.5'	9.5'	PROBABLE WEATHERED ROCK AT 7.5'
P-30	21.5'	21.5'	
P-31		25' NR	25.0' PROBE DEPTH WITH NO REFUSAL SURFACE ENCOUNTERED

S.W.COLE ENGINEERING, INC.

ROCK CORE LOG

PROJECT: PROPOSED OFFICE BUILDING

CLIENT: MARTINS POINT HEALTHCARE

LOCATION: 331 VERANDA STREET PORTLAND, MAINE

LOGGED BY: GWB DATE: 12/07/05

CHECKED BY: PFK DATE: 12/07/05

BORING NO.: B-2

PROJECT NO.: 05-0927 S

SHEET NO.: 1 OF 1

CORE SIZE: NQ-2

DEPTH BELOW SURFACE (FT)	CORE RUN	CORE INTERVAL (FT)	CORE RECOVERY (FT)	RQD (%)	ROCK QUALITY	GRAPHIC LOG	ROCK DESCRIPTION AND IDENTIFICATION
13.5'	R-1	5.0'	4.4'	31"/60" 52%	FAIR		HIGHLY FRACTURED ZONE PIECES <2" GRAY SULFIDIC PELITE • HIGHLY WEATHERED BECOMING... • HARD • RUST STAINS ON FRACTURE SURFACES • FRACTURES AT 25 TO 55 DEGREES FROM HORIZONTAL • ... MODERATELY WEATHERED
18.5'							ZONE OF CORE LOSS

S.W.COLE ENGINEERING, INC.

ROCK CORE LOG

PROJECT: PROPOSED OFFICE BUILDING — BORING NO.: B-3

CLIENT: MARTINS POINT HEALTHCARE — PROJECT NO.: 05-0927 S

LOCATION: 331 VERANDA STREET PORTLAND, MAINE

LOGGED BY: GWB — DATE: 12/07/05 — SHEET NO.: 1 OF 1

CHECKED BY: PFK — DATE: 12/07/05 — CORE SIZE: NQ-2

DEPTH BELOW SURFACE (FT)	CORE RUN	CORE INTERVAL (FT)	CORE RECOVERY (FT)	RQD (%)	ROCK QUALITY	GRAPHIC LOG	ROCK DESCRIPTION AND IDENTIFICATION
16.5'	R-1	5.0'	5.0'	37"/60" 62%	FAIR		GRAY SULFIDIC PELITE • MODERATELY WEATHERED • HARD • RUST STAINS ON FRACTURE SURFACES • FRACTURES AT 10 TO 20 AND 55 DEGREES FROM HORIZONTAL
21.5'							

S.W.COLE ENGINEERING, INC.

ROCK CORE LOG

PROJECT: PROPOSED OFFICE BUILDING

CLIENT: MARTINS POINT HEALTHCARE

LOCATION: 331 VERANDA STREET PORTLAND, MAINE

LOGGED BY: GWB DATE: 12/07/05

CHECKED BY: PFK DATE: 12/07/05

BORING NO.: B-5

PROJECT NO.: 05-0927 S

SHEET NO.: 1 OF 1

CORE SIZE: NQ-2

DEPTH BELOW SURFACE (FT.)	CORE RUN	CORE INTERVAL (FT.)	CORE RECOVERY (FT.)	ROD (%)	ROCK QUALITY	GRAPHIC LOG	ROCK DESCRIPTION AND IDENTIFICATION
5.0'							
	R-1	5.0'	5.0'	8"/60" 13%	VERY POOR		GRAY SULFIDIC PELITE • HIGHLY WEATHERED • SOFT • VERY RUSTY • (RUST STAINS ON ROCK SURFACE AND FRACTURE SURFACES) • FRACTURES AT 10 TO 75 DEGREES FROM HORIZONTAL HIGHLY FRACTURED ZONE ... PIECES <1"
10.0'							

KEY TO THE NOTES & SYMBOLS
Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - based on laboratory unconfined compressive test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. based on pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass. RQD is computed from recovered core samples.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

0 to 5% TRACE
5 to 12% SOME
12 to 35% "Y"
35+% AND

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

S.W.COLE ENGINEERING, INC.

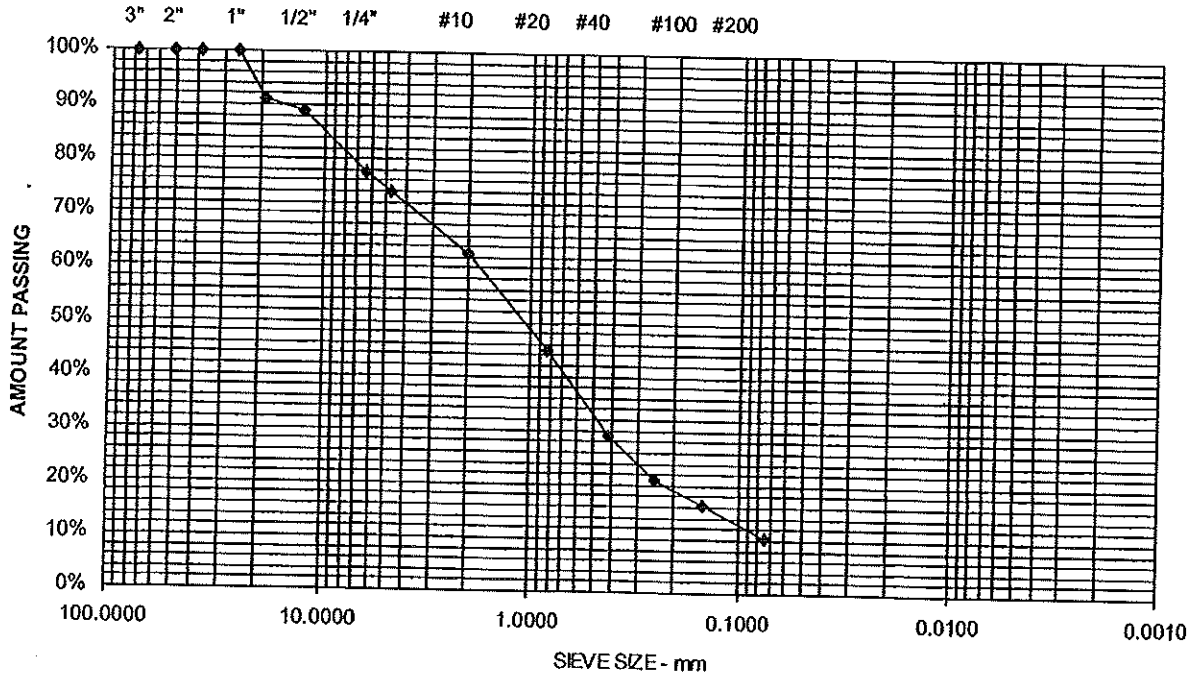
Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND - PROPOSED FACILITY EXPANSION - VERANDA STREET - GEOTECHNICAL ENGINEERING SERVICES	Project Number	05-0927
Client	MARTIN'S POINT HEALTHCARE	Lab ID	4557G
Exploration	B-2 S-1	Date Received	12/7/2005
Material Source	0-2'	Date Completed	12/9/2005
		Tested By	

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	6"	100	
125 mm	5"	100	
100 mm	4"	100	
75 mm	3"	100	
50 mm	2"	100	
38.1 mm	1-1/2"	100	
25.0 mm	1"	100	
19.0 mm	3/4"	91	
12.5 mm	1/2"	89	
6.3 mm	1/4"	78	
4.75 mm	No. 4	74	25.9% Gravel
2.00 mm	No. 10	63	
850 um	No. 20	45	
425 um	No. 40	29	63.6% Sand
250 um	No. 60	21	
150 um	No. 100	16	
75 um	No. 200	10.4	10.4% Fines

GRAVELLY SAND WITH SOME SILT (FILL)



Comments: w = 9.5%

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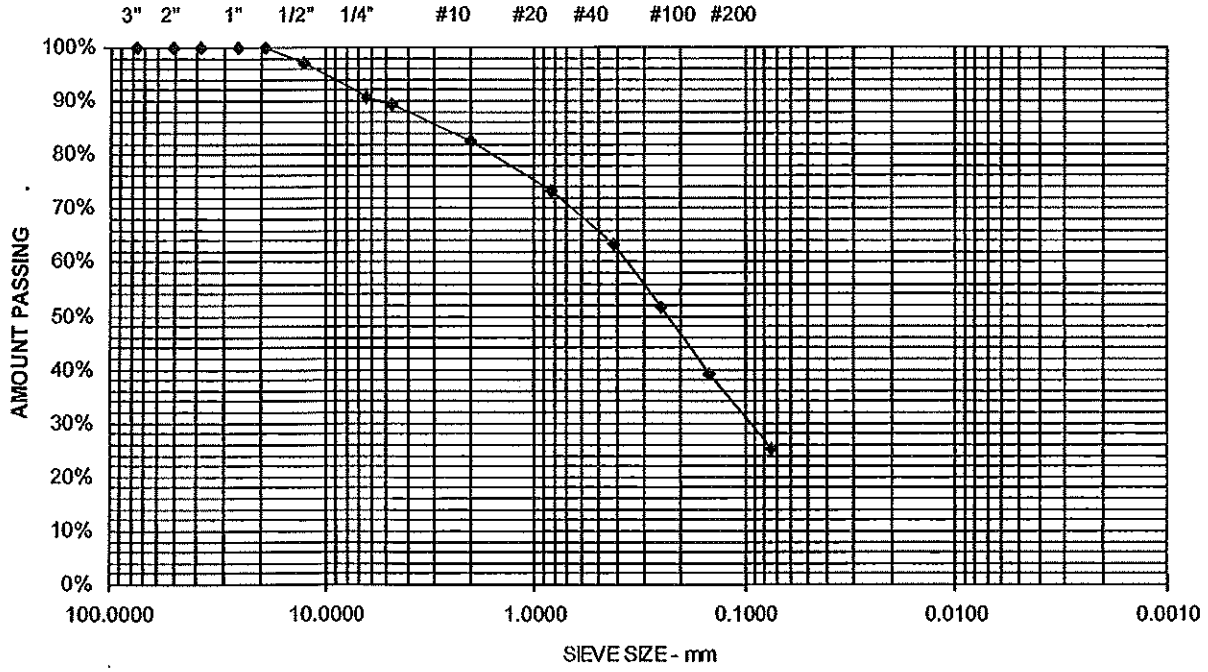
Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND - PROPOSED FACILITY EXPANSION - VERANDA STREET - GEOTECHNICAL ENGINEERING SERVICES	Project Number	05-0927
Client	MARTIN'S POINT HEALTHCARE	Lab ID	4558G
Exploration	B-3 S-2	Date Received	12/7/2005
Material Source	5'-7'	Date Completed	12/9/2005
		Tested By	

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	6"	100	
125 mm	5"	100	
100 mm	4"	100	
75 mm	3"	100	
50 mm	2"	100	
38.1 mm	1-1/2"	100	
25.0 mm	1"	100	
19.0 mm	3/4"	100	
12.5 mm	1/2"	97	
6.3 mm	1/4"	91	
4.75 mm	No. 4	89	10.7% Gravel
2.00 mm	No. 10	83	
850 um	No. 20	73	
425 um	No. 40	63	63.9% Sand
250 um	No. 60	51	
150 um	No. 100	39	
75 um	No. 200	25.4	25.4% Fines

SILTY SAND WITH SOME GRAVEL (TILL)



Comments: w = 28.2%

S.W.COLE ENGINEERING, INC.

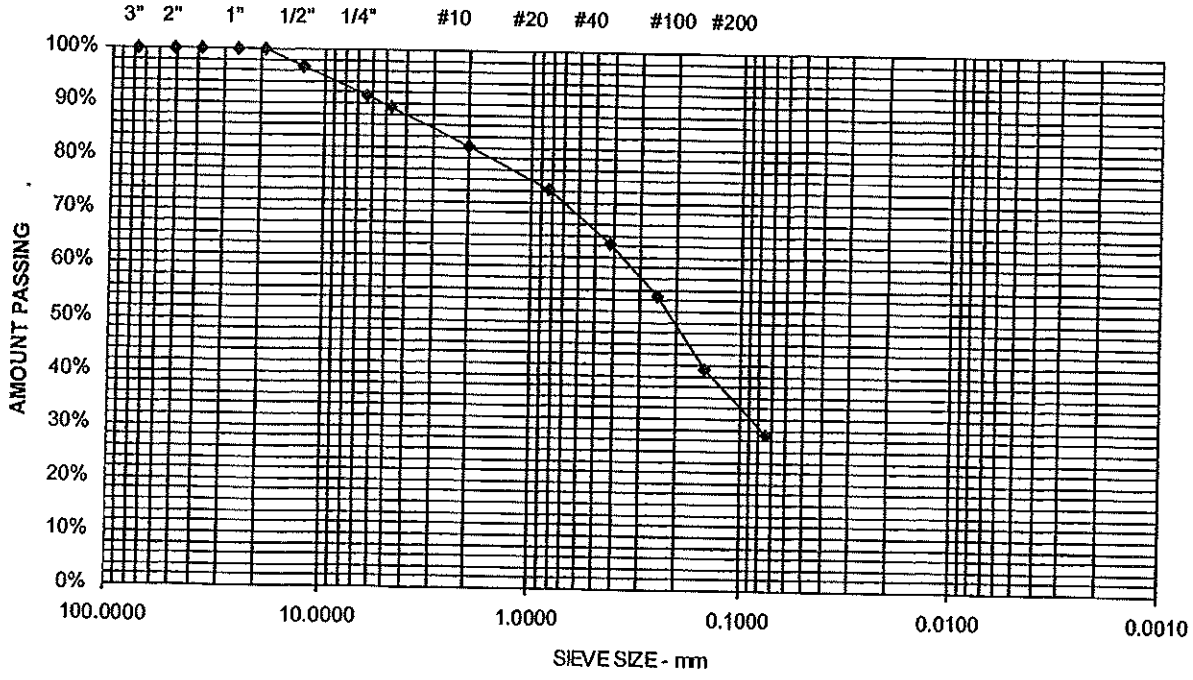
Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND - PROPOSED FACILITY EXPANSION - VERANDA STREET - GEOTECHNICAL ENGINEERING SERVICES	Project Number	05-0927
Client	MARTIN'S POINT HEALTHCARE	Lab ID	4559G
Exploration	B-3 S-4	Date Received	12/7/2005
Material Source	10'-12'	Date Completed	12/9/2005
		Tested By	

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	6"	100	
125 mm	5"	100	
100 mm	4"	100	
75 mm	3"	100	
50 mm	2"	100	
38.1 mm	1-1/2"	100	
25.0 mm	1"	100	
19.0 mm	3/4"	100	
12.5 mm	1/2"	97	
6.3 mm	1/4"	91	
4.75 mm	No. 4	89	10.7% Gravel
2.00 mm	No. 10	82	
850 um	No. 20	74	
425 um	No. 40	64	60.2% Sand
250 um	No. 60	55	
150 um	No. 100	41	
75 um	No. 200	29.1	29.1% Fines

SILTY SAND WITH SOME GRAVEL (TILL)



Comments: w = 33.1%

S.W.COLE ENGINEERING, INC.

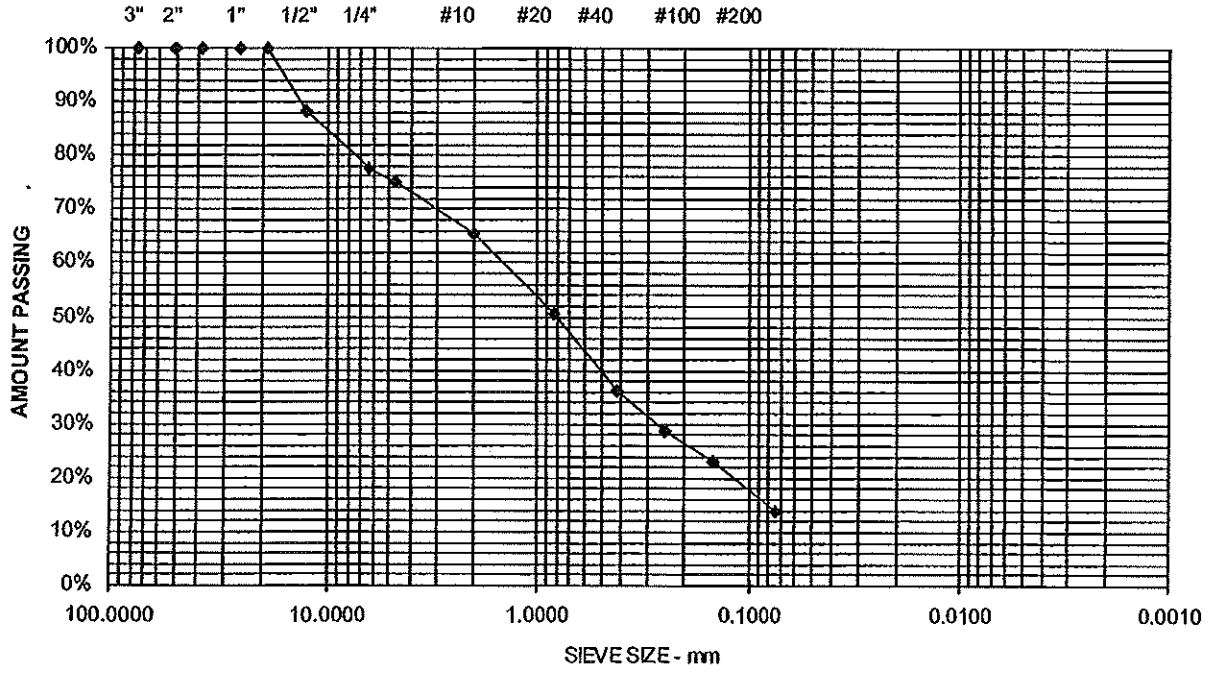
Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND - PROPOSED FACILITY EXPANSION - VERANDA STREET - GEOTECHNICAL ENGINEERING SERVICES	Project Number	05-0927
Client	MARTIN'S POINT HEALTHCARE	Lab ID	4560G
Exploration	B-7 S-1	Date Received	12/7/2005
Material Source	0-2'	Date Completed	12/9/2005
		Tested By	

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	6"	100	
125 mm	5"	100	
100 mm	4"	100	
75 mm	3"	100	
50 mm	2"	100	
38.1 mm	1-1/2"	100	
25.0 mm	1"	100	
19.0 mm	3/4"	100	
12.5 mm	1/2"	88	
6.3 mm	1/4"	77	
4.75 mm	No. 4	75	25.1% Gravel
2.00 mm	No. 10	65	
850 um	No. 20	50	
425 um	No. 40	36	60.9% Sand
250 um	No. 60	29	
150 um	No. 100	23	
75 um	No. 200	14.0	14% Fines

SILTY GRAVELY SAND (FILL)



Comments: w = 11.6%

APPENDIX A

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Protection, modification and/or installation of utilities as sitework progresses paying particular attention to grade changes and any necessary staging of work.

B. Cutting, filling and grading to required lines, dimensions, contours and proposed elevations for proposed improvements.

C. Scarifying, compaction, drying and removal of unsuitable material to ensure proper preparation of areas for fills or proposed improvements.

D. Sequencing the construction is required to protect the subgrades, the work and to comply with the Erosion/Sediment Control Plan for this project.

E. Section 02100 of these specifications defines the building pad zones. Application of this specification shall be based upon the building pad zone description provided in Section 02100.

F. The footing zone shall be defined to be the area under footings and projecting outward and away from the footing at an imaginary 1:1 slope.

G. Dewatering, trench protection, shielding, attendant safety measures, and protection of the work throughout construction required by the contract.

1.2 RELATED REQUIREMENTS

A. Section 02050 - Demolition

B. Section 02100 - Site Preparation

C. Section 02221 – Excavation, Backfilling and Compacting for Structures

D. Section 02222 – Excavation, Backfilling and Compacting for Utilities

E. Section 02227 – Aggregate Materials

F. Section 02229 – Rock Removal

G. Section 02270 – Slope Protection and Erosion Control

H. Geotechnical Report for boring locations and findings of subsurface materials and conditions.

I. Contract Drawings

A copy of the Erosion and Sedimentation Control Report is appended to Specification Section 02270 and shall be considered part of the Contract Document.

1.3 REFERENCE STANDARDS

American Society for Testing and Materials (ASTM), Latest Edition:

D422 Method for Particle Size Analysis of Soils

D698 Test for Moisture-Density Relations of Soils Using 5.5 lb. (2.5 kg) Rammer and 12-inch (304.8mm) Drop (**Standard Proctor**)

D1556 Test for Density of Soil in Place by the Sand Cone Method

D1557 Test for Moisture-Density Relations of Soils using 10-lb (4.5 kg) Rammer and 18-inch (457 mm) Drop (**Modified Proctor**)

D1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

D2167 Test for Density of Soil in Place by the Rubber Balloon Method

D2216 Laboratory Determination of Moisture Content of Soil

D2487 Classification of Soils for Engineering Purposes

D2922 Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D4318 Test for Plastic Limit, Liquid Limit, & Plasticity Index of Soils

American Association of State Highway and Transportation Officials (AASHTO), Latest Edition:

T88 Mechanical Analysis of Soils

1.4 ENVIRONMENTAL REQUIREMENTS

Construct temporary erosion control systems as shown on the plans as directed by the Engineer or to comply with environmental permits to protect adjacent properties and water resources from erosion and sediment damages.

1.5 QUALITY ASSURANCE

A. Independent Testing Laboratory: Refer to General Conditions for Clarification if the testing firm to perform construction testing is to be selected and paid by Contractor or by the Owner. Site testing requirements shall be based on the following:

1. Building Subgrade Areas, including 10'-0" Outside Exterior Building Lines: In cut areas, not less than one compaction test for every 5,000 square feet. In fill areas, same rate of testing for each lift of fill (measured loose). This area shall include all footing zones.
2. Areas of Construction exclusive of building subgrade: In cut areas, not less than one compaction test for every 20,000 square feet. In fill areas, same rate of testing for each lift of fill (measured loose).

B. If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to the Owner.

C. The following tests shall be performed on each type of on-site or imported soil material used as compacted fill as part of construction testing requirements:

1.	Moisture and Density Relationship:	ASTM D 698 or ASTM D 1557
2.	Mechanical Analysis:	AASHTO T-88
3.	Plasticity Index:	ASTM D 4318

D. Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements:

1.	Sand-Cone Method:	ASTM D 1556
2.	Balloon Method:	ASTM D 2167
3.	Nuclear Method:	ASTM D 2922 (Method B - Direct Transmission)

E. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, the project Site Engineer, Architect, Geotechnical Engineer of Record, and Contractor shall be provided with copies of reports within 96 hours of time test was performed. In the event that any test performance fails to meet these Specifications, the Owner and the Contractor shall be notified immediately by Testing Laboratory.

F. Unless stipulated otherwise, the following compaction requirements shall be required for this project and placed in accordance with the following maximum lift (layer) thicknesses.

Fill Placement Criteria – Martin's Point Redevelopment Project, Portland, Maine			
Fill Application or Use	**Allowable Material Type**	**Maximum Lift Thickness (in.)**	**Minimum Compaction in % of Maximum Dry Density (ASTM D-1557)**
1. Building Pad Fill Outside of Footing Zone and Lower than 12" Below the Finish Floor Slab	Gravel Borrow	9	95
2. Building Pad for Slab	Foundation Backfill	9	95
3. Building Entryway and Contiguous Sidewalk	Foundation Backfill	9	95
4. Footing Zone	Foundation Backfill	9	95
5. Pavement Subbase Course	Aggregate Subbase	9	95
6. Pavement Base Course	Aggregate Base	4	95
7. Beneath Footings	Crushed Stone	9	95
8. Road Embankment Drainage Layers and Granular Shell Materials	Granular Borrow	12	95
9. Road Embankment Fill and Parking Area Subgrade Fill	Common Borrow, Granular Borrow, or Structural Fill	12	95
10. Retaining Wall Backfill * Within 5 Feet of Wall Face	Granular Borrow or Select Fill with Drainage Stone in Modular Block Voids	9	93 (Unless governed by other criteria) Hand-operated compaction equipment required.
* Beyond 5 Feet of Wall Face	Granular Borrow	12	93 (Unless governed by other criteria)
11. Access Path Walkway	Reclaim Asphalt or Concrete	10	95
12. Turf	Loam w/Organic Admixture	N/A	N/A
13. Underdrain and Flexible Pipe Bedding	Crushed Stone	100%	100 ASTM C-29 not D1557

The following fill material types correspond to the Maine Department of Transportation (MDOT) current standard specification/designation and are permitted for use as follows:

Fill Placement Criteria –Martin's Point Redevelopment Project, Portland, Maine		
Material	**MDOT Designation**	**Permissible Uses**
Subbase Aggregate	MDOT 703.06(a) Type D	- Engineered Fill Beneath Buildings - Retaining Wall Backfill Within 5 Feet of Wall Face - Backfill within 10 Feet of Backface of 1.5H:1V Riprap Slopes - Backfill Above Perimeter Foundation Drains - Pond Aggregate Over Clay Layers - Pavement Subbase Course Layer
Aggregate Base	MDOT 703.06(a) Type A	- Pavement Base Course Layer; Also May be Used for all Applications Where Subbase, Select, Common or Granular Borrow is Required
Granular Borrow	MDOT 703.19	- Backfill and Retained Soil Behind Retaining Walls Road Embankment Play and Yard Area Subgrades (below subbase) Pavement Subgrade
Common Borrow	MDOT 703.18	- General Sitework Outside of Building Pad and not Below Pavement Subgrade
Drainage Stone	¾ Inch Stone	- Filling Voids in Modular Block Walls - Backfill Around Foundation Drains - Bedding Around Storm Drain Pipe, Sewers and Water Mains - Soft Ground Working Mat
Granular Fill	MDOT 703.06(b) Type E	- Backfill and Retained Soil Behind Retaining Walls - Road Embankment Layers - Pavement Subgrade (below subbase)
Granular Borrow	MDOT 703.19	- Backfill and Retained Soil Behind Retaining Walls
Foundation Backfill	Structural Fill	- Below slab areas - Against perimeter foundation walls

All costs related to retesting due to failures shall be paid for by the Contractor at no additional expense to the Owner. The Owner reserves the right to employ an Independent Testing Laboratory and to direct any testing that is deemed necessary. Contractor shall provide free access to site for testing activities.

1.6 SUBMITTALS

A. Submit a sample and gradation test results of each type of off-site fill materials that is to be used at the site in an airtight, 10-lb. container for the testing laboratory.

B. Submit the name of each material supplier and specific type and source of each material. Any change in source throughout the job requires approval of the Owner and Engineer.

C. For use of fabrics or geogrids, an Owner-approved design shall be submitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Excavated and re-used materials for subsoil fill as specified herein.

B. Aggregate fill as specified in Section 02227.

C. Imported subsoil material approved by the Owner and specified herein or in Section 02227.

D. Topsoil fill as specified in Section 02930 with proper organic admixtures.

E. Acceptable stabilization fabrics as Geogrids for some (but not all) uses.

1. Mirafi 500X or 600X
2. Phillips 66 Supac 6WS
3. Dupont Typar 3401 and 3601
4. Trevira S1114 and S1120
5. Tensar SS-1 and SS-2
6. Exxon GTF-200 or 350
7. Geogrids specifically shown on the Contract Drawings for some (but not all) uses

F. Acceptable filter/drainage fabrics for some (but not all) uses:

1. Mirafi 140NS
2. Phillips 66 Supac 4NP
3. Dupont Typar 3341
4. Fabric Types Specifically Shown on the Contract Drawings

G. When the Contract Drawings show a specific fabric or geogrid type, that material shall be used unless otherwise approved by the Engineer and Owner in writing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Locate and identify existing utilities that are to remain and protect them from damage.

C. Notify utility companies to remove and/or relocate any utilities that are in conflict with the proposed improvements.

D. Protect plant life, lawns, fences, existing structures, sidewalks, paving and curbs from excavation equipment and vehicular traffic.

E. Protect benchmarks, property corners and all other survey monuments from damage or displacement. If a marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, by the same.

F. Remove from site material encountered in grading operations that, in opinion of Owner or Owner's representative, is unsuitable or undesirable for backfilling, subgrade or foundation purposes. Dispose of in a manner satisfactory to Owner and in accordance with the applicable State, Local, and Federal Regulations, including Section 18 "Solid Waste" of the MeDEP Site Location of Development Permit application.

G. Prepare the site as specified in Section 02100.

H. Prior to placing fill in low areas, such as previously existing streams, ponds, or wetlands, perform following procedures:

1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain same results. Direct runoff to approved erosion control measures.
2. After drainage of low area is complete, remove muck, mud, debris, and other unsuitable material by using acceptable equipment and methods that will keep natural soils underlying low areas dry and undisturbed.
3. If proposed for fill, all muck, mud, and other materials removed from above low areas shall be dried on-site by spreading in thin layers for observation by the Owner's representative. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under or within 10'-0" of perimeter of building pad or paving subgrade. If, after observation by the Owner's representative, material is found to be unsuitable, all unsuitable material shall be removed from site.

3.2 EXCAVATION FOR FILLING AND GRADING

A. Classification of Excavation: Contractor by submitting bid acknowledges that he has investigated site to determine type, quantity, quality, and character of excavation work to be performed. All excavation shall be considered unclassified excavation except that defined as rock. Refer to Section 02229.

B. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and governing agencies.

C. When performing grading operations during periods of wet weather, provide adequate drainage and ground water management to control moisture of soils. Protect exposed clay soils from runoff, erosion or elevated moisture content.

D. Comply with the erosion control plan and special provisions shown on the Contract Drawings.

E. Shore, brace, and drain excavations as necessary to maintain safe, secure, and free of water at all times.

F. Excavated material containing rock or stone exceeding 6" in size limitations is unacceptable as fill within the proposed building and paving area.

G. Protect excavated materials from moisture and condition as required for placement in parking lot subgrades, embankments, and general site fills. (Material excavated from the site shall not be used in the building pad zones.)

H. Excavation shall consist of the removal of all materials encountered in grading the project and disposal where necessary.

I. Excavation shall be accomplished in a manner which complies with the erosion control measures for this site, meets all OSHA and related requirements, and maintains positive drainage of the subgrade throughout construction.

3.3 FILLING AND SUBGRADE PREPARATION

A. BUILDING SUBGRADE AREAS:

1. Building subgrade pad zones shall be as defined in Section 02100.
2. The building subgrade pad shall be prepared in strict accordance with the "foundation subsurface preparation notes" shown on the civil-site drawings and defined in Section 02100.
3. Unless specifically indicated otherwise on the Drawings, areas exposed by excavation or stripping and on which building subgrade preparations are to be performed shall be completed with a smooth-blade excavator. These areas shall then be proofrolled to detect any areas of insufficient compaction prior to placement of any fill. Proofrolling shall be accomplished by making a minimum of two (2) complete passes with a fully-loaded tandem-axle dump truck, or approved equivalent, in each of the two perpendicular

directions under the supervision and direction of a field geotechnical engineer. Areas of failure shall be excavated, replaced with select fill and recompacted as stated above.

4. Unless specifically indicated otherwise on the Drawings, fill materials used in preparation of building subgrade shall be placed in lifts or layers not to exceed 12" loose measure compacted to a minimum density of 95% of maximum dry density, in accordance with ASTM D 1557 at a moisture content of not less than 1% below and not more than 3% above the optimum moisture content.

B. AREA OF CONSTRUCTION EXCLUSIVE OF THE BUILDING SUBGRADE:

1. Unless specifically stated otherwise on the Drawings, areas exposed by excavation or stripping and on which the subgrade preparations are to be performed shall be completed with a smooth-blade excavator. These areas shall then be proofrolled to compact the subgrade. Proofrolling shall be accomplished by making a minimum of two (2) complete passes with a fully-loaded tandem-axle dump truck, or approved equivalent, in each of the two perpendicular directions under the supervision and direction of a field geotechnical engineer. Areas of failure shall be excavated, replaced with select fill and recompacted as stated above.
2. Unless specifically stated otherwise on the Drawings, fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed the lift thickness specified in Section 1.05 of this specification and compacted to a minimum density specified in Section 1.05 of this specification.
3. The following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable fill material in the specified areas; unless specifically stated otherwise on the Drawings:

Location*	PI	LL
Area below upper two feet, exclusive of building area	20	50
Upper two feet, exclusive of building area	15	40

*References to depth are to proposed subgrade elevations.

4. Material imported to the site shall meet the material specifications of Section 02227 of these specifications and Section 1.05 of this specification.

3.4 PLACEMENT OF EMBANKMENTS AND BUILDING PAD FILLS

Place embankments and fills in the lift thickness specified in Section 1.05 and compact to meet the density specified in Section 1.05. The embankments and fills shall be placed using the materials specified, incorporate the drainage and all special placement measures stipulated by the Erosion Control Plan, the Contract Documents, and Permits required by the drawings using appropriate compaction equipment. In building fill zones, the compaction equipment should include a vibratory drum compactor with a minimum static weight of 10,000 pounds and a minimum dynamic force of 20,000 lbs. In areas close to retaining walls and buried manholes or appurtenances, the use of hand-held vibratory equipment is anticipated. In parking lot

embankments and other site fills, the use of steel drum rollers to compact native borrow material from the site is anticipated.

The selection of compaction equipment, their use, and operation to achieve the specified compaction is the sole responsibility of the Contractor.

The embankments shall be protected from inclement weather including:

3.4.1 Rolling any exposed embankments and parking lot fills constructed of on-site material with a smooth drum roller at the end of each workday.
3.4.2 Covering all exposed embankments of parking lot fills with a compacted sand layer prior to any significant rainfall.
3.4.3 Maintaining positive drainage from the embankments and parking lot subgrades throughout construction.
3.4.4 Providing drainage chutes and windrowing the top edge of embankments to avoid concentrated runoff from traveling down embankment sideslopes.
3.4.5 Staging and phasing the work to meet the requirements of the erosion control plan and specific sequences shown on the drawings.
3.4.6 Compliance with the project geotechnical report.

3.5 MAINTENANCE OF SUBGRADE

A. Finished subgrades shall be verified to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks and dump trucks.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in a manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

D. Grading of building and paving areas shall be checked by string line from grade stakes (blue tops) set at not more than 50' centers. Tolerance of + 0.10 feet will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations.

E. Maintain subgrade for area to be paved and building pad subgrades. Make adjustments that may be required in accordance with Specifications at no additional expense to Owner.

The Contractor shall protect all soils, compacted gravel, sand, and drainage material under poured slabs and in areas where slabs will be poured within the building from surface runoff excessive moisture. All expenses associated with protective measures, temporary heating, and recompaction shall be at the expense of the Contractor.

3.6 RIPRAP

A. Place riprap in all areas where indicated on the Drawings. The stone for riprap shall be washed and consist of field stone or rough unhewn quarry stone as nearly uniform in section as is practical.

The stones shall be dense, resistant to the action of air and water, and suitable in all aspects for the purpose intended. The riprap shall be composed of a well-graded mixture down to the one-inch size particle such that 50 percent of the mixture by weight shall be larger than the D50 size specified on the drawings.

A well-graded mixture is defined as a mixture composed primarily of the larger stone size but with a sufficient mixture of other sizes to fill the progressively smaller voids between the stones. The diameter of the largest stone size in such a mixture shall be 1.5 times the D50 size. When subjected to the magnesium sulfate soundness test (ASTM C-88), the percent weight loss shall be less than 15%. When tested according to ASTM C-131, the crushed stone shall have a maximum loss of 45% at 5,000 revolution.

B. Slopes and other areas to be protected shall be dressed to the line and grade shown on the plans prior to the placing of riprap. Contractor shall then undercut the areas to receive riprap to an elevation equal to the final elevation less the specified thickness of riprap as shown on the drawings.

C. Filter fabric and bedding material shall be installed prior to the placement of the riprap if so indicated on the drawings. The bedding material shall be in accordance with Section 02227 and shall be 6" in depth. Filter fabric shall be as specified herein and as detailed on the plans.

D. Stones shall be placed so that the greater portion of their weight is carried by the earth and not by the adjacent stones. These stones shall be placed uniformly with close joints. The upright areas of the stone shall make an angle of approximately 90 degrees with the embankment slope. The courses shall be placed from the bottom of the embankment upward, the larger stones being placed in the lower courses. Open joints shall be filled with spalls. Stones shall be embedded in the embankment as necessary to present a uniform top surface such that the variation between tops of adjacent stones shall not exceed 3".

3.7 FINISH GRADING

A. Grade all areas where finish grade elevations or contours are indicated on Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free of rock, debris, or irregular surface changes. Finished subgrade surface shall not be more than 0.10 feet above or below established finished subgrade elevation, and all ground surfaces shall vary uniformly between indicated elevations. Finish ditches shall be graded to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil application, refer to Section 02930 (TURF AND GRASSES).

B. Correct all settlement and eroded areas within one year after date of completion at no additional expense to owner. Bring grades to proper elevation. Replant or replace any grass, shrubs, bushes, or other vegetation disturbed by construction using corrective measures. Refer to Section 02270 for slope protection and erosion control.

C. Refer to Section 02200 for soil stabilization and geotextile fabric materials.

3.8 ROCK EXCAVATION

See Section 02229 - Rock Removal

END OF SECTION 02200

SECTION 02221

EXCAVATION, BACKFILLING AND COMPACTING FOR STRUCTURE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavate to line, grade and configuration as shown in the plans and specifications for proposed building or structures.

B. Fill to line, grade and configuration as shown in the plans and specifications for proposed structures.

C. Compacting for materials in an acceptable manner as stated herein.

D. The work of this section applies to the building pad zone as defined by Section 02100 of these specifications. The building pad zone includes all footing zones.

1.2 RELATED REQUIREMENTS

A. Section 02100 – Site Preparation

B. Section 02200 - Earthwork

C. Section 02227 - Aggregate Material

D. Section 02229 - Rock Removal

E. Section 02505 - Paving Base Course

F. Section 02511 - Asphaltic Concrete Paving

G. Geotechnical Report for boring locations and findings of subsurface materials and conditions.

H. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

D422 Method for Particle and Size Analysis of Soils

3.6 FINISH GRADING

A. Finish grading shall be in accordance with Section 02200 and as more specifically stated herein.

B. Grading of building areas shall be checked by string line from grade stakes (blue tops) set at not more than 50' centers. Tolerance of up to 0.05 feet, will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, and elevations.

3.7 ROCK EXCAVATION

See Section 02229 - Rock Removal.

END OF SECTION 02221

SECTION 02222

EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavating trenches for the installation of utilities.

B. Backfilling trench with bedding materials as specified and indicated and finishing filling trench with suitable material to proposed subgrade.

C. Compacting backfill materials in an acceptable manner.

D. Within 5' of the building and under the building the Division 2 Contractor is responsible for excavation and backfill of the pipes and coordination with the work of other trades.

1.2 RELATED REQUIREMENTS

A. Section 02200 – Earthwork

B. Section 02227 - Aggregate Materials

C. Section 02229 - Rock Removal

D. Section 02605 - Sewer and Catch Basin Structures

E. Section 02607 – Filterra Stormwater Structure

F. Section 02660 - Water Distribution Systems

G. Section 02720 - Storm Sewer Systems

H. Section 02730 - Sanitary Sewer Systems

I. Geotechnical Report for boring locations and findings of subsurface materials and conditions

J. Construction Drawings.

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

D422 Method for Particle Size Analysis of Soils

D698 Test for Moisture-Density Relations of Soils Using 5.5 lb. (2.5 kg) Rammer and 12-inch (304.8mm) Drop **(Standard Proctor)**

D1556 Test for Density of Soil in Place by the Sand Cone Method

D1557 Test for Moisture-Density Relations of Soils Using 10-lb (4.5 kg) Rammer and 18-inch (457 mm) Drop **(Modified Proctor)**

D1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

D2216 Laboratory Determination of Moisture Content of Soil

D2487 Classification of Soils for Engineering Purposes

D2922 Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D4318 Test for Plastic Limit, Liquid Limit, & Plasticity Index of Soils

C25 Chemical Analysis of Limestone, Quicklime and Hydrated Lime

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.

T88 Mechanical Analysis of Soils

1.4 QUALITY ASSURANCE

Independent testing laboratory approved by the Owner shall be retained to perform construction testing on backfilling operations as specified in Section 02200 and as stated herein. It shall be the responsibility of the Contractor to accurately establish locations for all utilities. Refer to the general contract conditions for clarification on the cost for this independent laboratory.

1.5 SUBMITTALS

A. Shop drawings or details pertaining to the work of this section are not required unless use of materials, methods or procedures contrary to Drawings or these specifications are proposed. Do not perform work until required shop drawings have been accepted by Owner.

B. The Contractor shall contact all utility companies and determine if additional easements will be required to complete the project. Contractor shall provide written confirmation of the status of all easements to the Owners at the time of the preconstruction conference.

C. Submit a sample of each type of off-site fill material that is to be used in backfilling in an air-tight container of a size appropriate for the material for the testing laboratory or submit a gradation and certification of the aggregate material that is to be used to the testing laboratory for review.

1.6 PROJECT RECORD DOCUMENTS

Accurately record actual locations of all subsurface utilities, structures and obstructions encountered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate Material as specified in Section 02227.

B. Acceptive Stabilization Fabrics and Geogrids for some (but not all) uses.

1. Mirafi 500X or 600X
2. Phillips 66 Supac 6WS
3. Dupont Typar 3401 and 3601
4. Trevira S1114 and S1120
5. Tensar SS-1 and SS-2
6. Exxon GTF-200 or 350
7. Geogrids specifically shown on the Contract Drawings for some (but not all) uses.

C. Filter/Drainage Fabrics

1. Mirafi 140 NS
2. Phillips 66 Supac 4NP
3. Dupont Typar 3341
4. Fabric Types

D. When the Contract Drawings show a specific fabric or geogrid type, that material shall be used unless otherwise approved by the Engineer and Owner in writing.

PART 3 - EXECUTION

3.1 SUMMARY

A. Set all lines, elevations, and grades for utility and drainage system work and control system for duration of work, including careful maintenance of bench marks, property corners, monuments, or other reference points.

B. Maintain in operating condition existing utilities, active utilities, and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.

C. Verify location, size, elevation, and other pertinent data required to make connections to existing utilities and drainage systems as indicated on Drawings. Contractor shall comply with local codes and regulations.

D. Over excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas are to be stabilized by using acceptable backfill material placed and compacted as specified, filter fabrics and/or additional bedding material.

E. Install dewatering systems that will be required to construct the proposed utilities in a manner that is described herein. Use proper sedimentation facilities to avoid turbid discharges.

3.2 EXCAVATION

A. The local utility companies shall be contacted before excavation shall begin. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks as nearly vertical as practical and remove stones as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding.

B. All trench excavation side walls greater than 5 feet in depth shall be sloped, shored, sheeted, braced or otherwise supported by means of the sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to an exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

C. Perform excavation as indicated for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

D. Remove excavated materials not required or not suitable for backfill or embankments and waste as specified. Any structures discovered during excavation(s) shall be disposed of as specified.

E. Utilities placed in embankment areas shall be placed by the induced trench method wherein the embankment is formed first and the utility is trenched into the embankment. In such situations, the embankment shall be formed to a height at least 24" above the crown of the pipe.

F. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.

G. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.

H. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

I. Trench width requirements below the top of the pipe shall not be less than 12" nor more than 18" wider than outside surface of any pipe or conduit that is to be installed to designated elevations and grades. All other trench width requirements for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.

J. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances unless otherwise shown on the Drawings:

1. Water Mains: 66" to top of pipe barrel or 6" below the frost line (established by the local building official), whichever is deeper, except where insulation is shown on the drawings.
2. Sanitary Sewer: Depths, elevations, and grades as indicated on Drawings.
3. Storm Sewer: Depths, elevations, and grades as shown on Drawings.
4. Electrical Conduits: 29" minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or the local utility company requirements, whichever is deeper.
5. TV Conduits: 29" minimum to top of conduit or as required by the local utility company, whichever is deeper.
6. Telephone Conduits: 29" minimum to top of conduit, or as required by the local utility company, whichever is deeper.
7. Propane Gas Mains and Service: 24" minimum to top of pipe, or as required by the local utility company, whichever is deeper.
8. Fire Alarm Conduit: 29" minimum to top of conduit, or as required by the local Fire Department, whichever is deeper.

K. Provide sheeting and bracing, when necessary, in trenches and other excavations where protection of workmen is required. Sheeting may be removed after sufficient backfilling to protect against damaging or injurious caving.

3.3 PIPE BEDDING

A. Accurately cut trenches for pipe or conduit that is installed to designated elevations and grades to line and grade from 6" below bottom of pipe and to width as specified. Place 6" of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel. After pipe installation, place select backfill and compact in maximum 6" layers measured loose to the top of the trench.

B. Place geotextile fabrics as specified on the plans and specifications.

3.4 BACKFILLING

A. Criteria: Trenches shall not be backfilled until required tests are performed and the utility systems comply with and are accepted by applicable governing authorities. Backfill trenches as specified. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as specified, to properly correct condition in an acceptable manner.

B. Backfilling: After pipe or conduit has been installed, bedded, and tested as specified, backfill trench or structure excavation with specified material placed in 8" maximum loose lifts.

C. Backfill trenches to the contours and elevations shown on the plans with unfrozen materials.

D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.5 COMPACTION

A. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

B. Maintain optimum moisture content of fill materials to attain required in-place density.

C. An independent testing laboratory shall perform field density tests at intervals not exceeding 200'-0" of trench for the first and every other eight-inch (8") lift of compacted trench backfill and furnish copies of test results as specified. Compact to minimum density of 95% of maximum dry density as determined by ASTM D 1557.

D. All materials used for backfilling shall be tested in accordance with Section 02200.

3.6 ROCK EXCAVATION

See Section 02229 - Rock Removal

END OF SECTION 02222

SECTION 02223

EXCAVATION, BACKFILLING, AND COMPACTING FOR PAVEMENT AND GENERAL SITE GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduct site preparation in accordance with Section 02100.

B. Excavate to line, grade and configuration as shown in the plans and specifications for proposed pavements.

C. Fill to line, grade and configuration as shown in the plans and specifications for proposed pavements.

D. Compacting fill materials in acceptable manner as stated herein.

1.2 RELATED REQUIREMENTS

A. Section 02200 – Earthwork

B. Section 02227 - Aggregate Material

C. Section 02229 - Rock Removal

D. Section 02505 - Paving Base Course

E. Section 02511 - Asphaltic Concrete Paving

F. Section 02525 – Granite and Bituminous Curbing

G. Geotechnical Report for boring locations and findings of subsurface materials and conditions

H. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition:

D422 Method for Particle and Size Analysis of Soils

D698 Test for Moisture-Density Relations of Soils Using 5.5 lb. (2.5 kg) Rammer and 12-inch (304.8mm) Drop (**Standard Proctor**)

D1556 Test for Density of Soil in Place by the Sand Cone Method

D1557 Test for Moisture-Density Relations of Soils Using 10-lb (4.5 kg) Rammer and 18-inch (457 mm) Drop (**Modified Proctor**)

D1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

D2167 Test for Density of Soil in Place by the Rubber Balloon Method

D2216 Laboratory Determination of Moisture Content of Soil

D2487 Classification of Soils for Engineering Purposes

D2922 Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D4318 Test for Plastic Limit, Liquid Limit, and Plasticity Index of Soils

C25 Chemical Analysis of Limestone, Quicklime and Hydrated Lime

C110 Physical Testing for Quicklime and Hydrated Lime, Wet Sieve Method

C618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

C977 Quicklime and Hydrated Lime for Soil Stabilization

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.

T88 Mechanical Analysis of Soils

1.4 QUALITY ASSURANCE

Independent Testing Laboratory selected and paid by Contractor and approved by the Owner shall be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 02200 and as stated herein.

1.5 SUBMITTALS

A. Shop drawings or details pertaining to excavating and filling for pavement are not required unless otherwise shown on the drawings or specifications or if contrary procedures to the project documents are proposed.

B. Submit a sample of each type of off-site fill material that is to be used in backfilling in an air-tight, 10-lb. container for the testing laboratory or submit a gradation and certification of the aggregate material that is to be used to the testing laboratory for review.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill material from on-site as specified in Section 02200 and approved by the owner or owner's representative.

B. Fill material from off-site as specified in Section 02200 and approved by the owner or owner's representative.

C. Aggregate material as specified in Section 02227.

D. Acceptable stabilization fabrics as Geogrids for some (but not all) uses.

1. Mirafi 500X or 600X
2. Phillips 66 Supac 6WS
3. Dupont Typar 3401 and 3601
4. Trevira S1114 and S1120
5. Tensar SS-1 and SS-2
6. Exxon GTF-200 or 350
7. Geogrids specifically shown on the Contract Drawings

E. Filter/Drainage Fabrics for some (but not all) uses.

1. Mirafi 140NS
2. Phillips 66 Supac 4NP
3. Dupont Typar 3341
4. Fabric Types

F. When the Contract Drawings show a specific fabric or geogrid type, that material shall be used unless otherwise approved by the Engineer and Owner in writing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify all lines, elevations and grades necessary to construct pavements, curb and gutter, bases, walkways and roadways as shown in the plans and specifications.

B. Carefully protect benchmarks, property corners, monuments or other reference points.

C. Locate and identify all site utilities that have previously been installed and may be in danger of damage by grading operations.

D. Locate and identify all existing utilities that are to remain and protect them from damage.

E. Over excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas are to be stabilized by using acceptable backfill materials placed and compacted as specified, filter fabrics and/or additional aggregate material.

3.2 EXCAVATION

A. Excavate roadway and pavement areas to line and grade as shown in the plans and specifications.

B. Engage all suitable materials into the project fill areas as specified in Section 02200.

C. Unsuitable excavated material is to be disposed of in a manner and location that is acceptable to the owner and the local governing agencies.

D. Perform excavation using capable, well maintained equipment and methods acceptable to the owner and the project document requirements.

3.3 FILLING

A. Stumps shall be removed in all parking lot areas and fill areas where the stumps are located within 4 feet of final grade. Topsoil, organic soils, and other unsuitable materials shall be stripped in all pavement areas to expose native soils of bedrock.

B. Construction dewatering shall begin as early as is practicable during site grading work to keep onsite soils as well drained as possible. Effective dewatering and surface runoff control shall be accomplished with a network of drains, swales, and sumps.

C. Dry subgrades in fill areas after grubbing and stripping shall be proofrolled with at least six passes of a minimum of 10,000 pound static weight roller and covered with a 12" layer of compacted Granular Fill, except as noted above, as early as practicable. The fill will provide a working mat to protect the subgrade from disturbance. Soft areas identified during proofrolling

or under subsequent traffic prior to subsequent filling activities shall be excavated and replaced with compacted Granular Fill.

D. Where excavations encounter wet natural soils, the work shall proceed carefully in a manner that avoids subgrade disturbance including: using smooth-edged cutting buckets when making excavations within one foot of the final subgrade elevation, and placement of the Subbase Course (pavement areas) as soon as practicable to protect the subgrade from disturbance. In fill areas, the initial lift of fill on wet, natural subgrades should consist of 12 inches of Select Fill.

Fill materials and/or subgrade materials that become contaminated with fines during construction shall be replaced with the appropriate clean materials immediately prior to placing overlying Subbase course, Base course, or engineered fill material.

E. To aid in maintaining stable cut and fill slope conditions, surface water runoff shall be diverted away from the top of slopes. Likewise, surface runoff shall be diverted away from footing excavations and floor slab excavations.

F. Any fill materials that become wet or disturbed before the overlying lift of fill can be placed (e.g., due to a rainstorm during the work day, overnight, or over a weekend) shall be proofrolled, recompacted and/or excavated and replaced with drier fill.

G. All fills consisting of on-site natural stiff olive-brown marine clays shall be placed at moisture contents no wetter than 3 or 4 percent of optimum in accordance with the criteria summarized below and Note 1. The maximum dry density of each fill material used should be determined in accordance with ASTM D-1557 (Modified Proctor), except the onsite clay which the maximum dry density shall be determined by ASTM D698:

Fill Application or Use	Allowable Material Type	Max. Lift Thickness (inches)	Min. Compaction in % of Max. Dry Density
1. Pavement base	Base Course Fill	4	95
2. Pavement subbase	Subbase Course Fill	12	95
3. General pavement subgrade fills	Engineered Fill Section or Granular Fill	12	95
4. General site fills	Engineered Fill Section, Granular Fill, or Common Borrow Fill	12	95
	Onsite Clay Borrow (1)	12	95% ASTM D698

(1) Onsite clay borrow shall be compacted to 95 percent of its maximum dry density as determined by ASTM D698, and at a moisture content no greater than 4 percent above the optimum moisture content as determined by ASTM D698 for total embankment sections less than or equal to 10 feet thick as measured from the original ground surface, and no greater than 3 percent above the optimum moisture content as determined by ASTM D698 for total embankment section greater than 10 feet thick as measured from the original ground surface. Pocket penetrometer tests shall be taken by the Independent Testing Agency as required by Section 02200, Paragraph 1.05.

3.4 COMPACTION

A Maintain optimum moisture content of fill materials to attain required compaction density.

B. All material shall be tested in accordance with Section 02200.

C. An Independent Testing Laboratory selected and paid by the Contractor and approved by the Owner shall be retained to perform testing on-site.

D. Compaction test will be as specified in Section 02200 together with the following for paving areas:

1. In cut areas not less than one compaction test for every 20,000 square feet.
2. In fill areas, same rate of testing for each 12" lift (measured loose).

E. If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to owner.

3.5 MAINTENANCE OF SUBGRADE

A. Finished subgrades shall be verified to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction including concrete trucks and dump trucks.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in a manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, true to.grade and cross section.

3.6 FINISH GRADING

A. Finish grading shall be in accordance with Section 02200 and as more specifically stated herein.

B. Grading of paving areas shall be checked by string line from grade stakes (blue tops) set at not more than 50' centers. Tolerances of 0.10 feet, more or less, will be permitted, provided drainage regime is maintained. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations.

C. All other areas shall be graded to achieve drainage. Tolerances shall be 0.16 foot, provided drainage flow rates are maintained.

3.7 ROCK EXCAVATION

See Section 02229 - Rock Removal

END OF SECTION 02223

SECTION 02227

AGGREGATE MATERIAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate Materials

1.2 RELATED SECTIONS

A. Section 02050 - Demolition

B. Section 02100 - Site Preparation

C. Section 02200 - Earthwork

D. Section 02221 - Excavation, Backfilling and Compacting for Structures

E. Section 02222 - Excavation, Backfilling and Compacting for Utilities

F. Section 02223 - Excavation, Backfilling and Compacting for Pavement and General Site Grading

G Section 02270 - Slope Protection and Erosion Control

H. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM): latest edition ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Course Aggregates. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

ANSI/ASTM D1157 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lbs (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

ASTM D2487 - Classification of Soils for Engineering Purposes.

ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

ASTM D4318 - Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 Kg) Rammer and an 18 inch (457 mm) Drop.

AASHTO M147 - Materials for Aggregate and Soil Aggregate.

1.4 QUALITY ASSURANCE

Test and analysis of aggregate material will be preformed in accordance with standard ASTM and AASHTO procedures listed herein.

1.5 SUBMITTALS

A. Submit in air tight containers a 10-pound sample of each aggregate or mixture that is to be incorporated into the project to the testing laboratory designated by the Owner.

B. Submit the names of each material supplier and specific type and source of each material. Any changes in source throughout the job requires approval of the Owner or Engineer.

C. Submit materials certificate to on-site Independent Testing Laboratory which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All construction and materials shall meet or exceed the requirements of this section and any state highway department specification section referred to or noted on the drawings which pertains to paving base course design, materials, preparation, and/or execution. All materials shall be as indicated on Drawings and shall comply with applicable state highway specification regarding source, quality, gradation, liquid, limit, plasticity index, and mix proportioning.

B. The following tables serve as a guidance for the gradation of the various aggregate materials. Local availability and variances with each State's requirements may change the gradations and parameters of these materials. The Contractor shall indicate when submitting material test results what the various applications will be.

Material Description	Percentage By Weight Passing A Square Mesh Sieve													
	4"	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	1/4"	No. 4	No. 8	No. 40	No. 100	No. 200
Select Fill	--	90-100	--	--	--	--	--	--	25-90	--	--	0-30	---	0-5
Aggregate Base**	--	--	100	--	--	--	45-70	--	30-55	--	--	0-20	--	0-5
Gravel Borrow*	--	--	--	--	--	--	--	--	0-70	--	--	0-50	--	0-20
Common Borrow	PER MDOT 703.18													
Select Backfill for pipes	--	--	--	--	--	--	--	85-100	--	--	--	0-5	--	--
Riprap Bedding Material & Structural Fill	--	100	--	--	--	--	--	--	25-70	--	--	0-30	--	0-7
Crushed Stone	--	--	100	100	20-55	90-100	--	20-55	--	0-10	0-5	--	--	--
Subbase Course Gravel***	--	100	--	--	--	--	--	--	25-70	--	--	0-30	--	0-5
Foundation Backfill	100	90/100	--	--	--	--	--	--	25-90	--	--	0-30		0-5

* The maximum stone size shall be limited to 3 inches within two feet of walls, piers, footings and floor slabs; and 6 inch maximum stone size elsewhere.

** Aggregate base course shall not contain particles of rock which will not pass the 2 inch square mesh sieve.

*** Aggregate subbase course shall not contain particles of rock which are larger than 4 inches.

PART 3 - EXECUTION

3.1 STOCKPILING

Stockpile on-site at locations indicated by the owner in such a manner that there will be no standing water or mixing with other materials.

3.2 BORROW SITES

Upon completion of borrow operations, clean up borrow areas as indicated on the plans and in neat and reasonable manner to the satisfaction of the property Owner or the Engineer.

3.3 TRANSPORTATION

Off-site materials shall be transported to the project using well maintained and operating vehicles. Once on the job site, all transporting vehicles shall stay on designated haul roads and shall at no time endanger any of the improvements by rutting, overloading or pumping the haul road.

END OF SECTION 02227

SECTION 02229

ROCK REMOVAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of identified and discovered rock during excavation.

B. Use of explosives to assist rock removal.

C. Incorporating removed rock into fills and embankments.

1.2 RELATED SECTIONS

A. Section 02200 – Earthwork

B. Section 02221 – Excavation, Backfilling and Compacting for Structures

C. Section 02222 - Excavation, Backfilling and Compacting for Utilities

D Section 02223 – Excavation, Backfilling and Compaction for Pavement and General Site Grading

E. Geotechnical Report for boring locations and findings of subsurface materials and conditions

F. Construction Drawings

1.3 REFERENCE STANDARDS

NFPA 495 - Code for Explosive Materials

1.4 ENVIRONMENTAL REQUIREMENTS

Determine all environmental effects associated with proposed work and safeguard those concerns as regulated by law and all others by reasonable and practiced methods.

1.5 JOB CONDITIONS

Rock is anticipated on the project site. Payment for trench and open rock removal will be based upon requirements provided under the allowance and unit price specification sections.

1.6 QUALIFICATIONS

Contractor to remove rock by blasting shall submit records of documented experience to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

Explosives, delay device and blast mat materials shall be the type recommended by the explosive firm that will comply with the requirements of this section.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify site conditions and note subsurface conditions affecting work of this section.

B. Identify required lines, levels, and elevations that will determine the extent of the proposed removals.

C. Conduct a pre-blast survey in accordance with the following requirements.

1. The Contractor shall conduct a Pre-Blast Survey of all structures within the Blasting Area and provide the Owner and MeDEP, a written report of the Pre-Blast Survey and Blasting Plan. The Pre-blast Survey shall be filed, reviewed, and approved by the MeDEP. This survey should include:

   - All structures within a minimum distance of 500 feet from any blasting activity. The area extending beyond the 500-foot minimum shall be determined by the Contractor. This distance shall be confirmed after consultation of the General Contractor, Site Contractor, Blasting Contractor and Insurance Companies.
   - A blasting plan which addresses:
     - Airblast limits
     - Ground vibrations
     - Maximum peak particle velocity
   - The blasting plan shall meet criteria established in Chapter 3 (Control of Adverse Effects) in the Blasting Guidance Manual of the United States Dept. of the Interior.
   - Provisions and measures to monitor and assure compliance with the blasting plan.

2. The Contractor shall provide the Engineer with a Blasting Log for the work. The Blasting Log shall contain the following information:

   - Location
   - Time and Date
   - Number of holes
   - Amount and type of explosive used per hole

- The names of persons, companies, corporations, or public utilities contacted, owning, leasing, or occupying property or structures in proximity to the site of the work of the Contractor's intention to use explosives.

3. Drilling equipment will be equipped with suitable dust control apparatus which must be kept in repair and used during all drilling operations.

A copy of the MeDEP approval of the pre-blast survey and blasting plan obtained by the Contractor shall be submitted to the Owner prior to blasting.

3.2 ROCK EXCAVATION

A. Rock Excavation - definition - Igneous, metamorphic or sedimentary rock that cannot be removed by rippers or other mechanical methods and, therefore requires drilling and blasting. Cut rock to form level bearing at bottom of trench. In the utility trenches, excavate to 6" below invert elevation of pipe. This excludes pavement, concrete, and boulders less than 3 cubic yards.

Reuse excavated materials on-site in accordance with Section 02200, if applicable.

B. Comply with all laws, rules, and regulations of Federal, State and local authorities and insurer which govern storage, use, manufacture, sale, handling, transportation, licensing, or other disposition of explosives. Take special precautions for proper use of explosives to prevent harm to human life and damage to surface structures, all utility lines, or other subsurface structures.

Do not conduct blasting operations until persons in vicinity have had ample notice and have reached positions of safety.

All blasting shall be performed in accordance with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., of the "Construction Safety Rules and Regulations," *as adopted by the State Board of Construction Safety, Augusta, Maine, and Maine Department of Transportation* "Standard Specifications" Section 107.12, Use of Explosives. Blasting through the over burden will not be allowed.

C. Contractor shall save harmless owner, architect, and owner's representative from any claim growing out of use of such explosives. Removal of materials of any nature by blasting shall be done in such manner and such time as to avoid damage affecting integrity of design and to avoid damage to any new or existing structure included in or adjacent to work. It shall be the contractor's responsibility to determine method of operation to ensure desired results and integrity of completed work.

D. Perform rock excavation in a manner that will produce material of such size as to permit it being placed in embankments in accordance with Section 02200. Remove rock to limits as indicated. Remove loose or shattered rock, overhanging ledges and boulders which might dislodge.

E. When during the process of excavation, rock is encountered, such material shall be uncovered and exposed. Remove as much weathered rock as possible with conventional excavating equipment. Notify the Architect before proceeding with any excavating, blasting or removal of materials which might be claimed as rock. The Contractor shall not proceed with the removal of the material claimed as rock until the material has been classified by the Architect.

Failure to uncover such material or notify the Architect to take cross sections prior to any excavation shall forfeit the Contractor's claim for ledge removal.

The Contractor shall employ and pay for an approved registered civil engineer or land surveyor acceptable to the Architect to take cross sections of rock before removal of same and to provide computations of cross sections within the limit lines of the excavation. No material claimed as rock shall be excavated, blasted or removed until the following procedures have been performed:

Contractor shall quantify rock excavation and provide Architect with sections and profiles for review.

Architect shall provide to the Contractor a letter of authorization to proceed with the excavation of material claimed as rock. The letter shall indicate the agreed upon quantity of rock and the price for the entire process of excavation, hauling and disposal.

Blasting operations shall be accomplished in compliance with the "Blasting" clause of the Supplemental General Conditions. Rock shall be trimmed so that none protrudes within 6 inches of all utilities when said utilities are installed to correct line and grade.

F. Definition of Rock Removal Classifications

Rock excavation shall be classified as either open or trench. Trench rock shall be excavation classified as rock where the pay width is 5'-0" or less. Trench rock includes certain rock removal for footings. All other excavation classified as rock shall be considered open rock. Rock shall be classified as open rock in the upper zones above trenches when applicable.

G. The volume of ledge excavation in trench to be paid for will be computed on the following basis: The depth will be the vertical distance from the bottom of the pipe bedding to the surface of the ledge, measured on the center line of the pipe. The pay width shall be the 4/3 the outside diameter of the conduit plus 18" for all utility trenches. After the ledge has been uncovered by the Contractor, elevations will be taken where necessary to determine the profile of the ledge.

H. The volume of ledge excavation in trench to be paid for will be computed on the following basis: The depth will be the vertical distance from the bottom of the pipe bedding to the surface of the ledge, measured on the center line of the pipe. The width shown on the Plans will be taken as the pay width. After the ledge has been uncovered by the Contractor, elevations will be taken where necessary to determine the profile of the ledge.

I. Rock excavation for structures shall be measured by cross sectioning the ledge surface. The depth shall be between the sectioned surface and the bottom of the concrete or gravel base, if called for. The horizontal limits shall be twelve (12) inches beyond the concrete lines unless otherwise noted on the Contract Drawings. All overblast not specifically required by the

Contract or over-excavation shall be at the Contractor's expense. Any sections over-excavated shall be brought to grade with materials which comply with the geotechnical report.

J. Rock excavation for roadways or pond areas shall be measured and computed using the average end area method.

K. Provisions for Blasting

Blasting shall be performed only after approval has been given by the Owner for such operations and must comply with the following provisions:

1. *The Contractor or any subcontractor shall use sufficient stemming, matting or natural protective cover to prevent flyrock from leaving property owned or under control of the owner or operator or from entering protected natural resources or natural buffer strips. Crushed rock or other suitable material must be used for stemming when available; native gravel, drill cuttings or other material may be used for stemming only if no other suitable material is available.*

2. *The maximum allowable airblast at any inhabited building not owned or controlled by the developer may not exceed 129 decibels peak when measured by an instrument having a flat response (+ or – 3 decibels) over the range of 5 to 200 hertz.*

3. *The maximum allowable airblast at an uninhabited building not owned or controlled by the developer may not exceed 140 decibels peak when measured by an instrument having a flat response (+ or – 3 decibels) over the range of 5 to 200 hertz.*

4. *Monitoring of airblast levels is required in all cases for which a preblast survey is required by paragraph F. The Contractor may file an MeDEP Permit Modification requesting the MeDEP waive the monitoring requirement if the Contractor or subcontractor secures the permission of affected property owners to increase allowable airblast levels on their property and the department determines that no protected natural resource will be adversely affected by the increased airblast levels. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.*

5. *If a blast is to be initiated by detonating cord, the detonating cord must be covered by crushed rock or other suitable cover to reduce noise and concussion effects.*

6. *A preblast survey is required and must extend a minimum radius of 2,000 feet from the blast site. The preblast survey must document any preexisting damage to structures and buildings and any other physical features within the survey radius that could reasonably be affected by blasting. Assessment of features such as pipes, cables, transmission lines and wells and other water supply systems must be limited to surface conditions and other readily available data, such as well yield and water quality. The preblast survey must be conducted prior to the initiation of blasting at the operation. The Contractor or subcontractor shall retain a copy of all preblast surveys for at least one year from the date of the last blast on the development site.*

   (a) *The Contractor or the subcontractor is not required to conduct a preblast survey on properties for which the owner or operator documents the rejection of an*

offer by registered letter, return receipt requested, to conduct a preblast survey. Any person owning a building within a preblast survey radius may voluntarily waive the right to a survey.

7. *Blasting may not occur in the period between sundown and sunrise the following day or in the period 7:00 p.m. and 7:00 a.m., whichever is greater. Routine production blasting is not allowed in the daytime on Sunday. Detonation of misfires may occur outside of these times but must be reported to the department within 5 business days of the misfire detonation. Blasting may not occur more frequently than 4 times per day. Underground production blasting may be exempted from these requirements provided that a waiver is granted by the department.*

8. *Sound from blasting may not exceed the following limits at any protected location:*

Number of Blasts Per Day	*Sound Level Limit*
1	*129 dbl*
2	*126 dbl*
3	*124 dbl*
4	*123 dbl*

9. *The maximum peak particle velocity at inhabitable structures not owned or controlled by the developer may not exceed the levels established in Table 1 in paragraph J and the graph published by the United States Department of the Interior in "Bureau of Mines Report of Investigations 8507," Appendix B, Figure B-1. The Contractor or subcontractor may apply for a MeDEP Project Modification to request a variance to allow ground vibration levels greater than 2 inches per second on undeveloped property not owned or controlled by the applicant if the department determines that no protected natural resource, unusual natural area or historic site will be adversely affected by the increased ground vibration levels. If inhabitable structures are constructed on the property after approval of the MeDEP and prior to completion of blasting, the Contractor immediately must notify the department and modify blasting procedures to remain in compliance with the standards of this subsection. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.*

10. *Table 1 of this paragraph or the graph published by the United States Department of the Interior in "Bureau of Mines Report of Investigations 8507", Appendix B. Figure B-1 must be used to evaluate ground vibration effects for those blasts for which a preblast survey is required.*

    (a) *Either Table 1 of this paragraph or graph published by the United States Department of the Interior in "Bureau of Mines report of Investigations 8507", Appendix B, Figure B-1 may be used to evaluate ground vibration when blasting is to be monitored by seismic instrumentation.*

    (b) *Blasting measured in accordance with Table 1 of this paragraph must be conducted so that the peak particle velocity of any one of the 3 mutually perpendicular components of motion does not exceed the ground vibration limits at the distances specified in Table 1 of this paragraph.*

(c) Seismic instruments that monitor blasting in accordance with Table 1 of this paragraph must have the instrument's transducer firmly coupled to the ground.

(d) An owner or operator using Table 1 of this paragraph must use the scaled-distance equation, $W=(D/D_s)^2$, to determine the allowable charge weight of explosives to be detonated in any 8 millisecond or greater delay period without seismic monitoring, where W is equal to the maximum weight of explosives, in pounds, and D and Ds are defined as in Table 1 of this paragraph. The Contractor may apply for a Permit Modification to MeDEP to authorize the use of a modified scaled-distance factor for production blasting if the contractor can demonstrate to a 95% confidence level, based upon records of seismographic monitoring at the specific site of the mining activity covered by the permit, that use of the modified scaled-distance factor will not cause the ground vibration to exceed the maximum allowable peak particle velocities of Table 1 of this paragraph. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.

(e) Blasting monitored in accordance with the graph published by the United States Department of the Interior in "Bureau of Mines Report of Investigations 8507", Appendix B, Figure B-1 must be conducted so that the continuously variable particle velocity criteria are not exceeded.

The Contractor may apply for a Permit Modification to MeDEP for a variance of the ground vibration monitoring requirement prior to conducting blasting at the development site if the Contractor agrees to design all blasts so that the weight of explosives per 8 millisecond or greater delay does not exceed that determined by the equation $W=(D/D_s)^2$, where W is the maximum allowable weight of explosives per delay of 8 milliseconds or greater, D is the shortest distance between any area to be blasted and any inhabitable structure not owned or controlled by the developer, and Ds equals 70 $ft./lb.^{1/2}$. As a condition of the variance, the department may require submission of records certified as accurate by the blaster and may require the owner or operator to document compliance with the conditions of this paragraph. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.

The following is Table 1.

Distance Versus Peak Particle Velocity Method		
Distance (D) from the blast area	*Maximum allowable peak particle velocity (Vmax) for ground vibration (in./sec.)*	*Scaled-distance factor (Ds) to be applied without seismic monitoring*
0 to 300	*1.25*	*50*
301-5000	*1.00*	*55*
Greater than 5000	*0.75*	*65*

11. *A record of each blast, including seismographic data, must be kept for at least one year from the date of the last blast, must be available for inspection at the development or at the offices of the owner or operator if the development has been closed, completed or abandoned before the one-year limit has passed and must contain at a minimum the following data:*

(a) *Name of blasting company or blasting contractor;*

(b) *Location, date and time of blast;*

(c) *Name, signature and social security number of blaster;*

(d) *Type of material blasted;*

(e) *Number and spacing of holes and depth of burden or stemming;*

(f) *Diameter and depth of holes;*

(g) *Type of explosives used;*

(h) *Total amount of explosives used;*

(i) *Maximum amount of explosives used per delay period of 8 milliseconds or greater;*

(j) *Maximum number of holes per delay period of 8 milliseconds or greater;*

(k) *Method of firing and type of circuit;*

(l) *Direction and distance in feet to the nearest dwelling, public building, school, church or commercial or institutional building neither owned nor controller by the developer;*

(m) *Weather conditions, including such factors as wind direction and cloud cover;*

(n) *Height or length of stemming;*

(o) *Amount of mats or other protection used;*

(p) *Type of detonators used and delay periods used;*

(q) *The exact location of each seismograph and the distance of each seismograph from the blast;*

(r) *Seismographic readings;*

(s) *Name and signature of the person operating each seismograph; and*

(t) *Names of the person and the firm analyzing the seismographic data.*

12. *All field seismographs must record the full analog wave form of each of the 3 mutually perpendicular components of motion in terms of particle velocity. All seismographs must be capable of sensor check and must be calibrated according to the manufacturer's recommendations.*

END OF SECTION 02229

SECTION 02230

SUBBASE AND BASE GRAVEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Granular Base and Subbase (also referred to as base and subbase aggregates or base and subbase gravels).

1.2 RELATED REQUIREMENTS

A. Section 02100 - Site Preparation

B. Section 02200 - Earthwork

C. Section 02227 - Aggregate Materials

D. Section 02511 - Asphaltic Concrete Paving

E. Section 02525 - Granite and Bituminous Curbing

F. Geotechnical Report

1.3 REFERENCES

A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ANSI/ASTM D1157 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lbs (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

C. ASTM D2167 - Test for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

D. ASTM D1556 - Test Method for Density of Soil in-place by the Sand-Cone Method.

E. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) Method B (Direct Transmission).

F. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

Submit materials certificate to on-site independent testing laboratory which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein. Materials shall comply with the gradations specified in Section 02227, Aggregate Material.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify substrate has been inspected, gradients and elevations are correct, and dry.

3.2 CONSTRUCTION

A. Perform base and subbase course construction in a manner that will drain surface properly at all times and at same time prevent runoff from adjacent areas from draining onto base course or subbase construction.

B. Compact base material to not less than 95% of maximum density as determined by ASTM D-1557 unless otherwise indicated on the Drawings.

C. Granular Subbase: Construct to thickness indicated on Drawings; apply in lifts or layers not exceeding 8", measured loose.

D. Granular Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 4" measured loose.

E. All work of this section shall conform to the requirements of Sections 304 of the Maine Department of Transportation Specification for furnishing, placing, and surface tolerance of aggregate base and subbase courses.

3.03 FIELD QUALITY CONTROL

A. An Independent Testing Laboratory, retained by the Owner, shall perform construction testing of in-place base courses for compliance with requirements for gradation and density. The Contractor shall retain an independent surveyor to verify paving base course tolerances (by rod and level readings on no more than fifty-foot centers) to +0.05' of design elevation that allow for paving thickness as shown in the Drawings. Contractor shall provide instruments and a suitable benchmark and perform all survey. The Contractor may, at his option, retain his own test laboratory for quality control, production schedules, or for any other reason at no cost to the Owner.

B. The following tests shall be performed on each type of material used as base and subbase course material:

1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
2. Mechanical Analysis: AASHTO T-88
3. Plasticity Index: ASTM D-4318-84
4. Base and subbase material thickness: Perform one test for each 20,000 square feet in-place base material area.
5. Base and subbase material compaction: Perform one test in each lift for each 20,000 square feet in-place base material area.
6. Test each source of base material for compliance with applicable state highway specifications.

C. Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements:

1. Sand-Cone Method: ASTM D1556
2. Balloon Method: ASTM D2167
3. Nuclear Method: ASTM D2922, Method B (Direct Transmission).

D. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. The Owner and Contractor shall be provided with copies of reports within 96 hours of time test was performed. In event that any test performed fails to meet these Specifications, the Owner and Contractor shall be notified immediately by Independent Testing Laboratory. The Owner reserves right to employ a separate testing laboratory and to direct any testing that is deemed by them to be necessary. Contractor shall provide free access to site for testing activities.

E. Any base or subbase courses which become contaminated due to weather, erosion, or other activities, whether or not such contamination is under the control of the Contractor shall be removed and replaced. Said removal and replacement shall be incidental to the work and no additional payment will be made to the Contractor.

END OF SECTION 02230

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations, to permit construction to proceed on stable subgrades and to restrict the flow of surface water into the excavation.

1.3 SUBMITTALS

A. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water, piles, slurry walls, or other formal dewatering systems.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

B. Comply with all OSHA and other safety regulations.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, Dirtbags®, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION 02240

SECTION 02242

CONCRETE MODULAR RETAINING WALL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work includes design and sizing of geogrids, furnishing and installing modular block retaining wall units, geogrid reinforcement, wall fill and backfill to the lines and grades designated on the construction drawings and as specified herein.

B. Work includes preparing foundation soil, furnishing and installing leveling pad, unit fill and backfill to the lines and grades designated on the construction drawings.

C. Furnishing and installing all appurtenant materials required for construction of the geogrid reinforced soil retaining wall as shown on the construction drawings.

1.2 RELATED SECTIONS

SECTION 02200 – EARTHWORK
SECTION 02720 – STORM SEWER SYSTEMS

1.3 REFERENCE STANDARDS

The following most current publications form part of the specification to the extent indicated by references thereto and shall be followed for all construction testing:

ASTM C90 – 85 Hollow Load Bearing Masonry Units
ASTM C140 – 75 Sampling and Testing Concrete Masonry Units
ASTM C145 – 85 Solid Load Bearing Concrete Masonry Units

1.4 DELIVERY, STORAGE AND HANDLING

A. Contractor shall check the materials upon delivery to assure that proper material has been received.

B. Geogrids shall be stored above –20 Degrees F.

C. Contractor shall prevent excessive mud, wet cement, epoxy, and like materials which may affix themselves, from coming in contact with the materials.

D. Contractor shall protect the material from damage. Damaged material shall not be incorporated into the retaining wall structure.

E. Rolled geogrid material may be laid flat or stood on end for storage.

1.5 SUBMITTALS

A. Samples of all products used in the work of this section. Available colors and texture shall be provided to the Owner for selection.

B. Latest edition of manufacturer's specifications for proposed materials, method of installation and list of material proposed for use.

C. The design of the wall stamped by a registered professional engineer. The wall shall be designed for highway surcharge. Lateral earth pressures used for design shall be an equivalent fluid weight of 55 lb./cubic foot and shall follow the geotechnical parameters provided in the geotechnical report.

1.6 QUALITY ASSURANCE

A. Soil testing and inspection services for quality control testing during earthwork operation will be supplied by the independent test laboratory retained by the Contractor and approved by the Owner. Refer to general contract provisions for clarification on who pays for the independent test site.

B. Qualifications – The Engineer's approval of the system and the supplier will be based upon the following considerations:

1. The geogrid reinforcement, drainage details, and erosion control system for the system have each been reviewed and approved for use.
2. The supplier has a large enough operation and the necessary experience to supply and support the construction on a timely basis.
3. Past experience in the design and construction of at least 10 projects of a similar magnitude of the proposed system can be documented.

C. The design of the concrete modular retaining wall shall be completed by the contractor and signed by a registered Professional Engineer who shall demonstrate a minimum Errors and Omissions insurance coverage of $500,000 by furnishing the Engineer with a current certificate of insurance. The design shall state the assumed soil parameters and conformance with the parameters provided in the geotechnical report.

D. Pre-Construction Conference – Prior to the installation of the geogrid, the Contractor shall arrange a meeting at the site with the geogrid material supplier and, where applicable, the geogrid installer. The Owner and the Engineer shall be notified at least 3 days in advance of the time of the meeting. The representative of the geogrid supplier shall be available on an "as-needed" basis during construction.

PART 2 - PRODUCTS

2.1 CONCRETE UNITS

A. Masonry units shall be Retaining Wall Units designed to create a modular block wall.

B. Concrete retaining wall units shall have a minimum net 28 day compressive strength of 3,000 psi. The concrete shall have a maximum moisture absorption of 6 to 8 lbs/ft.^{3}.

C. Exterior dimensions may vary in accordance with ASTM C90-85. Standard and Compac units shall have a minimum of 1 square foot face area each. Mini units shall have a minimum ½ square foot face area each.

D. Units shall have angled sides capable of concave and convex alignment curves with a minimum radius of 10 feet. NOTE: Where applicable, for straight walls use non-angled straight side cap units.

E. Units shall be interlocked with non-corrosive fiberglass pins.

F. Units shall be interlocked as to provide a 6 degree setback per each course of wall height.

2.2 GEOGRID

A. Geogrid to be used as soil reinforcement shall be TENSAR UX1500 or approved equal.

2.3 FIBERGLASS CONNECTING PINS

A. Connecting pins shall be ½ inch diameter thermoset isopthalic polyester resin/pultruded fiberglass reinforcement rods.

B. Pins shall have a minimum flexural strength of 128,000 psi and short beam shear of 6400 psi.

2.4 BASE LEVELING PAD MATERIALS

A. Material shall consist of compacted structural fill, ¾" crushed stone, and underdrains as shown on the construction drawings. The compacted leveling pad shall be a minimum 12 inches thick for each layer (structural fill and crushed stone).

2.5 UNIT FILL

A. Fill for units and within the geogrid behind the units shall be structural fill.

2.6 BACKFILL

A. Material shall be compacted structural fill as approved by the Engineer.

B. Where additional fill is required Contractor shall submit sample and specifications to the Engineer to determine if acceptable.

C. Backfill zone shall extend to encapsulate all Geogrids.

2.7 FILTER FABRIC

Filter fabric shall be installed as shown on the plans and shall meet the requirements of Section 02200 of these Specifications.

PART 3 - EXECUTION

3.1 PREPARATION

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Over excavation shall not be paid for and replacement with compacted fill and/or wall system components will be required at contractor expense. Contractor shall be careful not to disturb embankment materials beyond lines shown.

3.2 FOUNDATION SOIL PREPARATION

A. Foundation soil shall be excavated as required for footing dimensions shown on the construction drawings or as directed by the Engineer.

B. Foundation soil shall be examined by the Engineer to assure that the actual foundation soil strength meets or exceeds assumed design strength. Soils not meeting required strength shall be removed and replaced with acceptable material.

C. Over-excavated areas shall be filled with approved compacted granular fill backfill material.

D. Foundation shall be proof rolled prior to fill and geogrid placement.

3.3 BASE LEVELING PAD

A. Leveling pad materials shall be placed as shown on the construction drawings, upon undisturbed in-situ soil.

B. Material shall be compacted so as to provide a level hard surface on which to place the first course of units. Compaction shall be to 95% of standard proctor.

C. Leveling pad shall be prepared to insure complete contact of retaining wall unit with base.

D. Leveling pad materials shall be to the depths and widths shown.

3.4 UNIT INSTALLATION

A. First course of concrete wall units shall be placed on the base leveling pad. The units shall be checked for level and alignment. The first course is the most important to insure accurate and acceptable results.

B. Insure that units are in full contact with base.

C. Units are placed side by side for full length of wall alignment. Alignment may be done by means of a string line or offset from base line.

D. Install fiberglass connecting pins and fill all voids at units with unit fill material. Tamp fill.

E. Sweep all excess material from top of units and install next course. Insure each course is completely unit filled, backfilled and compacted prior to proceeding to next course.

F. Lay up each course insuring that pins protrude into adjoining courses above a minimum of one inch. Two pins are required per unit. Pull each unit forward, away from the embankment, against pins in the previous course and backfill as the course is completed. Repeat procedure to the extent of wall height.

G. The top two courses of wall units below the cap shall also have an adhesive or epoxy to provide a permanent bond of the upper blocks.

H. As appropriate where the wall changes elevation, units can be stepped with grade or turned into the embankment with a convex return end. Provide appropriate buried units on compacted leveling pad in area of convex return end.

3.5 CAP INSTALLATION

A. Place Modular Block Cap units over projecting pins from units below. Pull forward to set back position. Back fill and compact to finished grade.

B. As required, provide permanent mechanical connection to wall units with construction adhesive or epoxy. Apply adhesive or epoxy bottom surface of cap units and install on units below.

3.6 GEOGRID INSTALLATION

A. The geogrid soil reinforcement shall be laid horizontally on compacted backfill. Connect to the concrete wall units by hooding geogrid over fiberglass pins. Pull taut, and anchor before backfill is placed on the geogrid.

B. Slack in the geogrid at the wall unit connections shall be removed.

C. Geogrid shall be laid at the proper elevation and orientation as shown on the construction drawings or as directed by the Engineer.

D. Correct orientation (roll direction) of the geogrid shall be verified by the contractor.

E. To pretension geogrid, pull pinned geogrid taut to eliminate loose folds. Stake or secure back edge of geogrid prior to and during backfill and compaction.

F. Follow manufacturer's guideline relative to overlap requirement of uniaxial and biaxial geogrids.

3.7 FILL PLACEMENT

A. Backfill material shall be placed in 8 inch lifts and compacted to 95% of Standard Proctor.

B. Backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack or loss of pretension of the geogrid.

C. Only hand-operated compaction equipment shall be allowed within 3 feet of the back surface of the Modular Block units.

D. Backfill shall be placed from the wall rearward into the embankment to insure that the geogrid remains taut.

E. Tracked construction equipment shall not be operated directly on the geogrid. A minimum backfill thickness of 6 inches is required prior to operation of tracked vehicles over geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

F. Rubber-tired equipment may pass over the geogrid reinforcement at slow speeds, less than 10 MPH. Sudden braking and sharp turning shall be avoided.

G. Fill placed one foot behind the geogrid units shall be wrapped in filter fabric as shown on the plans. A 6" overlap of the filter fabric shall be provided at the top of each layer of stone backfill.

H. The fill placement shall be coordinated with the installation of handrails, fences, or guiderails.

END OF SECTION 02242

SECTION 02270

SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary and permanent erosion control systems.

B. Slope Protection Systems.

1.2 RELATED SECTIONS

A. Section 02000 - Site Location of Development Permit

B. Section 02100 - Site Preparation

C. Section 02200 - Earthwork

D. MeDEP Site Location of Development Permit application, Section 14, Erosion and Sedimentation Control Report (Appended to this Specification Section)

E. Construction Requirements

1.3 ENVIRONMENTAL REQUIREMENTS

A. The Contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the contract in accordance with the Erosion and Sediment Control Report prepared for this project and in accordance with the requirements of the MeDEP Site Location of Development Permit and special conditions of the permits. The Erosion and Sediment Control Report and Site Permits have specific restrictions on seasonal work limits, the amount of area which can be exposed at a given time, the general sequence of construction, and contractor monitoring.

B. The general contractor will be required to designate, by name, a Registered Professional Engineer or equivalent person responsible for implementation of all erosion control measures as required by the MeDEP Site Location of Development Permit and Federal NPDES Permit for this project. Specific responsibilities will include:

1. Assuring and certifying the contractor's construction sequence is in conformance with the specified schedule. In addition, a weekly certification stating compliance, any deviations, and corrective measures shall be filed with the owner by this person. A copy of the

certification, form is contained the Erosion and Sedimentation Control Report which is appended to this Specification Section.

2. Inspection of the project work site on a weekly basis, with the installation of added erosion control measures in areas which appear vulnerable to erosion.
3. Inspection of all erosion control measures and drainage inlets after any significant rainfall. Accumulated silt/sediment should be removed when the depth of sediment reaches 50 percent of the barrier height. Accumulated silt/sediment should be removed from behind silt fencing when the depth of the sediment reaches 6 inches. A significant rainfall shall be defined as over ½ inch of precipitation in any consecutive 24-hour period.
4. Inspect areas for catch of grass. A minimum catch of 75 percent is required prior to removal of erosion control measures.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quick growing grasses for temporary seeding (see seed mixes contained in Erosion and Sedimentation Report).

B. Hay or straw bales.

C. Fencing for siltation control as specified on the plans.

D. Erosion Control blankets with wood excelsior contained in a photodegradable net or natural fibers sewn together with cotton thread.

E. Bale stakes shall be a minimum of 4 feet in length and 1" in width.

F. Temporary mulches such as loose hay, straw, netting, wood cellulose or agricultural siltage.

G. Fence stakes shall be metal stakes a minimum of 8 feet in length.

H. Stone check dams shall be spaced according to the Erosion Control Detail Plan.

I. Stone Sediment Barriers or SiltSacks™, or approved equal for inlet protection.

J. A stabilized construction entrance shall be constructed temporarily.

K. Riprap for slopes, culvert, storm drain inlet, and outlet aprons.

L. Sand blankets, of native material, to protect clay subgrades.

M. Reinforced turf.

N. Inlet risers for ponds.

O. Wood mulch.

P. Calcium chloride and water for dust control.

Q. DIRTBAGS® as outlined on the contract drawings.

R. Erosion Control Netting/Matting: Neutral Fiber Biodegradable netting: COIR or Jute.

S. Filter fabric shall be constructed of post consumer plastic geotextile.

PART 3 - EXECUTION

3.1 PREPARATION

A. Review site erosion control plan attached to this section of the specifications.

B. Deficiencies or changes in the erosion control plan as it is applied to current conditions will be brought to the attention of the Engineer for remedial action.

3.2 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Provide catalog cuts and information concerning the erosion control products which will be used for construction for review by the Owner.

B. Provide information concerning the installation of the erosion sedimentation control including anchorage trench provisions and anchorage devices and spacing for review by the Owner.

C. Place erosion control systems in accordance with the erosion control plan and in accordance with approved installation procedures.

D. This contract limits the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations. The Owner has the authority to direct the Contractor to provide immediate permanent or temporary pollution control measures. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical.

E. The temporary erosion control systems installed by the Contractor shall be maintained as directed by the Engineer to control siltation at all times during the life of the Contract. The Contractor must respond to any maintenance or additional work ordered by the Engineer within a 48 hour period.

F. Any additional material work required beyond the extent of the erosion control plan shall be paid for by the Owner except where such measures are required to correct deficiencies caused

by the failure of the Contractor to construct the work in accordance with the erosion sediment control plan.

G. Slopes that erode easily shall be temporarily seeded as the work progresses with a cereal grain of wheat, rye or oats.

END OF SECTION 02270

MEDEP SITE LOCATION OF DEVELOPMENT PERMIT APPLICATION

Section 14 - Erosion and Sedimentation Control Report

SECTION 14

EROSION AND SEDIMENTATION CONTROL REPORT FOR MARTIN'S POINT PROJECT

Prepared for

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Attachments

A – Seeding Plan
B – Sample EPA Certification and Inspection Forms

SECTION 14

EROSION AND SEDIMENTATION CONTROL REPORT

14.0 Introduction

DeLuca-Hoffman Associates, Inc. has been retained by Martin's Point to assist in the site design and site permitting of the proposed Martin's Point Redevelopment Project. The project includes demolition of two existing maintenance buildings, renovation of the existing Marine Hospital building, construction of a new 27,000 square foot footprint building, construction of a parking structure, associated access drives, parking area improvements, water quality features, and miscellaneous site improvements. Approximately four (4) acres of area will be disturbed as part of the project. Erosion controls will be especially important on this site due to steep existing grades and the proximity of the project to resource boundaries.

This narrative contains the Erosion Control Plan designed and required for this project.

The project is not in a lake watershed or a watershed most at risk from development.

14.1 Existing Site Conditions

The existing site consists of the property currently owned by Martin's Point as well as the City parcel which is currently under contract with Martin's Point which contains the Marine Hospital and School Department maintenance buildings. Many steep slopes and bedrock outcrops exist on the site.

The soils in the vicinity of the project are mapped by the U.S. Department of Agriculture, Soils Conservation Service (SCS) on the Medium Intensity Soils maps. The soil types and names are shown on Figure 8 included with this submission and are described by the SCS as follows:

Hollis	The Hollis series consists of shallow, somewhat excessively drained, gently sloping to steep, moderately coarse-textured soils that have a few too many outcrops. These soils formed in glacial till, and they are on uplands and in coastal areas. Slopes range from 3 to 35 percent. Hollis soils are associated with Woodbridge soils in inland areas. Also included are a few small areas of Buxton soils and wet spots near coastal areas or soils that have outcrops.
Windsor	The Windsor series consists of deep, excessively drained, nearly level to strongly sloping, coarse-textured soils. These soils formed in glacial outwash deposits. They are on terraces adjacent to many streams and rivers. Slopes range from 0 to 30 percent. Windsor soils are associated with Hinkley, Deerfield, and Au Gres soils and small areas of soils that have thin lenses of clay.

One of the key differences between the Hollis and Windsor soils is the depth to bedrock. Depth to bedrock for Windsor soils is typically 5 feet or greater, whereas depth to bedrock in Hollis soils ranges from 12 to 18 inches. Additional information regarding bedrock depth for the site is provided in the Geotechnical Report.

Baseline information to prepare the permit applications and establish existing conditions includes:

- Topographic and Boundary Survey secured by Owen Haskell
- Geotechnical Studies by S. W. Cole Engineering
- Resource Delineation by Normandeau Associates

14.2 Overview of Soil Erosion and Sedimentation Concerns

The susceptibility of soils to erosion is indicated on a relative "K" scale of values over a range of 0.02 to 0.69. The "K" value is frequently used with the universal soil loss equation. The higher values are indicative of the more erodible soils. The project area consists of the following soils based upon the USDA Medium Intensity Soils Survey.

Soil Type	Soil Description	K Value
Windsor	Coarse-textured soils	.17
Hollis	Coarse-textured soils	.32

Based on a review of the K values, the onsite soils in the area where construction is focused are moderately susceptible to erosion after the cover material is stripped.

The primary emphasis of the erosion and sedimentation control plan to be implemented for this project is as follows:

1. Development of a careful construction sequence.
2. Rapid stabilization of denuded areas to minimize the period of soil exposure.
3. Rapid stabilization of drainage paths to avoid rill and gully erosion.
4. The use of on-site measures to capture initial sediment (hay bales/silt fence, etc.).
5. The provision for the use of Dirtbags for dewatering of areas likely to encounter groundwater.
6. Inclusion of special provisions for winter construction.
7. The implementation of long-term measures for erosion/sediment and pollutant treatment through the construction of permanent water quality measures.

14.3 Description and Location of Limits of All Proposed Earth Movements

The Martin's Point project will disturb most of the 4.6-acre parcel currently owned by the City, with some additional disturbance attended with the improvements on the existing Martin's Point parcel.

The most significant cut and fill areas will occur where the proposed building is to be constructed, as well as at the terraced parking proposed to the north of the Marine Hospital.

After demolition of the Maintenance Building, the site will set for several months until the contract for building construction is awarded.

Earthmoving activities will generally be to strip and grub the site, stockpile the loam for subsequent reuse, regrade and contour the land to support the proposed project

elements, and the installation of buried utilities to serve the site. Blasting will be required at the site.

Stormwater will be intercepted by a formal drainage system. The formal drainage system will integrate planned water quality system areas.

14.4 Existing and Proposed Drainage Features

The site has steep topography sloping from Elevation 67 at the Marine Hospital building point to about elevation 30 at the lower parking area to the north. Drainage emanates from the site in all directions.

Limited existing formal drainage currently exists on the site.

The proposed drainage systems are not being designed to reduce peak discharge rates at or below existing levels. Instead, the flow will be conveyed in new storm drains to stable outfall points. The control of the peak runoff rates is discussed in more detail in the Stormwater Management Report provided as part of this application.

14.4A Critical Areas

The critical areas of the site are the steep slopes along the edge of the project and where grading will be required within the 75-foot setback from the resource boundary.

14.5 Erosion/Sedimentation Control Devices

The Contractor as part of the site development will implement the following erosion and sediment control devices. These devices shall be installed as indicated on the plans or as described within this report. For further reference, see the Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices.

1. Siltation fence shall be installed downslope of any disturbed areas to trap runoff borne sediments until the site is revegetated. The silt fence shall be installed per the detail provided in the plan set and inspected immediately after each rainfall and at least daily during prolonged rainfall. Repairs shall be made immediately by the Contractor if there are any signs of erosion or sedimentation below the fence line. Proper placement of stakes and keying the bottom of the fabric into the ground is critical to the fence's effectiveness. If there are signs of undercutting at the center or the edges, or impounding of large volumes of water behind the fence, the barrier shall be replaced with a stone check dam.

   Silt fence is shown by three types depending upon the timing and intent as follows:

SCHEDULE OF SILT FENCE REQUIREMENTS		
Silt Fence	**Type Purpose**	**Time of Installation**
Type 1	To trap sediment along the grading edge where the new contours nearly parallel existing contours.	At initial site preparation, prior to other work.
Type 2	To trap sediment from the work area; install in short sections parallel to existing contour; typically occurs where proposed and existing contours form a "V" shape.	At initial site preparation, prior to other work or as fills are blended to existing grades along the contour.
Type 3	To trap sediment along the base of proposed contours, typically in cut areas.	During construction after new grade is shaped. Time between work in area and shaping new grade to allow silt fence to be installed shall be minimized.

2. Straw or hay mulch including hydroseeding is intended to provide cover for denuded or seeded areas until revegetation is established. Mulch placed on slopes of less than 10 percent shall be anchored by applying water; mulch placed on slopes steeper than 10 percent shall be covered with a fabric netting and anchored with staples in accordance with the manufacturer's recommendations. Proposed drainage channels, which are to be revegetated, shall receive Curlex blankets by American Excelsior or equal. Mulch application rates are provided in Attachment A of this section. Hay mulch shall be available on site at all times in order to provide immediate temporary stabilization when necessary. Where necessary for concentrated runoff to be conveyed down a slope, a temporary stone channel or pipe sluice shall be used to convey runoff down the slope.

3. Water quality systems will be required to provide water quality enhancement and sedimentation control for stormwater runoff from the parking and drive areas after construction.

4. Riprap slopes, ditch linings, stone check dams, hay bale barriers, and culvert outlet aprons are intended to reduce runoff velocities and protect denuded soil surfaces from concentrated flows. Installation details and stone sizes are provided in the construction plan set on the erosion control detail sheets.

5. A construction entrance will be constructed at all access points onto the site to prevent tracking of soil onto Veranda Street.

6. Stone sediment traps or a premanufactured SiltSack™ will be installed at catch basin inlets to prevent silt from entering the storm drain system. Installation details are provided in the plan set on the erosion control detail sheets.

7. Reinforced turf and mechanically stabilized turf slopes will be used on extremely steep slopes in areas designated on the drawings.

8. Dirtbags™ will be required to be on site and available for construction dewatering. The Contractor will be required to provide four Dirtbags™ with one prepared for operation prior to commencing any trenching operations.

9. Loam and seed is intended to serve as the primary permanent revegetative measure for all denuded areas not provided with other erosion control measures, such as riprap. Specific areas as shown on the landscape plan will receive sod. Application rates are provided in Attachment A of this section for temporary and permanent seeding.

10. Sorbent oil bags will be required in catch basins which receive runoff from paved areas. The sorbent bags shall be places in the basin immediately prior to paving and remain in place for 60 days after paving operations are complete. After this time, the sorbent bags shall be removed and disposed of at an appropriate facility. The Contractor shall notify the Owner of the disposition location for the sorbent bags.

11. Water will be the principal means to control fugitive dust.

14.6 Temporary Erosion/Sedimentation Control Measures

The following are planned as temporary erosion/sedimentation control measures during construction:

1. A crushed stone-stabilized construction entrance shall be placed at any construction access points from Veranda Street.

2. Type 1 and 2 siltation fence shall be installed along the downgradient side of the proposed improvement areas prior to work in these areas. Type 2 and 3 siltation fence shall be installed as work progresses. The siltation fence will remain in place and properly maintained until the site is acceptably revegetated.

3. Dirtbags™ shall be installed in accordance with the details in the plan set. The Dirtbags'™ function on the project is to receive any water pumped from excavations during construction. A Dirtbag™ shall be installed any prepared for operation prior to any trenching on site. When Dirtbags™ are observed to be at 50% capacity, they shall be cleaned or replaced. Stone under the Dirtbag™ shall be removed and replaced concurrently.

4. Temporary stockpiles of stumps, grubbings, or common excavation will be protected as follows:

   a) Temporary stockpiles shall not be located within 100 feet of the resource limits and at least 50 feet upgradient of the perimeter silt fence.

   b) Inactive stockpiles shall be stabilized within 5 days by either temporarily seeding the stockpile with a hydroseed method containing an emulsified mulch tackifier or by covering the stockpile with mulch. If necessary, mesh shall be installed to prevent wind from removing the mulch.

5. All denuded areas, which have been rough graded, shall receive mulch or erosion control mesh fabric within 14 days of initial disturbance of soil.

6. All soils disturbed between November 1 and April 1 will be covered with mulch within 5 days of disturbance, prior to any predicted storm event of the equivalent of ½" of equivalent rainfall in a 24-hour period, or prior to any work shutdown lasting more than 35 hours (including weekends and holidays). The mulch rate shall be double the normal rate.

7. For work which is conducted between November 1 and April 15 of any calendar year, all denuded areas will be covered with hay mulch, applied at twice the normal application rate and (in areas over 10% grade) anchored with a fabric netting. The time period for applying mulch shall be limited to 5 days for all areas or immediately in advance of a predicted rainfall event.

8. Offsite roadways shall be swept to control mud and dust as necessary. A street sweeper shall be available from the Contractor on immediate notice or request from the Owner, City or regulatory agency. A water truck shall be used to control dust both on the site and along points of ingress and egress.

9. During grubbing operations stone check dams or hay bale barriers shall be installed at any evident concentrated flow discharge points.

10. Silt fencing with a maximum stake spacing of 6 feet should be used, unless the fence is supported by wire fence reinforcement of minimum 14 gauge and with a maximum mesh spacing of 6 inches, in which case stakes may be spaced a maximum of 10 feet apart. The bottom of the fence should be properly anchored a minimum of 6" per the plan detail and backfilled. Any silt fence identified by the owner or reviewing agencies, as not being properly installed during construction shall be immediately repaired in accordance with the installation details.

11. Storm drain catch basin inlet protection shall be provided through the use of stone sediment barriers or a premanufactured SiltSack™ as distributed by A. H. Harris Company, Portland, Maine. Stone sediment barrier installation details are provided in the plan set. The barriers or SiltSacks™ shall be inspected after each rainfall and repairs made as necessary, including the removal of sediment. Sediment shall be removed and the barrier or SiltSack™ restored to its original dimensions when the sediment has accumulated to ½ the design depth of the barrier. Sediment shall be removed from SiltSacksTM as necessary. Inlet protection shall be removed when the tributary drainage area has been stabilized.

12. All slopes over 4:1 shall receive erosion control mesh.

13. Slopes steeper than 3:1 shall receive reinforced turf unless rip rap or other nonvegetative stabilization measures are required by the contract.

14. Type 2 and 3 silt fence shall be installed as construction progresses.

15. Areas of visible erosion shall be stabilized with crushed stone. The Owner's representative in consultation with the engineer shall determine the size of the stone.

16. Catch basins shall all be installed with an opening 2'-6" below finish grade to receive a 4" underdrain with an end cap. A 3'-0" stub of underdrain surrounded by 6" of ¾" crushed stone and filter fabric shall be installed.

17. All catch basins which receive parking lot runoff shall have a sorbent bag installed as described in section 14.5 of this narrative.

14.6A Standards for Stabilizing Sites for the Winter

1. Standard for the timely stabilization of ditches and channels: The contractor shall construct and stabilize all stone-lined ditches and channels on the site by November 15. The contractor shall construct and stabilize all grass-lined ditches and channels on the site by September 15. If the contractor fails to stabilize a ditch or channel to be grass-lined by September 15, then the contractor shall take one of the following actions to stabilize the ditch for late fall and winter.

   i. Install a sod lining in the ditch. The contractor shall line the ditch with properly installed sod by October 1. Proper installation includes the applicant pinning the sod onto the soil with wire pins, rolling the sod to guarantee contact between the sod and underlying soil, watering the sod to promote root growth into the disturbed soil, and anchoring the sod with jute or plastic mesh to prevent the sod strips from sloughing during flow conditions.

   ii. Install a stone lining in the ditch. The contractor shall line the ditch with stone riprap by November 15. The contractor shall hire a registered professional engineer to determine the stone size and lining thickness needed to withstand the anticipated flow velocities and flow depths within the ditch. If necessary, the contractor shall regrade the ditch prior to placing the stone lining so as to prevent the stone lining from reducing the ditch's cross-sectional area.

2. Standard for the timely stabilization of disturbed slopes: The contractor shall construct and stabilize stone-covered slopes by November 15. The contractor shall seed and mulch all slopes to be vegetated by September 15. The department will consider any area having a grade greater than 15% (10H: 1V) to be a slope. If the contractor fails to stabilize any slope to be vegetated by September 15, then the contractor shall take one of the following actions to stabilize the slope for late fall and winter.

   i. Stabilize the soil with temporary vegetation and erosion control mesh. By October 1 the contractor shall seed the disturbed slope with winter rye at a seeding rate of 3 pounds per 1000 square feet and apply erosion control mats over the mulched slope. The contractor shall monitor growth of the rye over the next 45 days. If the rye fails to grow at least three inches or fails to cover at least 75% of the disturbed slope by November 15, then the contractor shall cover the slope with a layer of woodwaste compost as described in item iii of this standard or with stone rip rap as described in item iv of this standard.

   ii. Stabilize the slope with sod. The contractor shall stabilize the disturbed slope with properly installed sod by October 1. Proper installation includes the contractor pinning the sod onto the slope with wire pins, rolling the sod to guarantee contract between the sod and underlying soil, and watering the sod to promote root growth into the disturbed soil. The contractor shall not use late-season sod installation to stabilize slopes having a grade greater than 33% (3H: 1V) or having groundwater seeps on the slope face.

iii. Stabilize the slope with woodwaste compost. The contractor shall place a six-inch layer of woodwaste compost on the slope by November 15. Prior to placing the woodwaste compost, the contractor shall remove any snow accumulation on the disturbed slope. The contractor shall not use woodwaste compost to stabilize slopes having grades greater than 50% (2H: 1V) or having groundwater seeps on the slope face.

iv. Stabilize the slope with stone rip rap. The contractor shall place a layer of stone riprap on the slope by November 15. The contractor shall hire a registered professional engineer to determine the stone size needed for stability and to design a filter layer for underneath the riprap.

3. Standard for the timely stabilization of disturbed soil: By September 15, the contractor shall seed and mulch all disturbed soils on areas having a slope less than 15%. If the contractor fails to stabilize these soils by this date, then the contractor shall take one of the following actions to stabilize the soil for late fall and winter.

   i. Stabilize the soil with temporary vegetation. By October 1, the contractor shall seed the disturbed soil with winter rye at a seeding rate of 3 pounds per 1000 square feet, lightly mulch the seeded soil with hay or straw at 75 pounds per 1000 square feet, and anchor the mulch with plastic netting. The contractor shall monitor the growth of the rye over the 45 days. If the rye fails to grow at least three inches or fails to cover at least 75% of the disturbed soil before November 15, then the contractor shall mulch the area for over-winter protection as described in item iii of this standard.

   ii. Stabilize the soil with sod. The contractor shall stabilize the disturbed soil with properly installed sod by October 1. Proper installation includes the contractor pinning the sod onto the soil with wire pins, rolling the sod to guarantee contact between the sod and underlying soil, and watering the sod to promote root growth into the disturbed soil.

   iii. Stabilize the soil with mulch. By November 15, the contractor shall mulch the disturbed soil by spreading hay or straw at a rate of at least 150 pounds per 1000 square feet on the area so that no soil is visible through the mulch. Prior to applying the mulch, the contractor shall remove any snow accumulation on the disturbed area. Immediately after applying the mulch, the contractor shall anchor the mulch with plastic netting to prevent wind from moving the mulch off the disturbed soil.

14.7 Sedimentation Sumps

The use of shallow sediment sumps on the downgradient side of erodible stockpiles and areas where denuded conditions will be prolonged is encouraged. The sediment sumps may be installed and used in conjunction with the underdrain inlets at catch basins.

14.8 Permanent Erosion Control Measures

The following permanent erosion control measures have been designed as part of the Erosion/Sedimentation Control Plan:

1. All storm drain pipes which are not connected to a formal inlet or outlet shall have riprap aprons at their outlet to protect the outlet and receiving channel from scour and deterioration. Installation details are provided in the plan set. The aprons shall

be installed and stabilized prior to directing runoff to the tributary pipe or culvert. It is noted that all inlets and outlets over 18" in diameter are to have a flared concrete inlet and an aluminum bar rack. Pipes less than 18 inches in diameter are to have an HDPE flare. Riprap shall not be extended above the area shown on the plans.

2. All areas disturbed during construction, but not subject to other restoration (paving, riprap, etc.) will be loamed, limed, fertilized, mulched, and seeded. Fabric netting, anchored with staples, shall be placed over the mulch in areas where the finish grade slope is greater than 10 percent except in the areas with over 3:1 slopes where reinforced turf is required. Native topsoil shall be stockpiled and temporarily stabilized with seed and mulch and reused for final restoration when it is of sufficient quality. Where necessary, compost shall be added and blended to increase the organic content of the soil.

3. Catch basins shall be provided with sediment sumps for all outlet pipes that are 12" in diameter or greater.

4. Permanent water quality measures will be installed.

14.9 Timing and Sequence of Erosion/Sedimentation Control Measures

The following construction sequence shall be required to insure the effectiveness of the erosion and sedimentation control measures are optimized. These measures are separate from the separate requirements to be employed during the building demolition phase of the project.

Note: For all grading activities, the Contractor shall exercise extreme caution not to overexpose the site by limiting the disturbed area.

1. Install crushed stone-stabilized construction entrances from Veranda Street the as shown on the Erosion and Sedimentation Control Drawing.
2. Install Type 1 and appropriate Type 2 siltation
3. Establish and prepare Dirtbag™ area.
4. Perform demolition activities and major site cuts and fills and blasting.
5. Install water quality systems and the storm drain system.
6. Construct diversion and drainage channels to direct flow to new storm drain and inlets where grades permit.
7. Install stone and hay bale check dams at any concentrated flow discharge points.
8. Prepare the subgrade, parking areas, building, and drive loop.
9. Install storm drain, underground electric, foundations and other utility work. Install inlet and outlet protection immediately after the installation of any inlets. Pump any accumulated water to the Dirtbag™
10. Bring initial site work area to subgrade including binder pavement, stabilization of all slopes, and loam seeding of areas.
11. Construct other site improvements and utilities.
12. Raise catch basins to grade and install inlet protection devices.
13. Install sorbent bags in catch basins which will receive runoff from pavement

14. Install final pavement as detailed on the site plans.
15. Loam, Lime, fertilize, seed and mulch all remaining disturbed and denuded areas.
16. Remove all accumulated sediment from silt barriers.
17. Review stability of the site. If a 75% catch of grass is achieved, remove all other temporary erosion control devices.

Soil will be considered disturbed if it does not have an established stand of vegetation covering at least 75% of the soil surface or has not been mulched with hay applied at a rate of 230 lb./1000 sq. ft.

It is anticipated that site work may be suspended prior to winter. If so, the General Contractor shall schedule a meeting with the City, Owner, and Owner's representatives to review the site for conformance with the plan. This meeting shall be scheduled at least 10 days prior to winter shutdown. The Owner may elect to provide the Contractor with a punch list for measures to be complete before the interim shutdown. The Owner's punch list shall not obviate the Contractor's responsibility for compliance with the erosion control requirements of the project or permits.

Construction of Improvements at Veranda Street may be conducted concurrently or following site work.

14.10 Contracting Procedure

A General Contractor under contract to Martin's Point will construct the project. The Contractor shall submit a schedule for the completion of the work which will satisfy the following criteria:

1. The above construction sequence should generally be completed in the specified order; however, several separate items may be constructed simultaneously. Work must also be scheduled or phased to prevent the extent of the exposed areas as specified below. The intent of this sequence is to provide for erosion control and to have structural measures such as silt fence and construction entrances in place before large areas of land are denuded.
2. The work shall be conducted in sections which will:
   a) Limit the amount of exposed area to those areas in which work is expected to be undertaken during the proceeding 30 days.
   b) Revegetate disturbed areas as rapidly as possible. All areas shall be permanently stabilized within 7 days of final grading or before a predicted storm event; or temporarily stabilized within 7 days of initial disturbance of soil for areas identified as critical (refer to paragraph 14.4.A) and 14 days for all other areas.
   c) Incorporate planned inlets and drainage system as early as possible into the construction phase. The ditches shall be immediately lined or revegetated as soon as their installation is complete.
3. Once final grade has been established, the Contractor may choose to dormant seed the disturbed areas prior to placement of mulch and placement of fabric netting anchored with staples.
   a. If dormant seeding is used for the site, all disturbed areas shall receive 4" of loam and seed at an application rate of 5#/1000 s.f.

All areas seeded during the winter months will be inspected in the spring for adequate catch. All areas insufficiently vegetated (less than 75 percent catch) shall be revegetated by replacing loam, seed and mulch.

b. If dormant seeding is not used for the site, all disturbed areas shall be revegetated in the spring.

4. The area of denuded non-stabilized construction shall be limited to the minimum area practicable. An area shall be considered to be denuded until the subbase gravel is installed in parking areas or the areas of future loam and seed have been loamed, seeded, and mulched. The mulch rate shall be twice the rate specified in the seeding plan. [For example, 115#/1,000 s.f. x 2 = 230#/1,000s.f.]

5. Within the exposed work area, temporary sedimentation sumps shall be provided at the interface between parking areas and graded slopes (refer to paragraph 14.7). This shall be accomplished by creating an area 18" below adjacent temporary grades. The sedimentation area shall have a bottom width of 3' and 3:1 side slopes. Culverts to allow access shall be installed by the Contractor. Along the sedimentation sumps, barriers shall be provided at sufficient intervals to permit runoff to be accumulated to a minimum depth of 12" before overflowing.

6. The schedule shall be subject to the approval of the Owner.

The Contractor must install any added measures, which may be necessary to control erosion/sedimentation from the site and fugitive dust emissions dependent upon the actual site and weather conditions.

The applicant may be required to retain a third party inspector. The Contractor shall cooperate with the third party inspector and permit access to the site by the inspector at all times.

The Contractor shall note that no area within 50 feet of a slope with a vertical drop of more than 3' in 50 feet shall remain denuded for a period of over 5 days before it is temporarily stabilized. Temporary stabilization shall be the installation of mulching. All other areas shall be stabilized within 14 days. For construction between November 1 and April 15 of any calendar year, all areas shall be temporarily stabilized at the earlier time frames specified above.

14.11 Provisions for Maintenance of the Erosion/Sedimentation Control Features

The Owner will contract the project. The project is subject to the requirement of a MeDEP Site Location of Development Permit administered through the City of Portland and a MeDEP Permit for Stormwater Pollution Prevention Plan during Construction. These permits require the Contractor to prepare a list and designate by name, address and telephone number all individuals who will be responsible for implementation, inspection and maintenance of all erosion control measures identified within this section and as contained in the Erosion and Sedimentation Control Plan of the contract drawings. Specific responsibilities of the inspector(s) will include:

1. Execution of the Contractor/Subcontractor Certification contained in Attachment B by any and all parties responsible for erosion control measures on the site as required by the MeDEP.

2. Assuring and certifying the Owner's construction sequence is in conformance with the specified schedule of this section. A weekly certification stating compliance, any

deviations, and corrective measures necessary to comply with the erosion control requirements of this section shall be prepared and signed by the inspector(s).

3. In addition to the weekly certifications, the inspector(s) shall maintain written reports recording construction activities on site which include:
   - Dates when major grading activities occur in a particular areas.
   - Dates when major construction activities cease in a particular area, either temporarily or permanently.
   - Dates when an area is stabilized.
4. Inspection of this project work site on a weekly basis and after each significant rainfall event (0.5 inches or more within any consecutive 24 hour period) during construction until permanent erosion control measures have been properly installed and the site has been stabilized. Inspection of the project work site shall include:
   - Identification of proper erosion control measure installation in accordance with the erosion control detail sheet or as specified in this section.
   - Determine whether each erosion control measure is properly operating. If not, identify damage to the control device and determine remedial measures.
   - Identify areas that appear vulnerable to erosion and determine additional erosion control measures that should be used to improve conditions.
   - Inspect areas of recent seeding to determine percent catch of grass. A minimum catch of 75 percent is required prior to removal of erosion control measures.
   - Record date of installation of sorbent bags in catch basins, the dates of paving, the date of removal, and the disposal method and location.

   Accumulated silt/sediment should be removed when the depth of sediment reaches 50 percent of the barrier height. Accumulated silt/sediment should be removed from behind silt fencing when the depth of the sediment reaches 6 inches.
5. If inspection of the site indicates a change should be made to the erosion control plan, either to improve effectiveness or correct a site-specific deficiency, the inspector shall immediately implement the corrective measure and notify the owner of the change.

Once construction has been completed, long term maintenance of the detention pond and catch basins will be the responsibility of the applicant. The catch basin sumps shall be inspected in April and October of each year. Sediment shall be removed when the depth of sediment reaches one half the depth of the sump.

All certifications, inspection forms and written reports prepared by the inspector(s) shall be filed with the Owner, and the MeDEP General Construction Permit File contained on the project site. All written certifications, inspection forms, and written reports must be filed within one (1) week of the inspection date.

14.12 Preconstruction Conference

Prior to any construction at the site, representatives of the Contractor, and the site design engineer shall arrange for and meet with the Owner to discuss the scheduling of the site construction. On or before that meeting, the Contractor will prepare a detailed schedule and a marked-up site plan indicating areas and components of the work and

key dates showing date of disturbance and completion of the work. Three copies of the schedule and marked-up site plan shall be provided to the Owner.

14.13 Attachments

Attachment A – Seeding Plan
Attachment B – Sample EPA Certification and Inspection Forms

14.14 Plan References

Erosion/Sediment Control Plans and Details

ATTACHMENT A

SEEDING PLAN

SEEDING PLAN LAWN AND OTHER AREAS

Project Martin's Point Redevelopment Project

Site Location Portland, Maine

X Permanent Seeding _____ Temporary Seeding

1. Area to be seeded: _____ acres, OR _____ M Sq. Ft.
2. Instructions on preparation of soil: Prepare a good seed bed for planting method used.
3. Apply lime as follows: _____ #/acres, OR 138#/M Sq. Ft.
4. Fertilize with _____ pounds of - - N-P-K/ac. OR
   18.4 pounds of 10 - 20 - 20 N-P-K/M Sq. Ft.
5. Method of applying lime and fertilizer: Spread and work into the soil before seeding.
6. Seed with the following mixture:

   45% Kentucky Bluegrass
   45% Creeping Red Fescue
   10% Perennial Ryegrass

When using small grain as nurse crop seed it at one-half the normal seeding rate.

7. Mulching instructions: Apply at the rate of _____ tons per acre. OR
   230 pounds per M. Sq. Ft.

	Amount	Unit #, Tons, Etc.
8. TOTAL LIME	138	#/1000 sq. ft.
9. TOTAL FERTILIZER	13.8	#/1000 sq. ft.
10. TOTAL SEED	6 to 8	#/1000 sq. ft.
11. TOTAL MULCH	230	#/1000 sq. ft.
12. TOTAL other materials, seeds, etc.	Compost is likely required	

13. REMARKS

- Recommended seeding dates after August 15.
- For areas with slopes >10%, waterways, areas within 100 feet of the stream, and fall and winter erosion control areas, mulch netting shall be used per manufacturer's specifications.
- Fertilizer requirements shall be subject to actual test results of the topsoil used for the project. The Contractor shall be responsible for providing topsoil test results for pH and recommended fertilizer application rates to the owner
- All loam shall have compost or peat admixtures to raise the organic content to 8%.

TEMPORARY SEEDING PLAN

Project Martin's Point Redevelopment Project

Site Location Portland, Maine

_____ Permanent Seeding X Temporary Seeding

1. Area to be seeded: varies acres, OR _____ M Sq. Ft.
2. Instructions on preparation of soil: Prepare a good seed bed for planting method used.
3. Apply lime as follows: _____ #/acres, OR 138#/M Sq. Ft.
4. Fertilize with _____ pounds of - - N-P-K/ac. OR
   18.4 pounds of 10 - 20 - 20 N-P-K/M Sq. Ft.
5. Method of applying lime and fertilizer: Spread and work into the soil before seeding.
6. Seed with the following mixture:

   50% Perennial Ryegrass
   50% Winter Rye

When using small grain as nurse crop seed it at one-half the normal seeding rate.

7. Mulching instructions: Apply at the rate of _____ tons per acre. OR
   180 pounds per M. Sq. Ft.

	Amount	Unit #	Tons, Etc.
8.	TOTAL LIME	138	#/1000 sq. ft.
9.	TOTAL FERTILIZER	18.4	#/1000 sq. ft.
10.	TOTAL SEED	6	#/1000 sq. ft.
11.	TOTAL MULCH	180	#/1000 sq. ft.
12.	TOTAL other materials, seeds, etc.		

13. REMARKS

The above seed mix is required in all temporarily disturbed wetland areas.

Fertilizer requirements shall be subject to actual test results of the topsoil used for the project. The Contractor shall be responsible for providing topsoil test results for pH and recommended fertilizer application rates to the owner.

ATTACHMENT B

SAMPLE EPA CERTIFICATION AND INSPECTION FORMS

STORMWATER POLLUTION PREVENTION PLAN

CONTRACTOR/SUBCONTRACTOR CERTIFICATION

PROJECT INFORMATION

Project Name: Martin's Point Redevelopment Project

Address: Portland, Maine 04103

CONTRACTOR/SUBCONTRACTOR INFORMATION

Firm Name:

Address:

Telephone:

Type of Firm:

CERTIFICATION STATEMENT

"I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the stormwater discharges associated with industrial activity from the construction site identified as part of this certification."

_____

Signature

_____

Typed Name

_____

Title

_____

Date

STORMWATER POLLUTION PREVENTION PLAN

INSPECTION REPORT

PROJECT INFORMATION

Project Name: Martin's Point Redevelopment Project

Address: Portland, Maine 04103

INSPECTOR INFORMATION

Inspector Name: _____

Firm: _____

Title: _____

Qualifications: _____

INSPECTION SUMMARY

Date of Inspection: _____

Major Observations: _____

_____

_____

_____

THE FACILITY IS IN COMPLIANCE WITH THE STORMWATER POLLUTION PREVENTION PLAN WITH THE FOLLOWING EXCEPTIONS:

_____

_____

_____

_____

ACTIONS NECESSARY TO BRING FACILITY INTO COMPLIANCE:

REQUIRED MODIFICATIONS TO STORMWATER POLLUTION PREVENTION PLAN (MUST BE IMPLEMENTED WITHIN 7 DAYS OF INSPECTION):

CERTIFICATION STATEMENT:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the systems, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of find and imprisonment for knowing violations."

Signature

Typed Name

Title

Date

SECTION 02271

DIRTBAG® SPECIFICATIONS FOR CONTROL OF SEDIMENT

PART 1 - GENERAL

1.1 DESCRIPTION

This work shall consist of furnishing, placing and removing the DIRTBAG® pumped sediment control device for erosion-sediment control. The DIRTBAG® pumped-silt control system is marketed by:

ACF Environmental, Inc.
2831 Cardwell Drive
Richmond, Virginia 23234
Phone: 800-448-3636 Fax: 804-743-7779

PART 2 - MATERIALS

2.1 DIRTBAG®

A. The DIRTBAG® shall be a non-woven bag which is sewn with a double needle matching using a high strength thread.

B. The DIRTBAG® seams shall have an average wide width strength per ASTM D-4884 as follows.

DIRTBAG® Style	Test Method	Test Result
DIRTBAG® 53	ASTM D-4884	60 LB/IN
DIRTBAG® 55	ASTM D-4884	100 LB/IN

C. Each standard DIRTBAG® shall be supplied with fill spout large enough to accommodate a 4" discharge hose and straps to secure the hose and prevent pumped water from escaping without being filtered.

401.15 Mixing. The Contractor shall combine the dried aggregate in the mixer in the amount of each fraction of aggregate required to meet the JMF. The Contractor shall measure the amount of PGAB and introduce it into the mixer in the amount specified by the JMF.

The Contractor shall produce the mixture at the temperature established by the JMF.

The Contractor shall dry the aggregate sufficiently so that the mixture will not flush, foam excessively, or displace excessively under the action of the rollers. The Contractor shall introduce the aggregate into the mixer at a temperature of not more than 14° C above the temperature at which the viscosity of the bituminous material being used is 0.150 Pas.

The Contractor shall store and introduce into the mixer the Performance Graded Asphalt Binder at a uniformly maintained temperature at which the viscosity of the material is between 0.150 Pas and 0.300 Pas. The aggregate shall be completely and uniformly coated with a thorough distribution of the PGAB. The Contractor shall determine the wet mixing time for each plant and for each type of aggregate used.

401.16 Spreading and Finishing. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the Contractor shall spread, rake, and lute the mixture with hand tools to provide the required compacted thickness.

On the roads opened to two way traffic, the Contractor shall place each course over the full width of the traveled way section being paved that day, unless otherwise approved by the Owner.

401.17 Compaction. Immediately after the Hot Mix Asphalt Pavement has been spread, struck off, and any surface irregularities adjusted, the Contractor shall thoroughly and uniformly compact the mixture by rolling.

The Contractor shall roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving. The Contractor shall prevent adhesion of the mixture to the rollers or vibrating compactors without the use of oil.

The Contractor shall immediately correct any displacement occurring as a result of the reversing of the direction of a roller or from other causes to the satisfaction of the Owner. Any operation other than placement of variable depth shim course that results in breakdown of the aggregate shall be discontinued.

Along forms, curbs, headers, walls, and other places not accessible to the roller, the Contractor shall thoroughly compact the mixture with mechanical vibrating compactors. The Contractor shall only use hand tamping in areas inaccessible to all other compaction equipment. On depressed areas, the Contractor may use a trench roller or cleated compression strips under a roller to transmit compression to the depressed area.

401.18 Joints. The Contractor shall construct wearing course transverse joints in such a manner that minimum tolerances shown in section 401.111 are met when measured with a straightedge.

The paver shall always maintain a uniform head of material during the joint construction. The bituminous mix shall be free of segregation and meet temperature requirements. Transverse joints of the wearing course shall be straight and neatly trimmed. The Contractor may form a vertical face exposing the full depth of the course by inserting a header, by breaking the bond with the underlying course, or by cutting back with hand tools. The Owner may allow feathered or "lap" joints on lower courses or when matching existing low type pavements.

The Contractor shall apply a coating of emulsified asphalt immediately prior to paving all joints, except those formed by pavers operating in echelon. The Contractor shall use an approved spray apparatus designed for covering a narrow surface. The Owner may approve application by a brush for small surfaces, or in the event of a malfunction of the spray apparatus, but for a period of not more than one working day.

Where pavement under this Contract joins an existing pavement of when the Owner directs, the Contractor shall cut the existing pavement along a smooth line, producing a neat, even, vertical joint. The Owner will not permit broken or raveled edges. The cost of all work necessary for the preparation of joints is incidental to related Contract items.

401.19 Quality Control.Method A & B.

The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the Contract requirements. The QCP shall meet the requirements of 106.031 and these Special Provisions. The Contractor shall not begin paving operations until the QCP is approved in writing by the Owner.

Prior to placing any mix, the Owner and the Contractor shall hold a Pre-paving conference to discuss the paving schedule, source of mix, type and amount of equipment to be used, sequence of paving pattern, rate of mix supply, and traffic control. All field and plant supervisors including the responsible onsite paving supervisor shall attend this meeting.

The QCP shall address all elements which affect the quality of the Plant Mix Pavement including, but not limited to, the following:

(a) JMF(s)
(b) Hot asphalt mix plant details
(c) Stockpile Management (to include provisions for a minimum 2 day stockpile)
(d) Make & type of paver(s)
(e) Make & type of rollers including weight, weight per inch of steel wheels, and average contact pressure for pneumatic tired rollers
(f) Name of QCP Administrator, and certification number
(g) Name of Process Control Technician(s), and certification number(s)
(h) Name of Quality Control Technician(s), and certification number(s)
(i) Mixing & transportation including process for ensuring that truck bodies are clean and free of debris or contamination that could adversely affect the finished pavement.
(j) Frequency of and tests for Quality Control pavement

(k) Laydown operations including longitudinal joint construction, procedures for avoiding paving in inclement weather, tacking of all joints, methods to ensure that segregation is minimized, procedures to determine the maximum rolling and paving speeds based on best engineering practices as well as past experience in achieving the best possible rideability of the pavement.
(l) Examples of Quality Control Forms
(m) Process for compacting paved shoulders and traveled way for method B projects
(n) Silo management and details (can show storage for use on project of up to 36 hours)
(o) Provisions for varying mix temperature due to extraordinary conditions.
(p) Name and responsibilities of the Responsible onsite Paving Supervisor

The QCP shall include the following technicians together with these minimum requirements:

(a) QCP Administrator – A qualified individual shall administer the QCP. The QCP Administrator must be a full-time employee of or a consultant engaged by the Contractor or paving subcontractor. The QCP Administrator shall have full authority to institute any and all actions necessary for the successful operation of the QCP. The QCP Administrator (or its designee in the QCP Administrator's absence) shall be available to communicate with the Owner at all times. The QCP Administrator shall be certified as a Plant Technician or Paving Technician certified by the New England Transportation Technician Certification Program.

(b) Process Control Technician(s) (PCT) shall utilize test results and other quality control practices to assure the quality of aggregates and other mix components and control proportioning to meet the JMF(s). The PCT shall periodically inspect all equipment used in mixing to assure it is operating properly and that mixing conforms to the mix design(s) and other Contract requirements. The QCP shall detail how these duties and responsibilities are to be accomplished and documented and whether more than one PCT is required. The Plan shall include the criteria to be utilized by the PCT to correct or reject unsatisfactory materials. The PCT shall be certified as a Plant Technician by the New England Transportation Certification Program.

(c) Quality Control Technician(s) (QCT) shall perform and utilize quality control tests at the job site to assure that delivered materials meet the requirements of the JMF(s). The QCT shall inspect all equipment utilized in transporting, laydown, and compacting to assure it is operating properly and that all laydown and compaction conform to the Contract requirements. The QCP shall detail how these duties and responsibilities are to be accomplished and documented, and whether more than one QCT is required. The QCP shall include the criteria utilized by the QCT to correct or reject unsatisfactory materials. The QCT shall be certified as a Paving Technician by the New England Transportation Technician Certification Program.

The QCP shall detail the coordination of the activities of the Plan Administrator, the PCT and the QCT. The project Superintendent shall be named in the QCP, and his responsibilities for successful implementation of the QCP shall be outlined.

The Contractor shall sample, test, and evaluate Hot Mix Asphalt Pavement in accordance with the following minimum frequencies:

Table 4: MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Temperature of mix	6 per day at street and plant	-
Temperature of Mat	4 per day	-
% TMD (Surface)	1 per 150 Mg	ASTM D-2950*
% TMD (Base)	1 per 600 Mg	AASHTO T-166
Fines/Effective Binder	1 per 1200 Mg	AASHTO TP-4
Gradation	1 per 600 Mg	AASHTO T-30
PGAB content	1 per 600 Mg	AASHTO T-164, T-287 or TP 53
Voids at N_{design}	1 per 600 Mg	AASHTO TP-4
Voids in Mineral Aggregate at N_{design}	1 per 600 Mg	AASHTO TP-4
Rice Specific Gravity	1 per 600 Mg	AASHTO T-209
Coarse Aggregate Angularity	1 per 6000 Mg	ASTM D 5821
Flat and Elongated Particles	1 per 6000 Mg	ASTM D-4791
Fine Aggregate Angularity	1 per 6000 Mg	AASHTO TP33

* May be modified according to the MDOT's policy on file at the Central Lab in Bangor.

The Contractor may utilize innovative equipment or techniques not addressed by the Contract documents to produce or monitor the production of the mix, subject to approval by the Owner.

The Contractor shall record all Hot Mix Asphalt Pavement plant test results in writing, signed by the appropriate technician and present them to the Owner by 10:00 AM on the next working day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall make density test results, including randomly sampled densities, available to, and summaries of each day's results shall be recorded and signed by the QCT and presented to the Owner by 10:00 AM the next working day.

The Contractor shall have a testing lab at the plant site, equipped with all testing equipment necessary to complete the tests in Table 4. The Contractor shall locate an approved SHRP Gyratory Compactor at the plant testing lab or within 30 minutes of the plant site.

The Contractor shall fill all holes in the pavement resulting from cutting cores by the Contractor or the Owner with an acceptable mixture no later than the following working day. Before filling, the Contractor shall carefully clean the holes and apply a coating of emulsified asphalt. On surface courses, cores shall not be cut except for calibration of the Nuclear Density Gauge, or as directed by QA testing by the Owner. On a daily basis, the Contractor shall perform nuclear density testing across the mat being placed, at 300 mm intervals. If the values vary by more than 2.0% from the mean, the Contractor shall make adjustments until the inconsistencies are remedied.

The Contractor shall monitor plant production using control charts as specified in Section 106. If plotted test results indicate a production problem, the Contractor shall notify the Owner and take corrective action acceptable to the Owner. The Contractor shall keep control charts up to date and available for review by the Owner at any time.

The Contractor may construct a pavement test strip on a given project at the option of the Contractor for each individual JMF. Prior to test strip placement the Contractor shall deliver a written notice to the Owner

notifying that a test strip will be scheduled. Prior to placement of the test strip, a passing verification test is required.

The test strip shall not exceed 800 M. The quantity of Hot Mix Asphalt produced for the test strip shall not exceed 700 MG, 4 hours production, or 4% of the total quantity for the project, as determined by the Owner.

The test strip is intended to allow the Contractor to establish rolling patterns to achieve optimum density for the mat being laid. The Owner will not test the first third of the mat, allowing the plant to "balance itself". The Owner will calibrate thin lift densometers against cut cores. For surface mixes, the Owner will select 3 test sites and take 4 shots at each site. For base and binder mixes, 3 cores shall be run for density verification. The Contractor shall not commence full production until the calibrations are complete and the test strip has attained its minimum values for percent voids and percent TMD.

Should the test strip fail to meet an average density of 89% or greater (minimum of 3 tests, maximum of 7 including re-tests) or should the volumetrics, based on QC results, be outside of the 3-6% range, the Owner will reject the test strip. The Contractor shall remove and replace rejected test strips at their expense. The test strip shall be considered part of the project pavement and no separate payment will be made.

The Contractor shall cease paving operations whenever one of the following occurs on a lot in progress:

(1) The Pay Factor (which will be used for QA purposes only) for VMA, Voids @ N_d, Percent PGAB, composite gradation, VFB, fines to effective binder or density using all available tests is less than 0.90.
(2) The Coarse Aggregate Angularity or Fine Aggregate Angularity value falls below the requirements of Table 3 for the design traffic level.
(3) The first 2 control tests for the lot fall outside the upper or lower limits.
(4) The Flat and Elongated Particles value exceeds 10 percent by ASTM D-4791.
(5) There is any visible damage to the aggregate due to over-densification other than on variable depth shim courses.
(6) The Contractor fails to follow the approved QCP.

Paving operations shall not resume until the Contractor and the Owner determine that material meeting the Contract requirements will be produced. The Owner will consider corrective action acceptable if the Pay Factor for the failing property increases. If the Owner determines that the resumption of production involves a significant change to the production process, the current lot will be terminated and a new lot will begin.

401.20 Quality Assurance.

Method A

This method utilizes Quality Level Analysis and Pay Factor specifications. However, the pay factor shall be utilized to evaluate pavement performance only. Payment for all material and labor to place the payment shall be included in the Lump Sum contract. No separate payment will be made.

For asphalt pavement designated for acceptance under Quality Assurance (QA) provisions, the Owner will sample once per sublot on a statistically random basis, test, and evaluate in accordance with the following Acceptance Criteria:

Table 5: ACCEPTANCE CRITERIA

PROPERTIES	POINT OF SAMPLING	LOT SIZE	SUBLOT SIZE	TEST METHOD
Gradation	Paver Hopper	JMF*	1200 Mg	AASHTO T-30
PGAB Content	Paver Hopper	JMF*	1200 Mg	AASHTO TP-53
% TMD (Surface)	Mat behind all Rollers	JMF*	300 Mg	ASTM-2950/ AASHTO T-166
% TMD (Base or Binder)	Mat behind all Rollers	JMF*	600 Mg	AASHTO T-166
Air Voids at N_d	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4
Voids in Mineral Aggregate at N_d	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4
Fines to Effective Binder	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4
Voids Filled with Binder	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4

* Not to exceed 6,000 Mg, unless an unplanned overrun less than 2400 MG, or agreed to at the Pre-Construction Conference.

On the first day of production the Owner will take 3 random samples which will be used to calculate the quality level of the in-place material in the event the lot is terminated prematurely. Only 1 of the 3 will be for tested, the other 2 will be held onsite until at least 3 random samples have been taken, at which time the other 2 will be discarded.

(a) Lot Size. For purposes of evaluating all acceptance test properties, a lot shall consist of the total quantity represented by each item listed under the lot size heading in the table above. Each lot will be divided into at least 3 sublots, 5 where possible.

(b) Sublot size. The quantity represented by each sample will constitute a sublot. The size of each sublot shall be as listed under the sublot size heading in the table above. If there is insufficient quantity in a lot to make up at least three sublots, then the lot quantity will be divided into three equal sublots.

If there is less than one half of a sublot remaining at the end, then it shall be combined with the previous sublot. If there is more than one half sublot remaining at the end, then it shall constitute the last sublot and shall be represented by test results.

(c) Rejection by Contractor. The Contractor may, prior to sampling, elect to remove any defective material and replace it with new material at no expense to the Owner. The Owner will sample, test, and evaluate any such new material for acceptance. The Owner will review any test results for density below 90%, and areas found to be deficient shall be isolated and 3 random tests taken. If the resultant Pay Factor falls at or below 0.75, the Contractor shall remove and replace the material for the full lane width for a length of no less than 50 Meters at no expense to the Owner.

(d) Acceptance Testing. The Owner will obtain samples of Hot Mix Asphalt Pavement in conformance with AASHTO T168 – Sampling Bituminous Paving Mixtures. The Owner will take the sample randomly within each sublot. Target values shall be as specified in the JMF. The Owner will use the following Table for calculating Pay Factors for gradation, PGAB content, air voids at N_d, VMA, Fines to Effective Binder and VFB.

Table 6: GRADATION, VOLUMETRIC AND ASPHALT CEMENT ACCEPTANCE LIMITS

Property	USL and LSL
Passing 4.75 mm and larger sieves	Target ± 7 percent
Passing 2.36 mm to 1.18 mm sieves	Target ± 4 percent
Passing 0.60 mm	Target ± 3 percent
Passing 0.30 mm to .075 mm sieve	Target ± 2 percent
PGAB Content	Target ± 0.4 percent
Air Voids	Target ± 1.5 percent
Fines to Effective Binder	0.6% to 1.4%
Voids in the Mineral Aggregate	JMF Target -/+ 1.5% but not more than 0.5% below the table 2 Min. Value
Voids Filled with Binder	Target +/- 5%

Prior to paving, the Contractor shall determine whether testing of the surface for density QA will be done with cores or the Nuclear Density Gauge. If the Owner tests with the Nuclear Method, then the following table shall apply:

Table 7a: Density Acceptance Limits

	TARGET	LSL	USL
% of Maximum Theoretical Density	94.5	92.0	97.0

The Owner will designate a control section of pavement approximately 150 m long at the start of the paving operations. Within the control section at least three locations will be tested at the same offset at approximately a 2 M spacing to calibrate the nuclear density gauge. After placement of pavement, the Contractor shall cool the pavement to be tested by using ice and promptly cut the necessary calibration cores. After cooling to 20° C, the Contractor shall remove the cores using a core removing tool to assure minimum damage to the core. The Owner will adjust the nuclear density gauge to reflect the average of the cores. The Owner reserves the right to designate a new control section at any time. When nuclear testing is performed at locations outside normal paving and traffic control areas, the Contractor shall furnish a flagger and other necessary safety devices to protect personnel and equipment.

For base of binder courses, or for surface course when the nuclear density gauge is not available and the Owner so directs, the Contractor shall cut cores within 24 hours of placement of the pavement, or by the end of the next working day.

If the Owner tests with the Core Method then the following Table shall apply:

Table 7b: Density Acceptance Limits

	TARGET	LSL	USL
% of Maximum Theoretical Density	95.0	92.5	97.5

The Owner will measure pavement density on the compacted wearing surface using core samples tested according to AASHTO T-166. The Owner will randomly determine core locations. The Contractor shall cut cores at no additional cost to the Owner within 24 hours of placement of the pavement, and immediately give them to the Owner. At the time of sampling, the Contractor and the Owner shall mutually determine if a core is damaged. If it is determined that the core(s) is damaged, the Contractor shall cut new core(s) adjacent to the initial sample. In the Owner's presence, the Contractor may saw-cut the bottom of the core onsite without disturbing the layer being tested to remove lower layers of Hot Mix Asphalt Pavement, gravel, or RAP. No recuts are allowed at a test location after the core has been tested.

The minimum acceptable density for shoulders shall be 90.0% unless waived by the Owner due to local conditions that make densification to this point detrimental to the finished pavement.

Method B

Method B utilizes Product Verification testing to determine the quality of the material incorporated into the project. The Hot Mix Asphalt Pavement (other than that placed outside the traveled way and shoulders) shall meet the material properties in Tables 1 through 3. Aggregates and Mix shall meet the Consensus and Volumetric properties in Table 8 and Section 401.03, Aggregates, utilizing the testing methods and sampling procedures in Table 5.

For the traveled way density will be tested with 3 random cores, and statistically evaluated for Pay Factors with a USL of 98.0% and an LSL of 92.0%. If the resultant Pay Factor is 0.75 or below, the Contractor shall remove and replace the material with mix meeting the specifications at no additional cost to the Owner.

Only the Owner shall be allowed to dispute whether the test results reflect the true quality of the mix.

Unless otherwise noted, the Owner will verify density by inspection to ensure that the proper compaction procedures are complied with. The Owner may test for density to ensure that the Contractor's method attains acceptable results. At any time, the Owner may take samples from the source of production to determine the properties shown in Table 8, Section 401.03, Aggregates, or will verify these properties with test results from another project done during the same time period.

Table 8: GRADATION, VOLUMETRIC AND PGAB CONTENT VERIFICATION LIMITS
(METHOD B)

	USL and LSL		
	Mainline	Shoulder	Drives & Sidewalks
Percent Passing 4.75 mm and larger sieves	Target ± 7	Target ± 7	Target ± 7
Percent Passing 2.36 mm to 1.18 mm sieves	Target ± 5	Target ± 5	Target ± 5
Percent Passing 0.60 mm	Target ± 4	Target ± 4	Target ± 4
Percent Passing 0.30 mm to 0.75 mm sieve	Target ± 3	Target ± 3	Target ± 3
PGAB Content	Target ± 0.5	Target ± 0.5	Target ± 0.5
Air Voids	4.0% ± 2.0	4.0% ± 2.0	Not Applicable
Fines to Effective Binder	0.6% to 1.6%	0.6% to 1.6%	Not Applicable
Voids in the Mineral Aggregate	JMF Target ± 1.5%*	JMF Target ± 1.5%*	Not Applicable
Voids Filled with Binder	Target ± 5%	Target ± 5%	Not Applicable

* But not more than 0.5% below the Table 2 Min. Value

For PGAB Content, Gradation, and Volumetric properties on items covered under Method B, the Owner may take 3 or more random samples from the material delivered to the project. The Owner may elect to test one or more of these samples to evaluate the quality of the mix. If there is concern about the quality, the Owner will test 3 or more random samples to determine a Pay Factor for each property using Table 8 USLs and LSLs. The Owner may reject material with a 0.75 pay factor or less. If the PF is less than 1.00 but greater than 0.75, price adjustments may be made accordingly. If the PF is 1.00 or greater the Owner will pay the full contract price.

401.21 Method of Measurement and Payment. All material, equipment and labor required to produce, place and test the asphalt pavement shall be included in the Lump Sum contract except testing by the independent testing laboratory hired by the Owner. No quantity measurement will be made for any pavement placed under this contract.

401.22 Basis of Payment. Payment for all paving activity shall be included in the Project Lump Sum contract price.

This Work shall include all labor, equipment, materials, and incidentals necessary to meet all related Contract requirements, including design of the JMF, implementation of the QCP, obtaining core samples, filling core holes, applying emulsified asphalt to joints, and providing testing facilities and equipment. Cleaning objectionable material from the pavement and furnishing and applying bituminous material to joints and contact surfaces is incidental.

No separate payment will be made for any pavement work under this Contract.

401.222 Pay Factor (PF) (Method A Only). The Owner will use density, Performance Graded Asphalt Binder content, voids @ N_d, VMA, VFB, F/B[e], and the screen sizes listed below (Table 9) for the type of material represented in the JMF. The Owner will evaluate materials using the following price adjustment factors under Subsection 106.033 for QA purposes only and no additional payment will be based on these calculations.

Table 9: Table of Gradation Composite "f" Factors
(Method A)

Constituent		"f" Factor				
		25 mm	19 mm	12.5 mm	9.5 mm Surface	9.5 mm Other
Gradation	25 mm	4	-	-	-	-
	19 mm		4	-	-	-
	12.5 mm			4	-	-
	9.50 mm				4	4
	2.36 mm	6	6	6	6	6
	1.18 mm					
	0.60 mm	2	2	2	2	2
	0.30 mm	2	2	2	2	2
	0.075 mm	6	6	6	6	6

For each lot of material, the Owner will determine a price adjustment as follows:

Gradation. The Owner will determine a composite pay factor (PF) using applicable price adjustment factors "f" from Table 9 and acceptance limits from Table 6. The Owner will not make price adjustments for gradations, but will monitor them as a shutdown criteria.

VFB and Fines to Effective Binder. The Owner will determine a pay factor (PF) using acceptance limits from Table 6. The Owner will not make price adjustments for VFB or Fines to Effective Binder, but will monitor them as a shutdown criteria.

Density. For mixes having a density requirement, the Owner will determine a Pay Factor using acceptance limits from Table 7a or 7b.

PGAB Content, VMA and Air Voids. For mixes having a Volumetric requirement, the Owner will determine a Pay Factor using acceptance limits from Table 6.

If any single Pay Factor for PGAB Content, VMA, Air Voids or Density falls below 0.75, the Owner will reject the material.

401.223 Process for Dispute Resolution (Method A Only).

The Owner will take a split for each QA test random sample, including mix samples for PGAB content, volumetrics and gradation, and label and store them to allow at least 2 working days for the Contractor to notify the Owner in writing of any disputes. At the time of sampling, the Contractor may also take a split sample of the material.

(a) PGAB content. To contest PGAB content within a sublot the Contractor must run its split of the original sample. If the Contractor tests its split and the results are equal to or greater than the allowable tolerances in Table 10, and notifies the Owner in writing within 2 working days of receiving the QA test results, the Owner will retest for PGAB content by the ignition method. If the re-test result is within the allowable tolerance shown in Table 10, the original test result will be used. If the re-test is equal to or greater than the allowable tolerances from Table 10 the new value will be used to calculate PGAB Content, VMA, VFB and Fines to Effective Binder.

(b) Density. To contest a nuclear density reading within a sublot, 1) the Contractor's nuclear gauge must have been calibrated using the same cores as the QA test gauge, and 2) the QC test must have been taken at

the same location, and 3) the difference must have been greater than the tolerance allowed inn Table 10. If the difference is greater, the Contractor may request a new reading be taken by the QA Technician within 10 meters at the same offset from centerline. If this result is within Table 10 tolerance, the Owner will use the initial QA test. If the resulting density reading differs more than allowed in Table 10, the Owner will use the second reading. If the difference is less than the tolerance allowed in Table 10, the Owner will use the original reading.

If the Contractor and the Owner believe that the mat being tested may be 5 mm less than the designated thickness or thinner, the Contractor may cut a core in the same location as the original test. If the core is found to be 5 mm or more thinner than the designated thickness, then the Owner will test the core. If the density results exceed the tolerances allowed in Table 10, then the Owner will substitute the core value for the nuclear value. Re-testing may only take place after the area is opened to traffic if approved by the Owner. On any pavement thickness found to be less than 30 mm, the Owner will determine density using the core.

Where the Owner tests for density by the core method, no disputes will be allowed unless based on evidence that the results are inaccurate, as reasonably determined by the Owner.

(c) Volumetric. If the Contractor believes that the Owner's test results vary significantly from the Contractor's results, the Contractor may dispute the Owner's results by testing their split of the original sample. If the Contractor's results vary from the Owner's results by more than the tolerance in Table 10, and the Owner is notified in writing within at least 2 working days of the Contractor receiving QA test results, the Owner will re-test the remaining split of the original sample. If the Owner's re-test is within the allowable tolerance shown in Table 10, the original test shall stand. If the re-test is outside the allowable tolerances from Table 10 but is within the Table 10 tolerance of the Contractor's test, the Owner will use the second value.

When the Contractor has initiated 3 disputes that have not been overturned, further disputes resulting in no change will be paid for by the Contractor at the rates established by the Owner.

Table 10. Dispute Resolution Variance Limits

PGAB Content	± 0.3%*
Density	± 1.0%
Voids @ N_d	± 0.8%
VMA	± 0.8%

* 0.4% will be used if the Contractor uses any method other than TP53.

END OF SECTION 02511-APPENDIX A

SECTION 02516

UNIT PAVERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS:

A. The Conditions of the Contract and all Sections of Division 1 are hereby made a part of this Section.

1.2 DESCRIPTION OF WORK:

A. Provide paving units where shown and as detailed on the drawings.

B. Related Work: Examine contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 02200 – Earthwork.

C. Unit Prices: Refer to Section 012200 to determine extent, if any, work of this Section will be affected by any Unit Prices.

1.3 QUALITY ASSURANCE, SUBMITTALS:

A. Comply with requirements of Division 1- General Requirements.

B. Paver installation to be performed by a professional firm with a proven history of successful projects of similar scope.

C. Submittals: Provide submittals as follows:

1. Product Data:
   a. Paving Brick.
   b. Edge restraint.

2. Samples:
   a. Unit or units representative of full color image, size, shape and texture of pavers.
   b. Edge restraint.

1.4 DELIVERY, STORAGE AND HANDLING

1. Protect pavers before and during construction from physical damage and contamination from soil and other materials that may cause staining.

1.5 JOB CONDITIONS

A. Cold Weather Protection:

1. Frozen Materials: Do not use frozen materials or materials mixed or coated with ice or frost.
2. Frozen Work: Do not install when subgrade, base, or setting bed is frozen. Remove and replace work damaged by frost or freezing.

PART 2 - PRODUCTS

2.1 PAVERS

A. Concrete Masonry Paving Units: Provide full depth concrete paving bricks as manufactured by Genest Concrete, Sanford, Maine or approved equal.

B. General specifications are per ASTM C-216.

1. Size: 3 5/8" x 7 5/8" x 2 1/4".
2. Color: TBD by Architect from standard available colors.

2.2 EDGE RESTRAINT

A. Provide injection molded plastic edge restraint as manufactured by Snap Edge Corporation or approved equal.

B. Edge restraint spikes to be 12" x 3/8" diameter galvanized steel.

2.3 SETTING BED AND JOINT SAND

A. Concrete sand conforming to ASTM C33.

B. Sand to be sharp, washed and free of foreign material.

PART 3 - EXECUTION

3.1 GENERAL

A. Place sand setting bed and edge restraints.

B. Set pavers in configurations/patterns as shown on drawings.

C. Compact and sand sweep joints to provide tight, interlocking surface.

D. Units with excessive chips, cracks, voids, discoloration, or other defects which may affect finished work, will not be used and will be rejected.

3.2 INSTALLATION OF UNIT PAVERS

A. Base:

1. Contractor shall inspect and verify that aggregate base and bituminous binder course for all work covered in this Section have been placed and compacted in the amounts specified in the Drawings and Specifications (See Section 02200 - Earthwork and Section 02513 – Bituminous Paving).
2. Commencement of work by the Contractor signifies acceptance of base conditions. Any deviations or abnormalities in base preparation are to be reported to the Architect immediately.

B. Edge Restraint:

1. Place edge restraint to exact lines as shown on drawings.
2. Straight runs to be true to the line, and curves to be smooth and true to form.
3. Install edge as per manufacturer's specifications.
4. Notify Architect after edge installation and before setting of pavers.

C. Sand Setting Bed:

1. Place and screed sand to grades and lines as required. Thickness after paver installation to be no less than 1" and no greater than 2".
2. Do not use water-saturated or frozen sand.
3. Do not use sand to compensate for improperly installed or compacted base or for making up any unevenness or irregularity in the base course surface as this will show through to the finished surface of the pavers over time.
4. Do not walk on or otherwise disturb screeded setting bed surface prior to paver installation.

D. Pavers:

1. Set pavers hand tight using specified colors, shapes and textures in patterns and configurations shown.
2. Trim and cut pavers as required using a motor driven masonry saw with a blade designed specifically for the cutting of paving units. Only the minimum number of cuts will be used. Small pieces used to create what could have been a larger, uncut whole will not be accepted.
3. A typical spacing of 1/16" is to be maintained between pavers.
4. Gaps between pavers and adjoining objects of greater than 3/8" to be filled with sand.
5. After pavers are set, vibrate into place with a plate vibrator capable of 3,000 to 5,000 pounds centrifugal compaction force and operating at a frequency of 80 to 90 hertz. Two passes in opposing directions (at right angles) minimum to be made with vibrator.

6. Sweep joints with dry sand, and vibrate (lightly water when sand/cement used). Repeat process to fill joints. Damp sand may be spread over paver surface and allowed to dry before filling joints.
7. Do not compact closer than 3' to an unrestrained paver edge.
8. All work must be compacted up to 3' from stopping point by the end of each workday. Cover and protect setting bed and uncompacted pavers until resumption of work.

E. Tolerances:

1. Unless specified otherwise, finished surface elevations are not to deviate more than 1/4" under a 10' long straight edge in any direction.
2. Surface elevation of pavers are to be 1/8" to 1/4" above adjoining curbs, inlets, walks, etc. (and may be 1/8" to 1/4" above final grades in general) to allow for characteristic minor settling.

3.3 REPAIR, PROTECTION, CLEANUP

A. Replace units that are chipped, broken, stained, or in any other way do not conform to or may adversely affect the adjoining work.

B. Work area to be left in a neat and orderly manner upon completion of work, free from debris and swept clean.

C. Finished work is not to be used for storage of materials, unapproved vehicle movement or other operations which may damage, stain or otherwise mar the paver surface.

3.4 INSPECTION AND ACCEPTANCE

A. When paver installation is complete, Architect will, upon request, inspect work to determine acceptability.

B. Work that does not comply with requirements will be removed and replaced as specified and as shown on drawings, at no additional cost to Owner.

C. Architect will, upon completion and request, inspect replaced areas to determine acceptability.

END OF SECTION 02516

SECTION 02525

GRANITE AND BITUMINOUS CURBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete and Bituminous Sidewalks

B. Granite Curb

C. Bituminous Curb

D. Exterior Plaza Areas

1.2 RELATED SECTIONS

A. Section 02100 - Site Preparation

B. Section 02227 - Aggregate Materials

C. Section 02505 - Paving Base and Subbase Course

D. Section 02584 - Pavement Markings

E. Section 03 30 00 - Cast-in-place Concrete

F. State Highway Department Standard Specifications

G. Construction Documents.

1.3 SECTION EXCLUDES STRUCTURAL SLABS AT ENTRANCES

A. Structural slabs are entryway areas consisting of a slab supported by a foundation contiguous with the building foundation.

1.4 REFERENCES

A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

SECTION 02584

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS:

A. Section 02200 Earthwork

B. Section 02505 Paving Base Course

C. Section 02511 Asphaltic Concrete Paving

D. Construction Drawings

1.2 PROJECT CONDITIONS

Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

The paint shall be a non-bleeding, quick-drying, alkyd petroleum base paint suitable for traffic-bearing surfaces and shall meet FS TTP-85E and mixed in accordance with manufacturer's instructions before application.

PART 3 - EXECUTION

3.1 SITE MEETING

A. A site meeting including the Engineer, General Contractor, Pavement Marking Subcontractor, and the Owner shall be conducted prior to conducting the work. Marking locations, colors, and dates of application shall be confirmed at this meeting.

3.2 PREPARATION

A. Sweep and clean surface to eliminate loose material and dust.

B. Where existing pavement markings are indicated on the drawings to be removed or would interfere with the adhesion of new paint, a motorized device shall be used to remove the markings. The equipment employed shall not damage the existing paving or create a surface hazardous to vehicle or pedestrian traffic. In all areas within public rights-of-way, the method of marking removal shall be approved by governing authority.

3.3 APPLICATION

A. Apply two (2) applications of paint at manufacturer's recommended rate without the addition of thinner, with a maximum of 125 square feet per gallon. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use a straightedge to ensure a uniform, clean, and straight stripe. A minimum of 48 hours shall elapse between the applications.

B. The following items are to be painted with the colors noted below:

- Pedestrian Crosswalks: White
- Guardposts: Forest green or black per Engineer's direction
- Lane Striping where separating traffic in opposite directions: Yellow
- Lane Striping where separating traffic in same direction: White
- Handicap Symbols: White symbol with 4' square non-skid blue background or per Local Code and conforming to ADA requirements
- Parking Stall Striping: Yellow or white (distinguished compact/non-compact spaces)
- Stop Bars: Provide painted stop bars where shown on the plan
- Directional Arrows: White

END OF SECTION 02584

SECTION 02605

WATER, SEWER, STORM AND CATCH BASIN STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage and accessories.

B. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage and accessories.

C. Masonry manholes sections with masonry transition to lid frame, covers, anchorage and accessories.

D. Catch basin structures.

E. Precast septic tank, holding tank, grease traps, and accessories when required on the contract drawings.

F. Outlet control structures when required on the contract drawing.

G. Flared concrete inlets when required on the contract drawing.

H. Water meter pit when required on the contract drawing. Note: When required water meter pits are to meet Portland Water District specifications.

I. Electrical transformer pads.

J. Electrical handholes and manholes.

K. Precast bases for lighting.

1.2 RELATED REQUIREMENTS

A. Section 02222 - Excavation, Backfilling, and Compacting for Utilities

B. Section 02720 - Storm Sewer Systems

C. Section 02730 - Sanitary Sewer System

D. Section 03 30 00 - Cast-In-Place Concrete

E. Local Governing Authority and Code Requirements

F. Construction Drawings

The public utility for sewers is the City of Portland. All materials, installation, and workmanship will comply with the requirements specified in this section, and the requirements of the City of Portland and the City of Portland Department of Public Works. Where a more stringent standard exists, the more stringent standard shall apply.

1.3. REFERENCES

A. ANSI/ASTM C55 - Concrete Building Brick

B. ASTM A48 - Gray Iron Castings

C. ASTM C478 - Precast Reinforced Concrete Manhole Sections

D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

E. ASTM D1248 - Precast Polyethylene Manholes

F. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specifications for Cold Weather Masonry Construction

1.4 SUBMITTALS

A. Shop Drawings: For all precast structures indicate manhole locations, rim elevation, piping, sizes and elevations of proposed penetrations. Submit a prefabrication drawing for each appurtenance showing this data.

B. Product Data: Provide manhole covers, component construction, features, configuration and dimensions.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE ITEMS

A. Precast Manhole and Catch Basin Sections: Manhole and catch basin super-structures shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Sections shall be installed with a flexible plastic gasket equal to or better than "Ram-Nek" as manufactured by K. T. Snyder Co., Houston, Texas, or sections may be fabricated to accept Tylox "0" rubber gaskets as manufactured by Hamilton Kent

Manufacturing Co., Kent, Ohio. The casting and the outside of the brick work required to bring the rim to grade shall be plastered with at least 3/8" mortar, thoroughly troweled to leave a smooth waterproof exterior surface.

Manhole steps shall be forged aluminum safety type, alloy 6061, temper T6, or reinforced polypropylene plastic. Steps shall be cast or anchored into walls of precast sections to form a ladder with a distance of 12 inches between steps.

The Contractor shall furnish the name of the manufacturer to the Engineer prior to commencing work.

B. Precast Manhole and Catch Basin Bases: Manhole and catch basin bases shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Bases shall be placed on a well-compacted layer of crushed stone.

Jointing system for pipe entering or leaving manholes shall be a flexible manhole sleeve cast in the base. A stainless steel pipe clamp shall be used to fix the pipe into the sleeve. All materials shall meet or exceed rubber quality standards of ASTM C-443 and C-361.

For manhole bases, a minimum of 4 inches shall be allowed between pipe invert and inside bottom of base for construction of brick inverts.

Where precast bases are used for drop manholes, a 6-inch concrete slab is to be placed under the base section large enough to receive the concrete encased drop pipes. Provide suitable ties between manhole sections and drop pipe encasements.

Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.

C. Water Quality Unit: N/A.

D. Outlet Control Structure: Provide precast concrete unit, covers, weirs, orifices and appurtenances as shown on the drawings.

E. Precast Tanks, Vaults and Appurtenances: Precast tanks, vaults, and appurtenances shall be constructed of precast reinforced concrete with inside dimensions conforming to those indicated on the contract drawings and conforming to ASTM C478. The tank may be a monolithic section or constructed with tongue and grooves with approved watertight sealants such as butyl sealant. All penetrations through the tank shall use either cast in place wall sleeves with Link Seals or a flexible boot secured in the casting such as Kor N Seal. Any clamps or metallic connections shall be stainless steel.

The tanks, vaults, and appurtenances shall include shop drawings and submittals with supporting computations which demonstrate the tank can support an H20 loading, an equivalent external fluid pressure of 105-lb./cubic ft. (with the tank empty), and an internal fluid pressure of 65-lb./cubic ft. The pressures shall be assumed to apply from the base of the structure to the finish grade surface.

Tanks which require attachment to an anti-flotation slab shall use stainless steel angles and anchors sized to resist the uplift force.

The tanks shall be coated with a waterproof seal on the interior and exterior. Sections shall be fabricated to receive a watertight seal.

F. Precast Lighting Bases: The precast light pole bases shall have the anchor bolts, conduit, and ground wire cast in the base. The anchor bolts and template shall be supplied by the Division 16 contractor after lighting submittals are approved.

2.2 CASTINGS

A. The Contractor shall furnish all cast iron frames, grates, and covers conforming to the details shown on the Drawings, or as hereinbefore specified.

B. Castings shall be at least Class 25 conforming to the ASTM Standard Specifications for Gray Iron Castings, Designation A-48-64 except for the 12" NDS risers and 12" inlets.

C. Before being shipped from the foundry, castings shall be given two coats of coal-tar-pitch varnish, applied in a satisfactory manner so as to make a smooth coating, tough, tenacious and not brittle or brittle with any tendency to scale off.

D. Sanitary sewer covers shall have the name "Sewer" cast therein. Storm drain covers shall have the name "Storm" cast therein.

E. The manhole castings for roadway or traffic areas shall be the equal of the Portland standard non-perforated manhole frame and cover M 24 x 8-S weighing approximately 425 pounds as manufactured by the Etheridge Foundry Company, or Catalog No. LK610 as manufactured by the E.L. LeBaron Foundry Company.

F. Catch basins castings shall have frames conforming to S 24" x 8 square by Etheridge with a 24" square type "M" bicycle safe grate or catalog LK 124 (LeBaron), unless otherwise noted on the drawings. Provide 24" Circular Frame and Casting for the center of the "windrows" shown on Drawing C-9.0, C-9.1 or C-9.2.

2.3 MORTAR

A. Mortar used to adjust rims and covers for manholes shall consist of the following materials and proportions by volume: 1 part of Portland cement; 1/4 part lime hydrate; and 3 parts sand.

B. For precast reinforced concrete manholes, mortar for invert construction shall consist of the following materials and proportions by volume: 1 part Portland cement and 2 parts sand. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5-1/2 gallons of water per sack of cement.

2.4 BRICK

Brick for manholes and catch basins shall meet Standard Specifications for Sewer Brick, AASHTO Designation M-91-42, Grade SA, Size No. 1 wire cut. Any brick rejected by the Engineer as unsuitable shall be immediately removed from the work.

2.5 VENTS

Vents, when required by the Contract Drawings, shall be constructed of galvanized piping of the diameter indicated on the plans with a minimum size of 4" with threaded joints. The top of the vent shall have a minimum of 12 square inches of screened opening to permit air passage, and a cap to prevent extraneous material from entering the vent. The cap shall not interfere with the air passage. Vents shall be connected to appurtenances using a cast in wall pipe.

2.6 SITE CONCRETE

Site concrete shall meet the requirements set forth below:

A. Aggregate: The aggregate shall conform to the Standard Specifications for Concrete Aggregates, ASTM Designation C-33, as revised.
   (a) Sand shall be a medium sand with a fineness modules of 2.60 - 2.90.
   (b) Coarse aggregate shall not exceed 1-1/2 inches for mass concrete.

B. Cement: All cement shall be a Portland Cement conforming to the requirements of Standard Specifications of the American Society for Testing Materials, Designation C-150, as revised, Type II. An air entraining agent, approved by the Engineer, shall be used.

C. Proportioning Concrete:

Maximum Size Coarse Aggregate (Inches)	Air Content Percent by Volume
1-1/2, 2, or 2-1/2	5 +/- 1
3/4 or 1	6 +/- 1

The strength of the concrete shall be fixed in terms of water-cement ratio in accordance with trial batches of the materials to be used. All concrete placed under this Specification shall be mixed in the ratio not to exceed six (6) U.S. gallons of water per sack of cement, including surface water carried by the aggregate in each case. The Contractor shall determine the approximate amount of surface water contained in the aggregate, and make proper allowance. Concrete shall have a minimum 28-day strength of 3750 psi. The Contractor shall submit the proposed mix proportions to the Engineer for approval ten (10) days prior to placing concrete. Copies of recent test results for the proposed mix design shall also be submitted.

2.7 REINFORCEMENT

The Contractor shall submit detailed shop drawings for concrete reinforcement in accordance with ACI 318 and ACI 315. The steel shall be deformed Grade 60 bars which conform to ASTM 615, ASTM 616, or ASTM 617. Supports, spaces, and chairs shall permit the steel to be supported in accordance with ACI 318.

2.8 INSULATION

Insulation, when required by the Drawings, shall be Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal. Profiles are generally the location where insulation required for the pipelines and appurtenances are shown.

Material submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05% by ASTM C272-53 and meet Federal Specification HH1524B Type II, Class B.

The Contractor shall coat the insulation material in accordance with the manufacturer's instructions.

2.9 TREATMENT OF INTERIOR SURFACES

All interior surface of cast in place concrete structures shall have a liquid hardener applied. The application shall consist of two coats of VANDEX or approved equal installed in accordance with manufacturer's instructions including requirements for surface preparation. Catalog cuts of the hardener shall be submitted to the Engineer for approval. All interiors of contrite items shall be treated with a waterproof coating (18 mil. film thickness).

2.10 TREATMENT OF EXPOSED SURFACES

All exposed exterior concrete surfaces shall have a "rub finish". Structures and appurtenances shall have an applied coating of Tnemec Series 104 H5 Epoxy applied in 2 coats or approved equal to achieve a minimum dry film thickness of 18 mils.

PART 3 - EXECUTION

3.1 MANHOLES

A. General: All appurtenant structures shall be set level on compacted material as specified in Section 2 of these Specifications and as shown on the Plans.

B. Manhole Channels: Channels shall be constructed in all sanitary sewer and storm drain manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the Engineer or a preformed manhole channel: "FIBERLINER" or equal. The sides shall be raised by brick masonry construction from the spring line perpendicular to the height of the crown of the pipe. Where changes in directions are made at manholes, the invert shall be shaped with as great a radius as possible, and to the complete satisfaction of the Engineer. Brick shall be carefully laid to present a smooth surface as indicated on the Plans and to the satisfaction of the Engineer.

C. Pipe Connections:

1. Stubs in Manholes: Stubs placed as specified and indicated on the Drawings shall be short pieces cut from the bell ends of appropriate pipe and shall have compatible watertight stoppers. Stubs shall be set accurately to the required line and elevation and encased in the structure masonry as indicated on the Drawings.
2. Wall Sleeves and Castings: Wall sleeves and castings as specified and indicated on the Drawings shall be accurately cast to the required location and elevations as indicated on the Drawings.

D. Steps: Manhole and appurtenant steps shall be cast in the wall and installed in a straight vertical alignment.

3.2 ALTERATIONS TO EXISTING MANHOLES AND CATCH BASINS

Existing manholes and catch basins to be altered shall be reconstructed as indicated on the Plans or as directed by the Engineer. Adjusting to grade or connecting to an existing pipe stub is not considered an alteration.

Alterations covered include, but are not limited to, adjustments to manhole invert channel caused by new pipe connections or removal of existing pipe connections, and removal and plugging of existing catch basin lead and replacing with a new lead connection conforming to the appropriate section of the Specifications contained herein.

3.3 ADJUSTING EXISTING MANHOLES AND CATCH BASINS

Existing manholes and catch basins to be adjusted to grade shall be reconstructed to the required grade. The existing frames, grates, and covers shall be re-used unless otherwise directed.

The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.

Adjustment will take place just prior to placing of surface pavement for adjustments of the frame and cover. Adjustments which require dismantling and reconstruction of the superstructure shall be accomplished at the time of subgrade preparation. Pavement which is removed for this adjustment shall be cut square, tack coated, and capped with 2" of bituminous concrete. No separate payment will be made for furnishing the bituminous cap.

Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.

3.4 ABANDONING EXISTING CATCH BASINS AND MANHOLES

Existing catch basins and manholes designated to be abandoned shall be removed to a depth of one (1) foot below the subgrade line, unless otherwise indicated on the Plans below the proposed building or directed by the Engineer. The existing pipes shall be plugged with concrete and brick masonry and the catch basins and manholes shall be filled with heavy gravel satisfactorily compacted in 9 inch lifts. Prior to backfilling, the sump shall be pumped and cleaned of all water and foreign material. When an existing catch basin or manhole is below the proposed building, it shall be removed.

3.5 MANHOLE ADAPTERS

When altering an existing manhole or where a pre-manufactured manhole adapter cannot be installed in precast manhole sections, the Contractor shall use a Fernco, or equal, concrete manhole adapter. The adapter shall be designed to provide a positive, watertight seal between the manhole and pipe and shall be mortared in place with Five Star grout or approved equal non-shrink grout.

3.6 PRECAST TANKS, VAULTS, AND APPURTENANCES

These precast items shall be set in a dry excavation, proofrolled, and prepared with one of the following bedding materials:

- Compacted ¾" crushed stone (8" min.),
- Compacted MDOT 703.06 Type D gravel.

If the subgrade is weak and/or unstable, a layer of Mirafi 600X shall be installed between the prepared subgrade and the bedding.

The anti-flotation slabs shall be carefully laid out and aligned, and set on the bedding with reinforcement and forms set on a dry excavation site. Concrete shall be poured and protected from inclement weather during the cure period.

Tanks shall be set on the anti-flotation slab. Where necessary for plumbness and level, the tank shall be shimmed with a strong slurry grout installed to fill the void space.

Multiple section tanks shall be set in place using approved sealants. Double rows shall be required when joint mastics are used. An approved adhesive primer shall be installed prior to installing the mastics and setting the concrete.

The tank shall be anchored to the anti-flotation slab with approved stainless steel masonry anchors. All anchors shall be inspected by the contractor to assure the anchor is secure and will provide the required resistance.

After anchorage, the tank excavation shall remain dewatered and backfilled. The backfill shall be brought up uniformly around the tank and compacted in place. Pipe connections shall occur after the tank has been backfilled to the level of the bottom of the pipe bedding.

Any voids created by removal of sheeting, bracing or shielding shall be filled and recompacted.

PART 4 - TESTING

4.1 GENERAL

All sanitary manholes, wetwells, septic tanks, holding tanks, and other appurtenant structures shall be tested as to watertightness. If the initial test fails a retest shall be required. The Contractor has the option of either of the following methods:

A. Water Test: The inlet and outlet of the structure shall be plugged by watertight plugs furnished by the Contractor, and the manhole shall be filled with water. The water shall remain for sufficient time for the absorption into the concrete pipe to have been substantially completed. The amount of water loss from the manhole shall then be determined. The rate shall not exceed five (5) gallons per hour. Obvious leaks shall be repaired by the Contractor by excavating outside the structure, if required, at no cost to the Owner.

B. Vacuum: The manholes shall be vacuum tested by a method and apparatus subject to the prior approval of the Engineer. Vacuum testing shall be performed in the following manner:

The manhole shall be fully assembled, including all pipe connections into the structure. The manhole shall be in its final location and shall not have been backfilled prior to the performance of the test.

All lift holes shall be plugged with a non-shrinking mortar, as approved by the Engineer.

The seal between the manhole sections shall be in accordance with ASTM C923.

The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe.

With the vacuum tester set in place:

- Inflate the compression band to effect a seal between the vacuum base and the structure.
- Connect the vacuum pump to the outlet port with the valve open.
- Draw a vacuum to 10" of Hg. and close the valve.
- The test shall pass if the vacuum remains at 10" Hg. or drops to 9" Hg. in a time greater than one minute. If the manhole fails the initial test, the Contractor shall locate the leak and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material.

Any appurtenant structure which shows obvious infiltration, whether tested or not, shall be sealed to eliminate said infiltration.

END OF SECTION 02605

SECTION 02607

FILTERRA STORM STRUCTURE

PART 1 - GENERAL

1.1 SUMMARY

A. The Filterra Storm Structure is a proprietary system selected by the Owner and his Engineer for use on this project. The design accommodates varying site configurations and allows installation in many areas where standard techniques, such as detention ponds, simply will not fit.

B. The Filterra Storm Structure manufacturer is responsible for a design that incorporates effective pretreatment by directing stormwater through Filterra's unique, multi-stage, total suspended solids (TSS) removal system prior to infiltration. This shall include: 1) a grit-filter bag to trap the larger floatables which may find their way past the catch basin preceding the FSS unit, 2) a series of sedimentation chambers fitted with "skimmers" (which significantly shall enhance the settling efficiency of particulates by continually drawing from just below the surface of the water, and "decanting" it to the next chamber, and 3) a gravel filter which serves as a substrate for a constructed wetland. Larger-diameter particulates shall be trapped inside the sedimentation chambers and smaller (silt and clay-sized) particles shall be filtered in the gravel wetland substrate. The smaller particles are predominantly organic in composition and therefore can be decomposed in the wetland soils by bacteria which reside within the wetland plant root zone.

   Treated stormwater may then be infiltrated into the ¾-inch stone used for backfill in the excavation around and under the Filterra tanks. This stone is highly permeable and serves to transmit the treated water downward until it encounters the parent soils. During peak flow periods, the infiltration rate may exceed the permeability of the parent soils and the stone backfill area serves as a temporary storage reservoir. As this area fills with water, a substantially larger leaching surface is encountered by the treated stormwater.

C. The primary purpose of the unit shall be for water quality enhancement, specifically phosphorus removal.

1.2 REQUIREMENTS

A. Manufacturer's Affidavit: The manufacturer of the unit shall provide a written affidavit and warranty stating the unit is acceptable for this site and all materials are warranted to be free of defects and can be expected to last over 20 years in the application selected for their use.

B. Manufacturer's Services: The manufacturer shall provide a representative to instruct the contractor on the installation of the units, to verify that there are no conditions that will affect the warranty, and that the methods of installation conform to the requirements of the manufacturer.

C. A letter from the Manufacturer summarizing the services provided under Paragraph B must be submitted to the Owner and Engineer prior to requesting final acceptance.

1.3 RELATED SECTIONS

A. Geotechnical Investigation – report and supplement attached to specifications

B. Section 02200 – Earthwork

C. Section 02240 – Dewatering

D. Section 02242 – Concrete Modular Retaining Wall

E. Section 02720 – Storm Sewer Systems

PART 2 - PRODUCTS

2.1 SPECIFICATIONS

A. The Filterra Storm Structure shall be constructed of recycled polyethylene plastic and must be suitable for the intended application of this site for phosphorus removal and water quality enhancement.

B. The Filterra Storm Structure shall meet the following sizing:

Diameter	9.5 feet
Height	4 feet
Inflow Pipe Diameter	4 inches
Outflow Pipe Diameter	2 inches

PART 3 – EXECUTION

3.1 INSTALLATION

A. Filterra Storm Structures provides installation assistance with shipping. Delivery staff are also trained and experienced in installation procedures. This service is required for the project. Generally, the installation steps are as follows:

1. Excavate an area approximately 10 feet by 10 feet and to a depth of approximately 5 feet (and more specifically to a level of one foot below the design elevation for the bottom of the units) for each Filterra Storm Structure (FSS) unit. Excavate additional areas for inflow and discharge pipes (specific to the design plans).
2. Pour a stone (approximate ¾-inch diameter) base and level to the base design elevation of the floor of the FSS units.
3. Lower Filterra Storm Structure units into place using sling hanging from a backhoe or, in sensitive areas, place by hand with crew.
4. Connect inlet and outlet/discharge piping and outlet control valve (PVC ball valve) with a valve cover and riser to access and operate the valve.
5. Carefully fill wetland container with "rice stone" (1/8 to ¼-inch diameter) alternating (at one-foot depth intervals) with backfilling excavation (outside unit) with ¾-inch diameter stone. Note: It is important the rice stone be naturally sorted (sometimes referred to as "bank run") or is carefully washed to eliminate "fines". Crushed stone commonly has high fractions of "fines" which may cause clogging of the wetland portion of the treatment system.
6. Plant wetland plants (provided from nursery as "plugs", approximate size of 6 inches in height). Wetland plant species may vary by region and local sunlight/shade and salt/fresh conditions as advised by nursery. However, we recommend bullrush and woolgrass (Scirpus) as generally adaptive to most conditions. Consult with local nursery for recommendations for other species.

B. Acclimate wetland plants (during the growing season) by leaving outlet valve closed for the first two weeks and filling the tanks (either by natural rainfall or from local water supply source), then opening the outlet valve to a low-discharge rate (approximately 0.25 gallons/minute) for an additional four weeks. After this acclimation period the outlet valves should be set at the design rate (2.0 gallons/minute for most applications).

C. Coordinate work with adjacent rock garden and retaining wall.

PART 4 – OPERATION/MAINTENANCE

The Maine Department of Environmental Protection (MeDEP) Permit for this project requires that the Owner operate and maintain the unit. The following is a guideline for Operation & Maintenance between system installation and acceptance by the Owner.

A. The operation and maintenance of the Filterra Storm Structure shall be limited to annual inspections and solids removal on an as-needed basis. The annual inspections should include the following steps:

1. Check the discharge flow rate: the lower outlet is designed to discharge at a rate of 2.0 gallons/minute. This provides for a retention time of approximately two days for the full tank to empty following a runoff event. The discharge rate can be checked by directly measuring a timed-discharge volume if the outlet is "daylighted" or through "falling-level" measurements inside the central sedimentation chambers. (The total static volume of the tank is 1,390 gallons and the height of the tank is 4 feet; therefore, a 2.0 gallons/minute discharge rate can be observed as the water level in the tank falling at a rate of 4 inches per hour.

2. Change the inlet grit filter inside the sedimentation chamber.
3. Measure sediment depth inside the pump-out if depth reaches 6 inches. A future pump-out date can be estimated by projecting based upon sediment accumulation rates since the last measurement or since original installation. On average, Filterra Storm Structures need to have sediment removed once every three years. This can be done using a standard septic system suction pumper or with a vacuum-pumping unit.
4. Observe wetland plant conditions and height (during growing season). Wetland plants may need to be supplemented during the first three growing seasons depending upon local site conditions.

END OF SECTION 02607

SECTION 02660

WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

Furnish labor, materials, services, equipment, and other necessary items required for accompanying the construction of the water systems. This shall include, but not be limited to the following: pipe and fittings for site water line including domestic water line and fire water line, valves and fire hydrants, set lines, elevations, and grades for water distribution systems work and control system for duration of work including careful maintenance of benchmarks, property corners, monuments, or other reference points.

1.2 RELATED SECTIONS

A. Section 02222 - Excavation, Backfilling and Compacting for Utilities.

B. Section 02227 - Aggregate Materials.

C. Local Governing Authority and Code Requirements.

D. All Necessary Construction Permits.

F. The public utility for water is the Portland Water Department. All materials, installation, and workmanship will comply with the requirements specified in this section, the requirements of the Public Utilities Commission and the Portland Water Department. Where a more stringent standard exists, the more stringent standard shall apply.

G. Section 02605 – Water, Sewer, Storm, and Catch Basin Structure.

1.3 REFERENCE

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop

B. ANSI/ASME B16.18 - Cast Copper Allow Solder Joint Pressure Fittings

C. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

D. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 Kg) Rammer and 18-in. (457 mm) Drop

E. ANSI/ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

F. ANSI/AWS A5.8 - Brazing Filler Metal

G. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe Fittings for Water

H. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquid

I. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings

J. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

K. ANSI/AWWA C500 - Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems

L. ANSI/AWWA C502 - Dry Barrel Fire Hydrants

M. ANSI/AWWA C504 - Rubber Seated Butterfly Valves

N. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS

O. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems

P. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances

Q. ANSI/AWWA C606 - Grooved and Shouldered Type Joints

R. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water

S. ASTM B88 - Seamless Copper Water Tube

T. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

U. ASTM D2241 - Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR)

V. ASTM D2855 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings

W. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

X. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

Y. ASTM D3139 - Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

Z. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

AA. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, ½ inch through 3 inch, for water.

BB. UL 246 - Hydrants for Fire - Protection Service.

1.4 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, hydrants, valves and accessories including ASTM designations, AWWA certifications and UL labels as required.

B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with utility company and/or municipality requirements.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

PART 2 - PRODUCTS

2.1 PIPE

A. Pipe sizes less than 3" that are installed below grade and outside building shall comply with the following:

1. Seamless Copper Tubing: Type "K" roll form to comply with ASTM B88-62. Fittings shall be brass compression manufactured by Ford, Mueller, or McDonald.

B. Pipe: Sizes 4" and larger shall comply with the following:

1. Ductile Iron Water Pipe: In accordance with ANSI A21.51. (AWWA C151) ductile iron pipe shall be cement mortar lined in accordance with AWWA C104. Joints shall meet requirements of AWWA C111. Push-on joint pipe to be supplied with gaskets and gasket lubricants. Pipe shall be 62-42-10 strength; 60,000 psi minimum tensile strength; 42,000 psi minimum yield strength; 10 but not including 12-inch shall have a Class 52 wall thickness. Size 12" and over shall have Class 51 wall thickness. The bituminous coating used for the sealing of the cement mortar lining shall be of a quality that will not have a deleterious effect on the quality, color, taste or odor of potable water.

C. Ductile Iron Fittings: Fittings shall be manufactured by Tyler or Griffin and material shall be ASTM A536-72 mini grade 70-50-05, in accordance with AWWA C110. Fittings shall be cement lined (AWWA C104-74). Interior seal coated (AWWA C104-74) and exterior bituminous coated. Mechanical joint with accessories furnished; D.I. glands, gaskets, Cor-Ten T-bolts and nuts; Class 350 pressure rating in accordance with AWWA C110. Thickness shall be equal to ductile iron pipe Class 53 in accordance with AWWA C151. All plain end fittings shall be beveled-edged (60^{o}) to fit slip-joint fitting and shall be long body design.

D. Retainer Glands: Glands shall be heavy duty ductile iron body as manufactured by Romac or Ebba Iron and shall have a minimum working pressure rating as follows:

1) 4" - 350 psi (pounds per square inch)
6" - 350 psi
8" - 250 psi
12" - 200 psi

Set screws shall be:

1) cupped style ends;
2) composed of Cor-Ten Steel or Ductile Iron

The number of set screws shall be equal to or greater than the number of inches of nominal diameter of the gland (i.e. 4" - 4 set screws; 6" - 6 set screws, etc.).

Gland shall meet AWWA specifications.

E. Bolts and Nuts: General description of properties required.

1. Stainless Steel: Type 316 - contains the addition of molybdenum to the nickel-chromium steels.

Specific Chemical Composition:

a)	Carbon	-	0.08% max.
b)	Manganese	-	2.00% max.
c)	Silicone	-	1.00% max.
d)	Phosphorus	-	0.04% max.
e)	Sulphur	-	0.03% max.
f)	Chromium	-	16-18.00%

g)	Nickel	-	10-14.00%
h)	Molybdenum	-	2-3.00%
i)	SAE No.	-	30316
j)	ASM No .	-	5361A, 5524A, 5573, 5648B, 5690D

2. Cor-Ten Steel: Trade name for cold formed
T-head bolts containing alloying elements such as copper, nickel, and chrome.

Specific Chemical Composition:

a)	Carbon	-	0.2% max.
b)	Manganese	-	1.25% max.
c)	Sulphur	-	0.05% max.
d)	Nickel	-	0.25% min.
e)	Copper	-	0.20% min.
f)	Combined (Ni,Cu,Cr)	-	1.25% min.

F. Resilient Sealed Gate Valve: Valve shall meet all provisions of ANSI/AWWA C509-87 specification as latest revised; shall have a smooth, unobstructed waterway which shall be a minimum of the nominal diameter of the valve. Valve ends to be specified and shall be furnished with Cor-Ten (or equal) bolts and nuts. Valves shall be manufactured by Mueller, Clow or Eddy and shall open right.

G. Valve Boxes: The valve box bottom section shall be slide-type with bell-type base. The valve box top section shall be slide-type. It shall have a top flange, but shall not have a "bead" or bottom flange. The valve box cover shall be a 2" drop-type cover to fit the 7-1/4" opening of the top section. The valve box extension shall be slide-type with a minimum 3" belled bottom. Material shall be cast iron or ductile free from defects. Interior and exterior of all components shall be bituminous coated with a minimum of 4 mils dry film thickness.

H. Service Box and Rod:

1. Service Box Specification:
   Shall be 1.0" (in.) I.D. black iron or steel pipe with top having N.P.I. threads for 1.0" screw-on cover.
   Shall be Erie style with 5-6' (ft.) slide-type riser.
2. Service Box Cover Specifications:
   Shall be Quincy type (heavy duty) cover that screws on (1.1 above).
   Shall be tapped with a 1" rope thread with a solid brass plug with pentagon operating head.
3. Service Box Foot Piece Specifications
   The standard foot piece shall be heavy duty (Ford style or equal) cast iron design.
   The large, heavy-duty foot piece shall have an arch that will fit over 2" ball-valve curb-stops.
4. Service Rod Specifications
   Shall be 24"-30" in length and have a self-aligning design.
   Shall be of circular dimension and constructed of:

a) 5/8" dia. min. cold rolled steel with an epoxy coating (minimum 4 mil D.F.T.), or,
b) 1/2" dia. min. #304 stainless steel.
Shall have a yoke design that is an integral part of the rod.
The curb-stop attachment point shall be a brass cotter pin.
The rod "wrench-flat" shall have a minimum thickness of 1/4" tapered to 1/16" and width of 5/8" or 1/2".

I. Tapping sleeves shall be as approved by the local water company. Options include the following:

Tapping sleeve shall be mechanical joint with recessed outlet flange for tapping valve; conform to AWWA C207, Class D, with rated maximum working pressure of 200 psi. The side rubber gaskets shall be rectangular in cross-section and fit into grooved channels in the casting. These gaskets shall extend the entire length of the sleeve and shall not require cutting or trimming to match MJ end gaskets. Tapping sleeve shall be AB-CD pattern to permit use of plain rubber and duck-tipped gaskets for various O.D. piping sizes.

Mechanical joint with accessories furnished; glands, gaskets, and Cor-Ten T-bolts and nuts or equal. All flange bolts shall be 316 stainless steel or silicone bronze. Interior and exterior to be bituminous coated with a minimum of 4 mils dry film thickness. The sleeve shall be provided with a 3/4" F.I.P.T. test port and brass plug.

The tapping sleeve shall be Romac Industries Inc., 304 Stainless Steel Tapping Sleeves with ductile iron flange. Flange bolts shall be stainless steel or silicon bronze. The sleeve shall be rated for a maximum, working pressure of 200 psi. The interior and exterior shall be bituminous coated with a minimum of 4 millimeters dry film thickness. The sleeve shall be provided with a 3/4" F.I.P.T. test port and plug.

J. Corporation Stop:

1. 3/4" - 1" shall be a ball valve design with a brass ball that is Teflon (or equal) coated. 1-1/2" - 2" shall be ball-corp design with an on-off identification mark on the operating nut.
2. The valve shall be supported by 2 seats for water tight shut-off in either direction.
3. The valve shall have a full port opening.
4. The body of the corporation-stop shall be of heavy duty design.

K. Specifications for Services:

1. Material
   Copper Tubing: ASTM B88, Type K, Seamless, Annealed, 2 Inch Diameter Maximum.
2. Fittings
   Brass Compression Manufactured by Ford, Mueller or McDonald.

L. Curb Stops

1. For sizes 3/4" - 2", the valve shall be a brass ball that is Teflon (or equal) coated.
2. The ball shall be supported by seats which are water tight in either direction.
3. The valve shall have a full-port opening.
4. The valve shall open with ¼ turn (90^{O}) with a check or stop.
5. The valve shall not have a drain.
6. The valve stem shall have 2 "O" rings and a bronze ring lock which holds the stem solidly in the valve body.
7. The valve body shall be a heavy-duty design.

M. Hydrant: Hydrant shall be Mueller Centurion or Eddy F-2641 all with stainless steel nuts and bolts below grade. The hydrant shall have an epoxy coated base, and open left. The nozzles shall have National Standard Threads. Operating nut shall be 1-15/16".

All material used in the production of fire hydrants for ordinary service shall conform to the specifications designated for each material listed in AWWA Standard C502.

N. Joint Restraint: Place thrust blocking consisting of 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 lbs./sq. ft. when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft.	90 Deg. Bend Sq. Ft.	45 Deg. Bend Sq. Ft.	22 Deg. Bend Sq. Ft.
4"	1.0	1.0	1.0	1.0
6"	1.5	2.0	1.0	1.0
8"	2.5	3.5	1.8	1.0
10"	4.0	5.5	2.8	1.5
12"	6.0	8.0	4.0	2.0
14"	8.0	11.0	5.5	3.0
16"	10.0	14.2	7.0	4.0

O. Rigid Insulation: Installation, when required by the Drawings, shall be Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.

Materials submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05 meet Federal Specifications HH1524B Type II, Class B.

P. Temporary Water Service: Provide temporary water service as necessary during the site work and building construction. Use materials as approved by the Portland Water Department.

Q. Meter Pit: Provide meter pit with fire line meter and valves as shown on the drawings.

PART 3 - EXECUTION

3.1 WATER DISTRIBUTION SYSTEM

A. Building Service Lines: Install water service lines to point of connection within approximately five feet outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed provide temporary caps. Connections of service lines to distribution mains shall be constructed in accordance with the following requirements.

1. 2 Inch and Larger: Connect by rigid connections and provide gate valve below frost line.

B. Regrading: Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

C. Pipe Laying, General

1. Install to same tolerances as specified for storm drain (Section 02720).
2. Do not lay pipe on unstable material in wet trench, or, when trench or weather conditions are unsuitable.
3. Support pipe laid in fill area at each joint, by brick or concrete piers carried down to solid undisturbed earth.
4. Do not lay pipe in same trench with other pipes or utilities.
5. Hold pipe securely in place while joint is being made.
6. At least one foot shall separate water lines vertically from other pipes or underground structures.
7. Where water pipes cross sanitary sewers or are laid parallel and adjacent to them, bottom of water pipe shall be separated by not less than one foot above top of sewer and ten feet horizontally.
8. Do not work over, walk on, pipes in trenches until covered by layers of earth well tamped in place to a depth of 12 inches over pipe.
9. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
10. Install water lines to avoid storm and sanitary sewer lines.
11. Clean interior or pipe thoroughly of all foreign matter before installation. Keep pipes clean during laying operations by means of plugs or other methods. When work is not in

progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.

12. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. Pipe clamps and tie rods, or concrete thrust blocks may be used. Type of pipe and soil conditions determine methods. Anchor water mains as specified in NFPA No. 24.
13. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work thoroughly clean exposed materials and equipment.

D. Laying Ductile Iron Pipe

1. Installing Pipe: Lay pipe in accordance with AWWA C600.
2. Joints:
   a. Mechanical: AWWA C111. Provide sufficient quantities of bolts, nuts, glands and gaskets for each socket opening on pipe and fittings.
   b. Push-On: Apply thin film of lubricant to gasket and place in proper position in contour of bell. Insert beveled end of joining pipe and make contact with gasket. Force beveled end of pipe to bottom of bell without displacing gasket. Do not caulk. Only lubricant furnished by manufacturer of pipe shall be used.
   c. Flanges: AWWA C115. Install only in concrete pits. Must be watertight and set not less than six inches from walls to floor.

E. Setting of Valves:

1. Install gate valves as indicated on the Drawings and support on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body.
2. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.
3. Clean valves and curb stops interior before installation.

F. Setting of Fire Hydrants

1. Install fire hydrant assemblies as indicated on Drawings in vertical and plumb position with steamer nozzle pointed toward building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil or concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.
2. Clean interior of hydrants of all foreign matter before installation.
3. Set center of each hydrant not less than two (2) feet nor more than six (6) feet back of edge of road or face of curb. Set barrel flange not more than two (2) inches above finished grade and eighteen (18) inches between center of steamer nozzle and finished grade.

G. Pipe Sleeves: Install where water lines pass through retaining and foundation walls. Properly secure in place, with approximately 1/4-inch space between pipe and enclosing sleeve, before

concrete is poured. Caulk annular opening between pipe and sleeves, and seal with asphaltic compound consisting of bituminous materials mixed with mineral matter. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

H. Meter: The Contractor will obtain the meter from the Portland Water Department and install the domestic water meter for the installation and will pay all usage charges connected with water supply until the installation is accepted by the Owner.

3.2 DISINFECTION

A. Disinfect distribution system with chlorine before acceptance for domestic operation in accordance with the following procedures:

1. The only acceptable method of disinfection shall be the continuous Feed Method of chlorine.
2. The rates of introduction of the chlorine and water shall be so proportioned so that the chlorine concentration in the water is maintained at a minimum of 50mg/l available chlorine.
3. During the application of the chlorine, valves shall be operated in such a manner that the treatment dosage shall not flow back into the line supplying the water. The operation of the valves shall be done under Water Department supervision.
4. The chlorinated water shall be retained in the main for at least 24 hours. At the end of the 24 hour period, the treated water shall contain no less than 25mg/l available chlorine.
5. At the end of the retention period, the chlorinated water shall be flushed from the main until the chlorine in the water leaving the main is no higher than the normal residual in the system, or less than 1 mg/1.
6. All bacteriological tests shall be collected in sample bottles and shall be tested at a State certified laboratory. All costs for disinfection of the main as well as bacteriological costs shall be borne by the Contractor.

3.3 TESTING OF WATER DISTRIBUTION SYSTEM

A. Test water distribution system pipe sizes installed below grade and outside building in accordance with following procedures:

1. Before pressure testing the water main, air shall be completely expelled from the pipe. If permanent air valves are not located at all high points, corporation stops shall be installed at all high points so that the air can be expelled as the pipe is being filled. After completion of the test, the corporation stops shall either be removed or left in place at the discretion of the Water District.
2. If fire hydrants are installed on the new water main, the test shall be conducted against a closed hydrant valve.
3. The test pressure shall be 1.5 times the static pressure at the lowest point of elevation of the line and shall not be less than 150 p.s.i.

4. The test shall not exceed the pipe or thrust restraint design pressures, nor exceed twice the rated pressure of the valves or hydrants and shall not exceed the rated pressure of the valves, if resilient - sealed butterfly valves are used.
5. Water, only, shall be used to bring the main to the required test pressure. The type of pump shall be approved by the Portland Water Department.
6. The test shall be of at least two hours in duration. A leakage test shall be conducted immediately after the pressure test.
7. After the pressure test period, water shall be pumped into the main to bring the pressure back up to the initial test pressure. No pipe installation shall be accepted if the leakage is greater than that listed in Table 1 attached to this Section.

If any pipe installation shows a leakage greater than that specified in Table 1, the contractor at his own expense shall locate and repair the leak until it is within the specified allowance.

The pressure and leakage tests shall be conducted under Portland Water Department's supervision.

END OF SECTION 02660

SECTION 02720

STORM SEWER SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site storm sewerage drainage piping, fittings, and accessories, and bedding.

B. Connection or providing stubs of building storm water drainage system.

C. Catch basins, paved area drainage, site surface drainage, and stormwater detention facilities.

1.2 RELATED SECTIONS

A. Section 02222 - Excavation, Backfilling and Compacting for Utilities

B. Section 02270 - Slope Protection and Erosion Control

C. Section 02605 -- Water, Sewer, Storm and Catch Basin Structures

D. Section 02730 - Sanitary Sewer Systems

E. Section 03 30 00 - Cast-in-Place Concrete: Concrete type for catch basin, cleanout or head wall base pad construction.

F. Local governing authority and code requirements.

G. All necessary construction permits.

H. Construction drawings.

1.3 REFERENCE

A. AASHTO M294 and M252 - Corrugated Polyethylene pipe smooth interior.

B. AASHTO M36 - Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.

C. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

D. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

E. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

F. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 Kg) Rammer and 18-in. (457 mm) Drop

G. ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

H. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

I. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly beside pipe to midpoint of pipe, prior to subsequent backfill operations.

B. Special Backfill: Fill placed above bedding beside and over pipe prior to other backfill operations.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipes and mains, connections, catch basins, cleanouts and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 COORDINATION

A. Coordinate the work with termination of storm connections outside building and trenching.

B. The exact location of roof drain leaders shall be determined from the Architectural Plans or as shown on the drawings. The number and location of the roof drains may be different than shown in the site drawings. Verify roof drain lead locations with the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS AND ACCESSORIES

Provide any one of the following materials subject to any restrictions noted in this subsection or on plans. The contractor shall provide catalog cuts to the Owner and indicate the proposed materials to be used prior to ordering materials. The approval of the Owner must be obtained prior to ordering materials.

A. Reinforced Concrete Pipe: Not permitted unless specifically stated on the drawing. Comply with requirements of ASTM C 76, Class IV unless another class type is indicated on Drawings, installed with flexible plastic (Bitumen) gaskets at all joints. Gaskets shall comply with AASHTO M-198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations.

B. Polyvinyl Chloride (PVC) Pipe: Pipe and fittings shall comply with ASTM D 3034, rated SDR 35. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant. PVC shall not be used for any drainage pipe which will be permanently exposed to sunlight.

C. Corrugated Polyethylene Pipe (CPP), Smooth Interior: Shall conform with AASHTO Designations M294 and M252. Pipe must be installed in accordance with manufacturer's installation guidelines for culvert and other heavy duty drainage applications. Acceptable manufacturers: Advanced Drainage Systems, Inc. (ADS) N-12 and HANCOR, INC. (HiQ smooth interior). CPP pipe shall not be used for any drainage pipe which will be permanently exposed to sunlight.

D. Polyvinyl Chloride (PVC) Large Diameter Closed Profile Gravity Sewer Pipe, UNL-B-9: Pipe and fittings shall be installed in accordance with pipe manufacturer's installation guidelines. Acceptable manufacturer: CARLON (Vylon HC). PVC pipe shall not be used for any drainage pipe which will be permanently exposed to sunlight.

E. Storm drain inlets, outlets, and culverts to include:

- Rip rapped aprons.
- Concrete flared inlets/outlets for pipes 24" or larger in diameter
- Aluminum bar racks for pipes 24" diameter or larger
- HDPE flares for pipe smaller than 24" in diameter. High-density polyethylene flares with added carbon black for exposure to sunlight.
- HDPE racks for pipe smaller than 24"

F. Manholes, Catch Basins, and Outlet Control Structures (Refer to Section 02605).

2.2 UNDERDRAIN SYSTEM

A. Polyvinyl Chloride (PVC) Pipe: The perforated underdrain pipe with ring-tite joints and fittings shall comply with the requirements of ASTM F 758. Holes shall be 120 degrees double row, ¼-inch diameter at 3 ¼-inch spacing. Underdrain pipe with a filter fabric sleeve shall not be acceptable. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM F 75B classification. Acceptable manufacturer shall be Johns-Manville "Ring-tite" Polyvinyl chloride.

B. Filter fabric: Filter fabric shall be used around all underdrains as specified in Section 02222.

2.3 INLETS AND CATCH BASINS

A. Lid and frame per details shown on plans.

B. Catch basin and inlet structures shall be in accordance with Section 02605.

C. The location of catch basins shall be accurately located by a registered land surveyor. Catch basins shall be located as follows:

1. Edge of frame 6" off face of curb where shown near sloped granite or bit concrete curblines.
2. Edge of frame at gutter line where Type I granite headstones are provided.
3. The center of aisle or parking modules when shown on plans.
4. In other cases, verify with Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut and excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on civil engineering drawings.

3.2 INSTALLATION - STORM DRAINS

A. The pipe shall be accurately laid to the line and grades to the satisfaction of the Engineer. The line and grade may be adjusted by the Engineer from that shown on the Drawings to meet field conditions and no extra compensation shall be claimed therefor.

The Owner or his representative reserves the right to check the elevations and alignment on any pipe for conformance with proposed line and grade. Installed grades shall be within the tolerance of plus or minus 0.02 feet from theoretical computed grades. Alignment shall be within a tolerance of plus or minus 0.04 feet. Pipe grade shall be defined as the invert elevation

of the pipe. Pipe not meeting the grade tolerance or of poor alignment shall be adjusted by the Contractor.

B. No pipe laying will be allowed to begin at any point other than a manhole or other appurtenance without the express consent of the Engineer. The interior of each length of pipe will be swabbed and wiped clean before laying the next length. No length of pipe shall be laid until the previous length has had sufficient fine material placed and tamped about it to secure it firmly in place to prevent any disturbance. Bell ends shall be laid uphill. Whenever the work is stopped temporarily, or for any reason whatsoever, the end of the pipe shall be carefully protected against dirt, water, or other extraneous material. Bedding shall be as shown on the Plans.

C. The pipe shall be cut as necessary for appurtenances. In general, the pipe material shall be cut by using a saw or milling process approved by the pipe manufacturer, and not by using any impact device, such as a hammer and chisel, to break the pipe. The pipe shall be cut, not broken. The cut end of the pipe shall be square to the axis of the pipe and any rough edges ground smooth.

D. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely, in a manner approved by the Engineer, to prevent entrance of trench water, dirt, or other substances.

E. All joints shall be made in a dry trench in accordance with the manufacturer's recommendations.

F. A minimum of two (2) pipe lengths or pipe stubs shall be used between any two (2) appurtenances.

G. When connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline service. Provide facilities for dewatering and for disposal of water removed from dewatering lines and excavations without damage to adjacent properties.

3.3 INSTALLATION-UNDERDRAIN SYSTEM

A. Pipe Laying: Underdrain system pipe laying shall comply with the requirements of pipe laying described above under "Installation - Storm Drains."

B. The underdrain pipe shall be installed with holes facing down unless otherwise noted on the plans.

C. Filter fabric shall be used around all underdrains. The filter fabric shall completely encapsulate the piping and a bedding and backfill of 3/4 inch crushed stone. The use of fabric sleeves for underdrains without stone shall not be permitted.

END OF SECTION 02720

SECTION 02730

SANITARY SEWER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

Furnish labor, materials, services, equipment, and other necessary items required for accompanying the construction of the sanitary systems. This shall include, but not be limited to, the following:

Sanitary sewer drainage piping, Fitting and Accessories, Cleanouts, and Bedding.

Set lines, elevations, and grades for sanitary sewer system work and control system for duration of work, including careful maintenance of benchmarks, property corners, monuments, or other reference points.

1.2 RELATED SECTIONS

A. Section 02222 - Excavation, Backfilling, and Compacting for Utilities.

B. Section 02605 – Water, Sewer, Storm and Catch Basin Structures.

C. Construction Drawings.

D. Local governing authority and code requirements.

E. All necessary construction permits.

The public utility for the sewer is the Portland Public Works Department. All materials, installation, and workmanship will comply with the requirements specified in this section, the requirements of the City of Portland. Where a more stringent standard exists, the more stringent standard shall apply.

1.3 REFERENCE

A. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings

B. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe

C. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pip

D. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) Drop

E. ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

F. ASTM A746 - Ductile Iron Gravity Sewer Pipe

G. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings

H. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

I. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

J. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS

A. Product Data: Provide catalog materials indicating pipe, pipe accessories, and fittings.

B. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

C. Manufacturer's Certificate: Certify that products meet or exceed ASTM designations.

1.6 COORDINATION

A. Coordinate the work with termination of the sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

PART 2 - PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Polyvinyl Chloride Sanitary Sewer:

1. Pipe and fittings shall comply with ASTM D 3034, rated SDR 35. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.

2. Pipe joints shall be integrally molded bell ends per ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.
3. Corrugated Polyvinyl Chloride sewer pipe and fittings shall comply with ASTM F 949. Pipe must be marked with manufacturer's name, pipe size, cell classification and ASTM F 949 Classification. Pipe must be installed per the manufacturer's installation requirements. Acceptable manufacturer: CONTECH, INC. "A-2000" PVC sewer pipe or Owner-approved equivalent.

B. Ductile Iron Sanitary Sewer: Pipe and fittings shall comply with requirements of ductile iron pipe described under "Section 02660, Water Distribution Systems."

C. Polyvinyl Chloride Pressure Sewer:

1. Pipe and fittings shall comply with ASTM D 2241, rated SDR 18 or ASTM D1784 and shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 2241 or D1784 classification.
2. Joints shall be integral gasketed joints formed on a continuous pipe length, utilizing elastomeric seal such as "Ring Tite" as manufactured by Johns Manville Company.

D. Manholes (Refer to Section 02605).

2.2 CLEANOUTS

A. Lid and Frame: Heavy-duty cast iron construction, manufactured by Mueller: Lid Design: (Refer to Section 02605).

B. Shaft Construction: Cast iron shaft of internal diameter as specified on plans with 2,500 psi concrete collar for cleanouts located in paved areas.

C. Base Pad: Cast-in-place concrete, 2,500 psi leveled top surface to receive cast iron shaft sections, sleeved to receive sanitary sewer pipe sections.

2.3 PIPE AND VALVING ASSOCIATED WITH STRUCTURES

A. All pipe and valving shall be cast/ductile iron with 125 lb ANSI standard flanges.

B. All pipe to be cement lined.

C. Air and vacuum valve shall be Crispir Model A141.

D. Paint any piping inside special appurtenances with epoxy paint in accordance with 10 state standards and/or TR-16 manual "Guides for the Design of Wastewater Treatment Works."

PART 3 - EXECUTION

3.1 INSTALLATION - GRAVITY AND PRESSURE SEWERS

A. Pipe Laying: Gravity and pressure sewer pipe laying shall comply with the requirements of pipe laying described under "Storm Sewer System" Section 02720.

B. All service leads shall have a temporary cap placed to permit testing as outlined in Part 4 of this specification.

C. All service leads shall have cleanouts installed in accordance with Part 1 of the State Plumbing Code.

PART 4 - FIELD QUALITY CONTROL

4.1 TESTING OF SANITARY SEWER SYSTEM (GRAVITY MAIN)

A. Testing of a section of sewer between manholes shall be performed using the below stated equipment according to stated procedures and under the supervision of the Owner's representative, the Portland Water District and the Town of Cumberland.

1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
2. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
3. All air used shall pass through a single control panel.
4. Three (3) individual hoses shall be used for the following connections:
   a. From control panel to pneumatic plugs for inflation.
   b. From control panel to sealed line for introducing the low-pressure air.
   c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

Procedures: All pneumatic plugs shall be seal tested before being used in the actual test installation. One (1) length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against the pressure without bracing and without movement of the plugs out of the pipe.

After a manhole-to-manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5

psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

Diameter (inches)	Minimum Allowable Pipe Minutes to Decrease from 3.5 - 2.5 psig Pressure In
4	2.0
6	3.0
8	4.0
10	5.0
12	6.0
15	7.5
18	9.0
21	10.5

B. In areas where ground water is known to exist, the Contractor shall install a one-half (1/2) inch diameter capped pipe nipple, approximately ten (10) inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple.

The hose shall be held vertically, and a measurement of the height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same.)

C. If installation fails to meet the above requirements for the air test, the Contractor shall correct the pipeline until an acceptable test is achieved.

D. The Contractor shall provide as required the proper plugs, weirs, and other equipment required to perform all tests. Testing of each section of sewer installed shall include the portions of service connections that are to be installed under the Contract.

E. Where groundwater is confirmed to be high, the Engineer at his option may elect to accept infiltration measurements in lieu of air testing.

F. These tests shall be conducted at all times in the presence of the Engineer. Should a line which has previously been tested indicate any water infiltration, or otherwise appear suspect to the Engineer, the Contractor shall conduct confirmation air tests on the line at no additional costs.

4.2 DEFLECTION TESTING

A. Deflection tests shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days.

B. No pipe shall exceed a deflection of 5 percent.

C. If the deflection test is to be run using a right ball or mandrel, it shall have a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.

4.3 TESTING OF SANITARY SEWER FORCE MAIN SYSTEM

A. Leakage in pressure mains shall not exceed the limits shown on Table 1, appended to Section 02660, when tested by water pressure at 100 psi. The Contractor shall furnish all necessary equipment and personnel for making such tests. Should the pipe fail to meet the leakage requirements, it shall be re-excavated and repaired by the Contractor. All testing shall be done in the presence of the Owner's representative and a representative of the Town of Cumberland Sewer Department.

END OF SECTION 02730

Table 1

Allowable Leakage for Mechanical-Joint or Push-On Joint Pipe in 18-ft. Nominal Lengths*

Avg. Test Pressure (psi)	Pipe Size - inches															
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
	Allowable Leakage per 1,000 ft-gph															
250	0.48	0.71	0.95	1.42	1.90	2.38	2.85	3.33	3.80	4.28	4.75	5.70	7.13	8.55	9.98	11.40
225	0.45	0.68	0.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50	5.40	6.76	8.11	9.46	10.81
200	0.42	0.64	0.85	1.27	1.70	2.12	2.55	2.97	3.40	3.82	4.25	5.10	6.37	7.61	8.92	10.19
175	0.40	0.60	0.79	1.19	1.59	1.99	2.38	2.78	3.18	3.58	3.97	4.77	5.96	7.15	8.34	9.54
150	0.37	0.55	0.74	1.10	1.47	1.84	2.20	2.58	2.94	3.31	3.68	4.41	5.52	6.62	7.72	8.83
140	0.36	0.53	0.71	1.07	1.42	1.78	2.13	2.49	2.84	3.20	3.55	4.26	5.33	6.40	7.46	8.53
130	0.35	0.51	0.69	1.03	1.37	1.71	2.06	2.40	2.74	3.08	3.42	4.11	5.14	6.16	7.19	8.22
120	0.33	0.49	0.66	0.99	1.32	1.64	1.98	2.30	2.63	2.96	3.29	3.95	4.93	5.92	6.91	7.89
110	0.31	0.47	0.63	0.94	1.26	1.58	1.89	2.21	2.52	2.83	3.15	3.78	4.72	5.67	6.61	7.56
100	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.40	6.31	7.21
90	0.28	0.43	0.57	0.86	1.14	1.42	1.71	1.99	2.28	2.56	2.85	3.42	4.27	5.13	5.98	6.84
80	0.27	0.40	0.54	0.80	1.08	1.34	1.61	1.88	2.15	2.42	2.69	3.22	4.03	4.84	5.64	6.45
70	0.25	0.38	0.50	0.75	1.00	1.26	1.51	1.76	2.01	2.26	2.51	3.01	3.77	4.52	5.28	6.03
60	0.23	0.35	0.46	0.70	0.93	1.16	1.39	1.63	1.86	2.09	2.32	2.79	3.49	4.19	4.89	5.58
50	0.21	0.32	0.42	0.64	0.85	1.06	1.28	1.49	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.10
40	0.19	0.28	0.38	0.57	0.76	0.95	1.14	1.33	1.52	1.71	1.90	2.28	2.85	3.42	3.99	4.56

* The allowable leakage for a pipeline is calculated by multiplying the leakage per hour per 1,000 feet at the average test pressure and for the diameter of pipe tested as obtained from the above table by the duration of the test in hours and the total length of the line being tested divided by 1,000. If the line under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

SECTION 02837

TIMBER GUIDE RAIL

PART 1 - GENERAL

1.1 SUMMARY

A. Provide timber guide rail as indicated on Drawings including all materials and labor required to complete the installation. Alternate materials may be used subject to approval.

1.2 RELATED SECTIONS

A. Section 02200 - Earthwork

B. Construction Drawings

1.3 REFERENCES

A. AWPA

B. ASTM 325

C. ASTM A153

D. AASHTO M111, M232 or M298 Class 50 Type I

1.4 SUBMITTALS

A. Contractor shall submit documentation on pressure-treated timber (wood type and preservative/process) and metal hardware (grade/protective coating) for proposed components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following:

1. Pressure-treated timber guide rail and metal hardware components as shown on drawings and supplied by local distributors/suppliers.

2.2 MATERIALS

A. Wood components shall be Douglas fir or southern yellow pine, number 2 or better, 0.40 CCA, D4S. The pressure-treated wood shall meet AWPA Standard P-5 or Federal Standard TT-W-550. The treating process shall meet Federal Specification TT-W-571, or AWPA Commodity Standards as applicable. All pressure-treated timber materials shall be free of "loose" or "edge" knots, large knots, fissures, chips, bark or other structurally weakening defects of importance, such as shake or holes and heart rot. Timbers shall not be bent, bowed or twisted or show signs of damage due to improper shipping and/or handling practices.

B. Railings

1. Railings shall be 3" x 10" x 6' rough-cut pressure-treated timber.

C. Line, End and Corner Posts with top cut on a 30-degree bevel plus or minus two degrees.

1. 8" x 8" x 96"

D. Hardware

1. Bolts shall be 10" x ½" size supplied with nut, two flat washers and one lock washer. Bolts and nuts shall be of suitable quality/grade. All hardware shall be hot dipped galvanized in accordance with AASHTO M111 (ASTM A123).

PART 3 - EXECUTION

3.1 GUIDE RAIL FABRICATION

A. Assemble guide rails as indicated on plans.

3.2 FINISH

A. Rails and Posts: Pressure-treated timbers do not require any finish unless specified by manufacturer.

B. Hardware and Accessories: Hardware shall be galvanized as specified above.

3.3 CONCRETE MIXING

A. Vacant.

3.4 INSTALLATION

A. Provide secure aligned installation of timber guide rail as indicated on drawings. Contractor shall perform clearing and grubbing necessary to construct the timber guide rail to the required grade and alignment. All surplus material, post-excavation spoils and other debris shall be removed and properly disposed of. Any post, rail or hardware which becomes damaged prior to the project's acceptance by the Owner shall be replaced. All cut ends, bolt holes and countersunk spaces shall be thoroughly treated with an application of wood preservative sufficient to restore protection to any exposed untreated wood per manufacturer's recommendations.

B. Drill or hand excavate postholes using posthole digger in firm, undisturbed or compacted soil. Posts shall be set plumb on a stable foundation in holes and the space around the posts backfilled in layers with suitable material, thoroughly tamped. 8" x 8" posts shall be spaced 72" apart on center with 5'-3" embedment. End post sections shall be spaced approximately 48" apart on center from adjacent line post and post tops shall be angle cut, as shown on timber guide post detail.

C. Rails and hardware shall be placed and fastened as shown on drawings. Rail shall be erected and aligned to provide a smooth, continuous barrier. End rails shall be installed as indicated on drawings. Bolt heads and nuts shall be countersunk ½" into rail face or back side of post, respectively. All bolts shall be of sufficient length to extend beyond the nuts, but not more than ½". Nuts shall be drawn tight to securely hold rail to post, but not overtightened so as to deform or damage post, rail or hardware.

END OF SECTION 02837

SECTION 02846

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide traffic control signs complying with U.S. Department of Transportation, Federal Highway Administration's "Manual on Uniform on Traffic Control Devices", local codes, and as specified. See Drawings for type, location, and quantity of signs required.

B. Related Sections:

1. Construction Drawings
2. Manufacturer's Mounting Instructions

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Signs to meet FHWA requirements NCHRP 350 certification, engineer grade reflective. Signs to be equivalent to those manufactured by SA-SO, Inc., Grand Prairie, TX, or equal.

B. Provide information for all signs, proposed mounting heights, mounting hardware, and posts to be submitted to the Owner for review and approval prior to installation.

2.2 MATERIALS

A. To be backed with Alucobond panels, to be tan or light grey or selected by the Owner. To be painted with reflective baked-enamel finish with following colors:

1. "STOP" Signs: (R1-1) 24"x24", red octagon, reflectorized copy and border.
2. "SPEED LIMIT" Signs: (R2-1) 18"x24", black legend on white background.
3. "HANDICAPPED SYMBOL" Signs: (R7-Series) per size shown on the contract drawing, white legend on blue background. Handicapped van accessible sign shall be the dimensions shown on the contract drawings.
4. "NO PARKING, FIRE LANE" Signs: (R7-Series) 12"x18", red letters on white background.
5. "KEEP RIGHT" signs: (R4-7a) 18"x24", black letters and symbol on white background.
6. "DO NOT ENTER" Signs: (R5-1) Highway Dept. standard red and white sign except 24"x24" size.
7. Miscellaneous Signs: Per Manual on Uniform Traffic Control Device recommendations or lettered with dimensions shown on the contract drawings.

2.3 POSTS

A. Posts shall be everbright powdercoat, round shape, 2-inch, 14-gauge with stainless steel mounting hardware, with colors as shown on the drawings or selected by the Owner.

PART 3 - EXECUTION

A. Conduct an on-site meeting with the Engineer and Owner prior to start of the work to review/confirm sign location and types.

B. Red signs shall be on top where multiple signs are on a single post; larger signs shall be installed above smaller signs.

C. Install weed control collar when signs are installed in turf areas.

D. All signs in pedestrian areas shall be mounted with the bottom of the sign at 7' above finish grade. Signs in non-pedestrian areas shall be mounted with the bottom of the sign at 5' above finish grade except ADA signs which shall be 7'. Set posts vertical and plumb as shown in the plans. Mount signs in accordance with manufacturer's instructions. Check mounting height, replace any posts which are not installed plumb.

E. Set sign posts vertical and plumb.

END OF SECTION 02846

SECTION 02850

SITE IMPROVEMENTS/MISCELLANEOUS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The CONDITIONS OF THE CONTRACT and all Sections of Division 1 are hereby made a part of this section.

B. All materials used for Site Improvements shall be approved by the Owner.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, and without limiting the generality thereof, furnish and install the following items in the base bid and those selected by the owner as part of the bid alternates.

This work includes:

1. Flagpole **(NOT USED)**
2. Timber Edging **(NOT USED)**
3. Latex Coating
4. Light Pole Bases
5. Imprinted Colored Concrete
6. Streetprint **(NOT USED)**
7. Light Base Coating
8. Level Lip Spreaders **(NOT USED)**
9. Stone Dust (Smoking Area) **(NOT USED)**

B. Related Work Specified Elsewhere: Carefully examine all Contract Documents for requirements that affect the work of this Section. All work including concrete for benches, bike racks, walks and plaza areas shall be considered part of the work included in the Sitework Bid Price.

C. Colors: Color selection is very important to the Owner. Submit color options as soon as possible.

1.3 DESCRIPTION OF "STREETPRINT" **(NOT USED)**

A. Description: Textured asphalt pavement shall be described as "StreetPrint Pavement Texturing" or "StreetPrint" on the drawings and documents related to the project. The Contractor shall be an Authorized StreetPrint Applicator as licensed by Integrated Paving Concepts Inc., and shall have at least one crewmember on the site who has successfully completed a StreetPrint Level 1 accreditation training program.

1.4 DEFINITIONS PERTAINING TO STREETPRINT **(NOT USED)**

"StreetPrint Pavement Texturing" is defined as a finishing system, which treats the surface of Hot Mix Asphalt Concrete (HMA) by imprinting surface bituminous concrete pavement with "grid style" or other styles of depressions to replicate, in relief, the concrete grout depressions common to hand-laid brick or cobblestone, or any other design as shown on the drawings or described in the specifications, and coating the imprinted asphalt surface using the StreetBond Surfacing System.

"StreetBond Surfacing System" is defined as a collection of proprietary coating products, specifically formulated by Integrated Paving Concepts, Inc., for application on asphalt surfaces, to provide color and texture to the asphalt surface, and/or to fill surface voids or segregation.

"Imprinting Hot Mix Asphalt" is defined as pressing flexible templates into hot, fully compacted, Hot Mix Asphalt to create the appearance of grout lines or patterns in the asphalt surface.

"Templates" are defined as flexible, woven wire rope cut and welded in various patterns, used for imprinting Hot Mix Asphalt.

"Accredited StreetPrint Applicator" is someone who has successfully completed the StreetPrint Level 1 accreditation training program.

"Reheating of the asphalt surface" is defined as the softening of existing compacted Hot Mix Asphalt by applying heat to the surface using equipment such as infrared heaters or hot air heaters. To avoid overheating or burning and degradation of the asphalt surface, continuous monitoring of the surface temperature, during the heating process, using an infrared thermometer is recommended. Equipment that is specifically excluded from this section and shall not be used for reheating of the asphalt is any form of direct flame heaters.

C. Imprinting of Hot Mix Asphalt Concrete: Layout and imprint of the pattern into the surface of the HMA shall be as per the drawings or specifications. Imprinting must be conducted between 5 and 40 days after the hot bituminous concrete surface pavement has been installed on asphalt, by applying heat to the asphalt surface to make the upper portion of the asphalt surface pliable enough to accept the imprint of the template. The application of heat to existing asphalt surface shall be done using re-heating equipment, such as infrared heaters or hot air heaters. Direct flame heaters shall not be allowed to be used for this purpose. The temperature of the asphalt

surface must be regularly monitored by the Contractor during the reheating process, to avoid overheating and degradation of the asphalt cement.

D. Application of the StreetBond Surfacing System: Supply and install "StreetBond Surfacing System" products as per the specifications.

1.5 SUBMITTALS

A. Submittals: Provide as follows:

1. Product Data:
   a. All manufactured equipment.
   b. Metal fasteners, anchors, other accessories.
2. Shop Drawings: All items where installation methods are not fully described in product data.
3. Technical Data: For each product specified, include technical data and tested physical and performance properties.
4. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.
5. Submit a full range of standard color samples for Engineer's review.

1.6 QUALITY ASSURANCE

A. Installation Qualifications: Engage experienced installers who have applied hard play area surface systems and streetprint systems, and with a record of successful in-service performance for the respective work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver to project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Follow manufacturer's recommendations regarding environmental limitations to application.

PART 2 – PRODUCTS & EXECUTION

2.1 "STREETBOND SURFACING SYSTEMS" (NOT USED)

A. The Owner or Owner's representative shall specify the color of the "StreetBond Surfacing System" that will be installed. At the time of installation, the Contractor will determine the StreetBond Surfacing System to be used depending on the climatic conditions. At least two applications are required.

If the asphalt surface is heavily segregated, or has an open texture, and this texture is undesirable, "StreetBond Coat Filler" may be applied prior to the application of the surfacing coatings.

All streets should receive a minimum of two applications of StreetBond SP 100 Formula.

2.2 PHYSICAL AND PERFORMANCE PROPERTIES (NOT USED)

The products used in the surfacing system shall meet the minimum physical and performance properties described in the following "StreetBond Surfacing System" Product Descriptions and Specifications.

A. StreetBond SP 50 Base: StreetBond SP 50 Base is a cement modified, acrylic polymer and aggregate blend developed specifically for use over imprinted asphalt. It is characterized by superior adhesion, flexibility and abrasion resistance, as well as chemical resistance and good scrubability. This combination of characteristics is required of a StreetPrint application. One application of StreetBond SP 50 Base will provide a surface build between 10 – 15 mils (0.25 - 0.4 mm). (For physical and performance properties see Tables 1 & 3.)

B. StreetBond SP 100 Base: StreetBond SP100 base is a blend of acrylic resins and aggregates having similar properties to StreetBond SP 50 Base, except that it has been specifically formulated to cure without the use of cement, and will not effloresce. It can therefore be applied in less favorable climatic conditions.

C. StreetBond Base Coat Filler: StreetBond Base Coat Filler, consists of a special blend of aggregates and manufactured fines, which is added to StreetBond SP 50 base, and used to fill voids, segregation or an open texture in the asphalt surface, prior to the application of StreetBond SP 50 or SP 100 base coat.

D. StreetBond Sealer Concentrate: StreetBond Sealer Concentrate is a breathable, high quality, acrylic polymer, clear sealer designed specifically for use with the StreetBond SP 50 Base. StreetBond Sealer Concentrate can also be used with StreetBond SP 100 Base if a "high gloss" appearance is desired. When applied over the StreetBond SP 50 Base, StreetBond Sealer Concentrate provides a breathable sealing membrane, which adds both durability and longevity to the SP 50 base. It is absolutely necessary to seal StreetBond SP 50 Base with StreetBond Sealer Concentrate. (For physical properties see table2.)

E. StreetBond Colorant: StreetBond Colorant is a highly concentrated, high quality, UV stable pigment blend designed to work with StreetBond SP 50 and SP 100 Base. StreetBond Colorant is available in eight standard colors: Granite, Slate, Terra Cotta, Brick, Bedrock, Sierra, Burnt Sienna and Hunter Green. The owner shall choose the color and may select up to two colors.

F. Pattern: The StreetPrint pattern shall be Offset Brick.

2.3 FLAG POLE (NOT USED)

A. Provide as indicated, conforming to requirements for commercial construction.

1. Flagpole with internal halyard, height and dimension as indicated on the contract drawing.
2. Provide concrete foundation as per drawings.

2.4 TIMER EDGING (NOT USED)

A. Timber edging material shall have been treated with a water-borne preservative rated safe for playground equipment as defined by the American Wood Preserver's Association (AWPA) standards.

2.5 BASKETBALL GOAL STANDARDS

A. Basketball Goal Component Standards shall be:

1. Post and Adjustable Extension manufactured by GameTime, PO Box 121, Fort Payne, Alabama 35967, Part No. 503 or approved equal.
2. Cast Aluminum Fan Shaped Backboard manufactured by GameTime, PO Box 121, Fort Payne, Alabama 35967, Part No. 854 or approved equal.
3. Heavy Duty Flex Goal w/Nylon Net manufactured by GameTime, PO Box 121, Fort Payne, Alabama 35967, Part No. 874 or approved equal.
4. Goal Post Safety Padding manufactured by Bison Inc., 603 "L" Street, Lincoln, Nebraska 685058, Part No. BA700PP or approved equal.

B. Provide a poured concrete base for each basketball goal as per drawings.

2.6 LIGHT BASE COATING

A. An acrylic latex coating shall be applied to the light pole bases. Two applications are required.

PART 3 – EXECUTION

3.1 GENERAL

A. Install all materials and equipment in compliance with manufacturer's recommendations, and as indicated on Drawings.

B. Provide concrete bases, supports or slabs as indicated and required.

3.2 ACRYLIC COLOR COATING SYSTEM

A. Surface preparation: Pavement surface must be cleaned entirely of dust, dirt, debris and all loose materials. New asphalt must cure 30 days before application. Repair of pavement surface defects, depressions and cracks must be completed prior to application. All repairs must be flush and smooth to adjoining surfaces. Pavement surface must be dry.

B. Level depressions or "bird baths" (1/8" or deeper) with acrylic patch binder or acrylic resurfacer patching mix.

C. Apply one or two coats of acrylic resurfacer as required by surface roughness and porosity to provide a smooth underlayment for application of the color system.

D. Over properly prepared asphalt surface apply a minimum of two coats of color coating system in accordance with manufacturer's mixing and application instructions.

3.3 ACRYLIC LINE MARKINGS

Line markings shall be laid out according to United States Tennis Association Specifications for tennis courts and Amateur Athletic Union for basketball.

A. Marking Paint:

1. Surface preparation: Surface must be dry and cleaned entirely of dust, dirt, debris and all loose material prior to applying marking paint.
2. Application: Line paint to be hand painted with a brush in two coats. Lines shall be masked with a high quality tape prior to applying paint. Remove tape as soon as line paint has dried. Do not dilute paint.

3.4 INSTALLATION OF STREETPRINT (NOT USED)

A. Surface Imprinting: The Contractor shall follow procedures detailed in the latest revision of StreetPrint Application Procedures as issued by Integrated Paving Concepts Inc. The pattern shall be created in accordance with the design as agreed by the Owner or Owner's representative. Patterning shall be achieved using steel rollers and/or vibratory plate compactors and shall be of consistent depth.

Imprinting shall be installed on surface pavement by applying heat to the asphalt surface to make the upper potion of the asphalt surface pliable enough to accept the imprint of the template. For proper imprinting success, the asphalt pavement must be adequately heat soaked (softened) to a depth of at least ½ inch (12.5mm), without burning the asphalt. The asphalt surface temperature shall not exceed 300°F (150°C). If smoke is visible, that is an indication that the asphalt is burning and the pavement may spall or crumble at a later date. Regular monitoring of the surface temperature during heating is required to prevent overheating.

B. Surfacing System: The Contractor shall apply the "StreetBond Surfacing System" as specified in 2.1. The air temperature should be at least 50°F (10°C) and rising for applying the StreetBond Surfacing System. There should be no precipitation expected within 24 hours after applying StreetBond SP Base, or within 2 hours after StreetBond SP 100 has dried. Installation shall be in accordance with the latest revision of the StreetPrint Application Procedures as issued by Integrated Paving Concepts Inc. The StreetBond Products shall be spray applied and broomed using a broom or brushes to cut in small areas where required. Once StreetBond SP 50 Base has fully dried, StreetBond Sealer Concentrate will be applied as a curing membrane. StreetBond Sealer Concentrate may be tinted using StreetBond colorant, spray applied and broomed into the surface. Care shall be taken to ensure that the entire surface is covered, including the vertical edges of the imprinted surfaces. Sufficient masking shall be used to ensure that the surfacing products are applied only where specified.

Table 1 Physical Properties "StreetBond SP 50 and SP 100 Base"

Characteristic	Test Specification	StreetBond SP 50 Base	StreetBond SP 100 Base
Solids by Volume (%)	ASTM D-5201	53 +/- 3%	58.3%
Solids by Wight (%)	ASTM D-1351	75.5 +/- 2%	74.7%
Density	ASTM D-1475	14.6 +/- 0.2 lbs./gal (1.75 kg/l)	13.9 lbs./gal (1.67 kg/l)
Flash Point	ASTM D-3287	>200°F (93°C)	>230°F (110°C)
Percent Pigment (by weight including cement)	ASTM D-3723	62 +/- 2%	61.9%
Sheen	ASTM D-523	< 3 @ 85°	

Table 2 Physical Properties "StreetBond Sealer Concentrate

Characteristics	Test Specifications	StreetBond Sealer Concentrate
Solids by Volume (%)	ASTM D-5201	24 +/- 2
Solids by Weight (%)	ASTM D-1353	27 +/- 2
Density	ASTM D-1475	8.50 LBS./GAL (1.03 kg/l)
Spec. Gravity	ASTM D-1475	1.03
Sheen	ASTM D-523	>75 @ 85°
VOC Coating	ASTM D-3960	>200
Flash Point	ASTM D-3278	>200°F (93°C)

Table 3 Performance Properties "StreetBond Surfacing System"			
Characteristics	**Test Specifications**	**Test Results StreetBond SP 50 Base**	**Test Results StreetBond SP 100 Base**
Dry Time (to re-coat)	ASTM D-711	20 Mins. –4 Hrs.	20 Mins. –4 Hrs.
Dry Time (for traffic) 75°F/30%RH	N/A	≅80% strength @ 6-8 hrs.	≅80% strength @ 2-4 hrs.
Taber Abrasion H-10 (Wear Index 1000 cycles)	ASTM D-4060	0.4 grams	0.2 grams
Adhesion (PLI) to an Asphalt Substrate	ASTM D-4640	Cohesive failure of asphalt prior to adhesive failure	Cohesive failure of asphalt prior to adhesive failure
QUV ΔE	ASTM G-53 ASTM G-154	300 hours 2.35 CIE units (ASTM G54)	300 hours 1 CIE units (ASTM G 154)
Hydrophobicity (3 days)	ASTM D-570	12% wt. Gain	
Shore Hardness	ASTM D-2240	80 D	
Temperature Limits for Service	Dry, cured material	-30°F to 160°F	-30°F to 140°F
Surface Build	N/A	10 – 15 mils (1 application)	10 – 15 mils (1 application)

3.5 INSTALLATION OF FLAGPOLE (NOT USED)

A. Install flagpole in location shown on Drawings and per manufacturer's specifications.

B. Protect installed flagpole during construction phase by appropriate measures until acceptance of project by Owner.

PART 4 – WARRANTIES

4.1 GENERAL

A. The supplier shall provide warranties on all materials and workmanship for one year excluding vandalism.

B. Contractor shall guarantee concrete base for one year excluding vandalism.

END OF SECTION 02850

SECTION 02930

TURF AND GRASSES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all materials and equipment, and do all work required to complete the loaming, seeding and sodding including furnishing and placing topsoil, as indicated on the Drawings and as specified.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 02200 – Earthwork

1.3 DEFINITIONS

A. Duff layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or dessicant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM)
   C 136 Sieve Analysis of Fine and Coarse Aggregates
   E 11 Wire-Cloth Sieves for Testing Purposes

1.5 SUBMITTALS

A. Samples: The following samples shall be submitted:

Material	Quantity(lb.)
Topsoil	1
Composted Soil Admixture	1
Fertilizer	1

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials if to be used on the project:
   Aluminum sulfate
   Fertilizer
   Lime

C. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:
   Grass seed mix (each) Commercial fertilizer
   Ground limestone Seed mix for sod

D. Gradation and laboratory analysis:
   Topsoil without Admixture
   Topsoil with Admixtures

1.6 INSPECTION AND TESTING

A. Work will be subject to inspection at all times by the Engineer/Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with the requirements of Section 01 45 00, Quality Control, to analyze and test materials used in the construction of the work. Where directed by the Engineer/Landscape Architect, the testing laboratory will make material analyses and will report to the Engineer/Landscape Architect whether material conforms to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.
2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Engineer/Landscape Architect, the Contractor shall provide such auxiliary personnel and services needed to accomplish the testing work and to repair damage caused thereto by the permanent work.
3. Gradation of granular materials shall be determined in accordance with ASTM C136. Sieves for determining material gradation shall be as described in ASTM E11.

B. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.

C. The Contractor shall engage an independent testing agency to perform the following tests and analyses:

Material	Tests and Analysis Required
Topsoil	Mechanical analysis of soil and determination of pH and organic matter content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring nutrient content and pH to satisfactory levels for seeding and sodding. Organic admixtures shall be provided and blended to provide an average organic content of 8% with a minimum of any test having 6% organic content by dry weight.

1. Materials shall not be used in construction until test results have been reviewed by the Engineer/Landscape Architect.
2. All costs associated with testing shall be at the expense of the Contractor.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Digging Sod:

1. Sod shall not be dug at the nursery or approved source until ready to transport sod to the site of the work or acceptable storage location.
2. Before stripping, sod shall be mowed at a uniform height of 2 in.
3. Cut sod to specified depth and to standard width and length desired.

B. Transportation of Sod:

1. Sod transported to the Project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury. Closed vehicles shall be adequately ventilated to prevent overheating of the sod.
2. Evidence of inadequate protection following the digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.
3. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or is in temporary storage.
4. Upon arrival at the temporary storage location or the site of the work, sod material shall be inspected for proper shipping procedures. Should the sod be dried out, the Engineer/Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall at once remove it from the area of the work and replace it with acceptable material.
5. Unless otherwise authorized by the Engineer/Landscape Architect, the Contractor shall notify the Engineer/Landscape Architect at least two working days in advance of the anticipated delivery date of sod material. Certificate of Inspection when required shall accompany each shipment.

C. Handling and Storage of Sod:
1. Sod material shall be handled with extreme care to avoid breaking or tearing strips.
2. Sod shall not be stored for longer than 30 hours prior to installation. Sod shall be stored in a compact group and shall be kept moist. Sod shall be prevented from freezing.
3. Sod that has been damaged by poor handling or improper storage will be rejected by the Engineer or Landscape Architect.

D. Deliver seed in original sealed containers, labeled with analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, location of packaging, and name of seed grower. Damaged packages will not be accepted.

E. Deliver fertilizer in sealed waterproof bags, printed with manufacturer's name, weight, and guaranteed analysis.

1.8 PLANTING SEASON

A. Planting season for seeding shall be as follows:

Item	Planting Period	
	Spring	Fall
Seed Mix	4/15 to 6/15	8/20 to 10/1
Wetland Seed Mix	Spring preferred	Increase rates/straw mulch per manufacturer's recommendation

B. Planting season for sod shall be as follows:

Item	Planting Period	
	Spring	Fall
Sod	4/15 to 7/1	8/20 to 10/15

C. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.

D. Planting season may be extended with the written permission of the Engineer/Landscape Architect.

1.9 ACCEPTANCE

A. Acceptance:
1. The Engineer/Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.
2. Acceptance of material by the Engineer/Landscape Architect will be for general conformance to specified requirements, and shall not relieve the Contractor of responsibility for full conformance to the contract Documents.
3. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Engineer/Landscape Architect, the Engineer/Landscape Architect will recommend to the Owner that the work of this Section be accepted.

B. Sod and seed areas will be accepted when in compliance with all the following conditions:
1. Roots are thoroughly knit to the soil;
2. Absence of visible joints (sodded areas);
3. All areas show a uniform stand of specified grass in healthy condition, free of weeds, individual bare spots of over 72 square inches or multiple bare spots in excess of 1 percent of the area.
4. At least 60 days have elapsed since the completion of work under this Section.

PART 2 - PRODUCTS

2.1 SEED

A. Seed shall be of the previous year's crop with 0.5% or less weed seed, and 1.75% or less crop seed, by weight. Seed shall be dry and free of mold. Seed shall meet the following requirements.

B. Seed Mixture:

1. Standard grade seed of the most recent season's crop. Seed shall be dry and free of mold.
2. Seed mixture shall be suitable as follows:

Name of Seed	% by Weight In Mixture	Minimum % Purity	Minimum % Germination
Athletic Field Areas*			
Perennial Ryegrass	35%	95%	85%
Kentucky Bluegrass	25%	95%	85%
Penn Lawn Tall Fescue	40%	95%	85%
Erosion Control Mix**			
Creeping Red Fescue	50%	95%	85%
Annual Ryegrass	25%	95%	85%
White Clover	5%	95%	85%
Timothy or Trefoil	3%	95%	85%
Red Top	2%	95%	85%
Tall Fescue	15%	95%	85%
Lawn Areas (Park Mix)			
Kentucky Bluegrass	35%	95%	85%
Creeping Red Fescue	20%	95%	85%
Chewings Fescue	15%	95%	85%
Imp. Perennial Ryegrass	15%	95%	85%
Annual Ryegrass	15%	95%	85%
Wetland or Swales***			
New England Wet Mix (see below)	100%	95%	85%
Field Grass – Low Maintenance Areas (Cottage Mix)			
Tall Fescue	35%	95%	85%
Creeping Red Fescue	30%	95%	85%
Perennial Ryegrass	20%	95%	85%
Annual Ryegrass	15%	95%	85%
Temporary Seeding Plan			
Perennial Ryegrass	50%	95%	85%
Annual Rye	50%	95%	85%

* In athletic field areas seed shall consist of at least two improved hybrid varieties of each species indicated as identified by NTEP (e.g., 30% Baron Bluegrass, 20% Midnight Bluegrass, 20% Amazing Perennial Ryegrass, 30% Pleasure XL Perennial Ryegrass).

** This mixture is similar to New England Erosion Control Seed Mix as manufactured by "New England Wetland Plants, Inc. – Amherst, MA", which may be used alternatively at the same rates.

*** New England Wetmix (Wetland Seed Mix) contains a wide variety of native seeds which are suitable for most wetland restoration sites that are not permanently inundated. All

species are best suited to moist disturbed ground as found in most wet meadows, scrub shrub, or forested wetland restoration areas. This mix is well suited for detention basin borders, and the bottom of detention basins not generally under standing water. The seeds will not germinate under inundated conditions. If planted during the fall months, the seed mix will germinate the following spring. During the first season of growth, several species will produce seeds, while other species will produce seeds after the second growing season. Not all species will grow in all wetland situations. This mix is composed of the wetland species most likely to grow in created/restored wetlands and should produce more than 75% ground cover in two full growing seasons.

The wetland seeds in this mix can be hand sown, used with a hand-held spreader, or hydroseeded on large or hard-to-reach sites. Lightly rake to ensure proper soil-seed contact. Seeding can take place on frozen soil, as the freezing, thawing weather of late fall and late winter will work the seed into the soil. If spring conditions are drier than usual, watering may be required. If planting during the summer months, watering may be required for at least 2-3 weeks after planting to ensure germination. A non-invasive annual such as winter rye may be added to the mix to obtain soil stabilization cover in the fall. Do not add annual ryegrass, Kentucky Bluegrass or perennial ryegrass as these species are very aggressive and they will inhibit the growth of the wetland seeds. A light mulch of clean, weed-free straw is recommended.

Botanical Name	Common Name	%
Carex comosa	Bristly/Cosmos Sedge	6.00%
Carex lupulina	Hop Sedge	4.00%
Carex lurida	Lurid Sedge (Shallow)	8.00%
Carex scorparia	Blunt Broom Sedge	2.00%
Carex vulpinoidea	Fox Sedge	35.00%
Eupatorium maculatum	Spotted Joe Pye Weed	4.00%
Iris versicolor	Blue Flag	4.00%
Juncus effusus	Soft Rush	8.00%
Lobelia cardinalis	Cardinal Flower	1.00%
Mimulus ringens	Square Stemmed Monkey Flower	5.00%
Onoclea sensibilis	Sensitive Fern	5.00%
Scirpus atrovirens	Green Bulrush	5.00%
Scirpus cyperinus	Wool Grass	3.00%
Scirpus validus	Soft Stem	4.00%
Verbena hastata	Blue Vervain	6.00%

2.2 SOD

A. Sod shall be a triplex mixture of hybrid bluegrass. Mixture shall contain approximately equal portions of each hybrid component. Hybrids shall include Cheri Kentucky Bluegrass, Flying Kentucky Bluegrass, Glade Kentucky Bluegrass, Baron Kentucky Bluegrass, or comparable equal bluegrass hybrids.

B. Sod shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully, and otherwise maintained from planting to harvest.

C. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of 5/8 in., plus or minus ¼ in., at the time of cutting. Measurement for thickness shall exclude top growth and thatch.

D. Strip Size: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus ½ in. on width, and plus or minus 5% on length. Broken strips and torn and uneven ends will not be acceptable.

E. Strength of Sod Strips: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.

F. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

G. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 36-hour period unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Engineer/Landscape Architect prior to its installation.

H. Thatch: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.

I. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.

J. Weeds: Sod shall be free of objectionable grassy and broadleaf weeds.

2.3 TOPSOIL

A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent available. Additional topsoil required shall be obtained from off-site sources.

B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam or loam soil as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

Textural Class	% of Total Weight	Average %
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 mm dia. range)	5 to 25	15

1. 95% of topsoil shall pass a 2.0 mm sieve.
2. Topsoil shall be free of stone 1 in. in longest dimension, earth clods, plant parts, and debris. All topsoil shall be screened using a 3/8" screen.
3. Organic matter content shall be an average of 8% of total dry weight with a minimum of any sample being 6%.

C. Topsoil shall have a pH value range of 6.0 to 6.5.

1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.
2. If pH is below desired level add ground limestone. If pH is above desired level add aluminum sulfate.

2.4 COMPOSTED SOIL ADMIXTURE

A. Organic composted soil admixture containing industrial residuals and/or municipal biosolids will not be permitted as an additive. The use of an organic composted admixture containing composted animal manure, other approved organic materials or peat will be permitted if it meets local ordinance requirements, all Maine Department of Environmental Protection guidelines under Chapter 567 C and must be approved for commercial landscaping. Composted animal manure or other approved organic materials and peat shall be weed seed free. Composted animal manure or other approved organic materials shall be product of 15 days of thermophilic aerobic decomposition followed by 90 days of curing. Compost will be adequately stabilized, pathogen free with acceptable odor. The material shall pass through a 3/8" mesh screen, be friable and free of stones, sticks, and all objectionable debris. The composted animal manure or other approved organic material source is subject to the review of the Engineer/Landscape Architect.

Typical Product Parameters:	
TKN Nitrogen	2.0%
Organic-N	1.44%
Carbon/Nitrogen Ratio	20 to 1
Total Phosphorus	2.20%
Total Potassium	.34%
Organic Matter	79%
Conductivity	6.2 mmhos/cm
pH	7.0
Screen Size	<3/8" available
Density	+/- 800-1200 lbs/cy

2.5 LIMESTONE

A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

Sieve Size	% Passing by Weight
No. 10	100
No. 20	90
No. 100	60

2.6 PEAT

A. Peat is an acceptable alternative to composted soil admixture to increase organic content. Additional lime in the pelletized form shall be provided to readjust the pH.

2.7 WATER

A. Water shall be suitable for irrigation and free from ingredients harmful to seeded or sodded areas.

2.8 ALUMINUM SULFATE

A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer, and net weight of contents.

2.9 COMMERCIAL FERTILIZER

A. Fertilizer shall conform to the following:

1. When applied as a topsoil amendment, fertilizer shall have an analysis that will deliver appropriate amounts of nitrogen, phosphorus, and potassium as required to remedy deficiencies revealed by testing the topsoil.
2. When used as a top dressing for the maintenance of sod, fertilizer shall conform to the following:

Constituent	% Present by Weight
Nitrogen (N)	10
Phosphorus (P)	20
Potassium (K)	20

a. 50% of nitrogen shall be derived from natural organic source of ureaform.
b. Available phosphorus shall be derived from superphosphate, bone meal, or tankage.
c. Potassium shall be derived from muriate of potash containing 60% potash.

B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.

C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equal to that specified.

2.10 MULCHES

A. Straw Mulch: Air-dried, clean, mildew and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

2.11 PESTICIDES, FUNGICIDES

A. General: Pesticide or fungicide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Restricted pesticides or fungicides shall not be used unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBGRADE

A. Subgrade shall be examined to ensure that rough grading and all other subsurface work in lawn areas and other areas to be seeded is done prior to start of seeding and sodding.

B. Existing subgrade shall be loosened or scarified to a minimum depth of 3 in. prior to spreading topsoil. Subgrade shall be brought to true and uniform grade, and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

3.2 PREPARATION OF TOPSOIL

A. Topsoil shall not be spread until it is possible to follow immediately or within 24 hours with seeding or sodding operations. If topsoil is spread prior to this time it shall be cultivated to loosen soil prior to seeding or sodding.

B. Topsoil shall not be placed when subgrade or topsoil material is frozen, excessively wet, or excessively dry.

C. Topsoil shall be spread in a uniform layer, to a thickness which will compact to the depth required to bring final lawn and grass surfaces to required elevation. Unless otherwise indicated, minimum depth of topsoil shall be 6 in. after compaction.

D. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

3.3 APPLICATION OF FERTILIZER AND CONDITIONERS

A. Fertilizer and conditioners shall be applied at the following rates:
1. Aluminum Sulfate – as required by test results of topsoil.
2. Limestone – as required by test results of topsoil.
3. Fertilizer – as required by test results of topsoil.
Suggested rate: 2 pounds active Nitrogen per 1,000 square feet.

B. Mixing with topsoil:
1. Fertilizer and conditioners shall be spread over the entire areas designated at the application rates indicated above.
2. Materials shall be uniformly and thoroughly mixed into the top 4 in. of topsoil by disking, rototilling, or other approved method.

3.4 FINISH GRADING

A. Final surface of topsoil immediately before seeding shall be within $\pm$ ½ in. of required elevation, with no ruts, mounds, ridges, or other faults, and no pockets or low spots in which water can collect. Stones, roots, and other debris greater than 1 in. in any dimension, which are visible at the surface, shall be removed and the resulting holes filled with topsoil, leaving a uniform planar surface.

B. Finish grade surface with a drag or rake. Round out all breaks in grade, smooth down all lumps and ridges; fill in all holes and crevices. Rolling with a light roller is acceptable, if the surface is scarified afterward.

C. In the event of settlement, the Contractor shall readjust the work to required finished grade.

3.5 SEED APPLICATION

A. Seed shall be broadcast by means of an approved mechanical slice seeder, to give a uniform application at the following rates:

Seed Application Rate	Lb./1,000S.F.
Athletic Fields	8.00
Erosion Control	1.00
Lawn	5.00
Wetland	0.40
Field Grass – Low Maintenance	5.00

1. Springtime seeding of wetland seed mix is optimal. Increase seeding rate and apply straw mulch if seeding occurs in summer or fall.

B. Seed shall be applied in two equal applications for uniform coverage; direction of travel of spreader for second pass shall be perpendicular to that of the first pass. Seeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 mph.

1. At the Contractor's option, and with the permission of the Engineer/Landscape Architect, seed may be spread by the hydroseeding method in areas where slice seeding is not practicable, utilizing power equipment commonly used for that purpose. Seed, lime, fertilizer, and mulch shall be mixed and applied to achieve application quantities specified herein for the conventional seeding method, with mulch applied at the rate of 1,200 lb./acre. Other provisions specified above for conventional seeding shall apply also to hydroseeding.

C. Following seeding the area shall be lightly raked to mingle seed with top 1/8 to ¼ in. of soil. Area shall then be fine graded. Stones and other debris greater than 1 in. in any dimension which are visible on surface shall be removed. Surface shall be rolled with a hand roller having a weight of 60 to 90 lb./ft. of width, and a minimum diameter of 2 ft.

D. Following seeding and raking, entire area shall be watered by use of lawn sprinklers, or other approved means. Initial watering shall continue until the equivalent of a 2-in. depth of water has been applied to entire seeded surface, at a rate which will not dislodge the seed. Watering shall be repeated thereafter as frequently as required to prevent drying of the surface, until the grass attains an average height of 1 inch. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.

3.6 SODDING

A. Edges of the sodded areas shall be smooth, and all sodded areas shall conform to the design cross sections and grade. At edges adjacent to curbs, paved areas, etc., top surface of earth in sod shall be ½ in. below adjacent hard surface.

B. Sod shall be placed and all sodding operations completed within 72 hours following stripping from sod source bed.

C. On slopes steeper than 2 to 1, sod shall be fastened in place with suitable wood pins or other approved methods, spaced at not less than 1 pin per square foot.

D. Surface of completed sodded area shall be smooth. Sod shall be laid edge-to-edge, with tight-butted, staggered joints. Sod shall be carefully placed to ensure that it is neither stretched nor overlapped. Immediately after laying, sod shall be pressed firmly into contact with sod bed by tamping or rolling, to eliminate air pockets. Following compaction, topsoil shall be used to fill all cracks, and excess soil shall be worked into grass with rakes, or other suitable equipment. Sod shall not be smothered with excess fill soil.

E. Immediately after sodding operations have been completed, entire surface shall be compacted with a cultipacker roller or other approved equipment weighing 100 to 160 lb./ft. of roller.

F. Completed sod shall immediately be watered sufficiently to uniformly wet the soil to at least 1 in. below the bottom of sod bed.

3.7 MAINTENANCE

A. Except as otherwise specified below, maintenance shall include all operations required to produce an established lawn, including but not limited to: Fertilizing, resodding, mowing, weeding, watering or reseeding.

B. Maintenance of seeded areas shall begin upon completion of seeding and shall continue until full turf establishment and acceptance of the lawn or seeded area, until mowing as specified below is completed, or until average height of grass is 1-1/2 in., whichever occurs later.

C. Maintenance of sodded areas shall begin upon completion of sodding and shall continue for 45 days thereafter, unless sodding is not completed until after September 15, in which case maintenance shall continue until the June 15 following.

D. After grass has sprouted, seeded areas which fail to show a uniform stand of grass shall be replanted as often as necessary to establish an acceptable stand of grass.
1. Scattered bare spots shall not exceed 50 sq. in. each.
2. Multiple bare spots shall not exceed 5 sq. ft. within a 500 sq. ft. area.

E. First mowing shall be done when average height of grass is 3 in., with mower set to cut at a height of 2 in. Subsequent mowings shall be made at not over one-week intervals, with the height of cut set at 2 in. With prior permission of the Owner, mowings during periods of slow growth or dormancy may be spaced at greater intervals.

F. If lawn or grass is established in the fall and maintenance is required to continue into spring months, lawn and grass shall receive an application of lime and fertilizer in the spring. Lime and fertilizer shall be spread in a uniform layer over the entire lawn surface, at the rates recommended by a soil test administered at that time.

3.8 PAYMENTS

A. Payment for loam & seed shall be as follows:
- 50% after all loam has been placed and initial seeding.
- 25% after three mowings, fertilizer, and weed killer applied.
- 25% after acceptance by the Owner.

END OF SECTION 02930

E. Plants shall be free of physical damage such as scrapes, broken or split branches, scars, bark abrasions, sunscalds, fresh limb cuts, disfiguring knots, or other defects. These defects shall not interrupt more than 25% of the circumference of the plant cambium.

F. Plants shall meet the sizes indicated on the Plant List. Plants larger or smaller than specified may be used only if accepted by the Engineer/Landscape Architect.

G. Where a size or caliper range is stated, at least 50% of the material shall be closer in size to the top of the range stated.

H. Plants shall not be pruned before delivery.

I. Plants indicated as "B&B" shall be balled and burlapped.

1. Unless otherwise permitted by the Engineer/Landscape Architect, plants shall be nursery grown.
2. Plants shall be grown for at least two years under climatic conditions similar to those in the locality of the Project.
3. Nursery grown plants shall be freshly dug. No heeled in plants or plants from cold storage will be accepted, unless otherwise permitted by the Engineer/Landscape Architect.

J. Container-grown plants shall be well rooted and established in the container in which they are growing. They shall have grown in the container for a sufficient length of time for the root system to hold the planting medium when taken from the container, but not long enough to become rootbound. Container grown plants exceeding the sizes indicated in ANSI Z60.1 shall have containers which are not less than 75% of the ball sizes for comparable B&B plant material. Each container plant shall be inspected and root pruned as needed.

1. Canes or Trunk(s) and Branches:
   a. Very well formed and sturdy.
   b. Branching plentiful and uniformly distributed to form a well-balanced plant.
   c. Scars shall be free of rot and not exceed 1/4 the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
   d. Pruning scars clean cut leaving little or no protrusion from the trunk or branch.
   e. Graft union completely healed.
   f. No mechanical or pest damage.
   g. No extreme succulence.

2. Foliage:
   a. Densely supplied with healthy, vigorous leaves of normal size, shape, color, and texture (except shrubs moved bare-root or deciduous shrubs when dormant).
   b. No holes, cavities, or depressed areas caused by broken or dead branches or insufficient foliage.
   c. No chlorosis.
   d. Pest or mechanical damage barely perceptible with no more than 5% of total foliage affected.
   e. No frost or cold damage discernible.

3. Root System:

a. Sturdily established in container.
b. Shall not be excessively rootbound except plants deliberately grown rootbound to produce a dwarf plant.
c. No large roots growing out of container.
d. No noxious weeds in container.

K. Bareroot stock, where specified or approved by Engineer/Landscape Architect, shall meet the standards of ANSI Z60.1 and shall conform to the following:
1. Root System. The root system of bareroot stock shall be sufficient to insure plant growth.
2. Bareroot Trees. Bareroot trees shall have a heavy fibrous root system that has been developed by proper cultural treatment, transplanting, and root pruning. The spread of the root system shall be 12 times greater than the trunk diameter plus an additional 6 in.
3. Bareroot Shrubs. Bareroot shrubs shall have a well-developed fibrous root system, with a minimum spread conforming to the following:

Plant Height, ft.	Minimum Spread of Roots, in.
1.5 to 2	10
2 to 3	11
3 to 4	14
4 to 5	16
5 to 6	18
6 to 8	20

2.2 TOPSOIL

A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent that suitable material is available. Additional topsoil required shall be obtained from off-site sources.

B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

Textural Class	% of Total Weight	Average %
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 mm dia. range)	5 to 25	15

1. 95% of topsoil shall pass a 2.0 mm sieve.
2. Topsoil shall be free of stones 1 in. in longest dimension, earth clods, plant parts, and debris.
3. Organic matter content shall be 4 to 12% of total dry weight.

2.3 COMPOST

A. Compost shall be highly organic dark brown to black containing 6-10% organic matter tested on a dry weight basis with pH between 6.0 – 8.0, free of plants, their roots, debris; other extraneous matter >1 in. diameter and shall be uncontaminated by foreign matter, or substances harmful to plant growth. Do not use soil for planting while in a frozen or muddy condition.

2.4 PLANTING SOIL

A. Planting soil shall be a mixture of 3 parts topsoil and 1 part compost, by volume.

B. Planting soil shall have pH value range of 5.5 to 7.0

1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.

2.5 LIMESTONE

A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

Sieve Size%	Passing by Weight
No. 10	100
No. 20	90
No. 100	60

2.6 WATER

A. Water shall be suitable for irrigation and shall be free from ingredients harmful to plant life.

2.7 ALUMINUM SULFATE

A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer and net weight of contents.

2.8 COMMERCIAL FERTILIZER

A. Fertilizer content shall conform to the following:

Constituent	% Present by Weight
Nitrogen (N)	10
Phosphorus (P)	10
Potassium (K)	10

1. 50% of nitrogen shall be derived from natural organic source of ureaform.
2. Available phosphorus shall be derived from superphosphate, bone meal, or tankage.
3. Potassium shall be derived from muriate of potash containing 60% potash.

B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.

C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equal to that specified.

D. Controlled-release fertilizer shall be equal to the following:

Product	Manufacturer
Agriform 20-10-5 Planting Tablets	Sierra Chemical Co. Milpitas, CA 95035
EZY-Grow Fertilizer Packet	EZY-Grow - Landscape Specialties

E. Slow-release fertilizer for seasonal plantings shall be Osmocote slow release 14-14-14 analysis.

2.9 MULCH

A. Mulch shall be a 100% fine-shredded pine bark, of uniform size and free from rot, leaves, twigs, debris, stones, or any material harmful to plant growth. Bark shall have been shredded and stockpiled no less than two months and no more than two years before use.

2.10 GUYING AND STAKING MATERIALS

A. Wood Stakes: For trees under 10 ft. in height, straight, sound, rough sawn lumber not less than 2 x 2 in., if square, or 2-1/2 in. diameter, if round. Wire for staking shall be 12 gauge steel.

B. Wire for Guying: Galvanized steel 1 x 19 preformed 3/16 in. diameter.

C. Turnbuckles: Galvanized steel fitted with eyebolts.

D. Deadman: Sound, rough sawn lumber 2 x 4 in., or other material approved by the Engineer/Landscape Architect.

E. Hose: High quality braided rubber hose, 3/4 in. diameter and suitable length, black in color.

F. Polyethylene tie strapping may be used with 2 x 2 pt. wood stakes as described in the installation detail.

2.11 ANTIDESICCANT

A. Antidesiccant shall be an emulsion specifically manufactured for plant protection which provides a protective film over plant surfaces which is permeable enough to permit transpiration. Antidesiccant shall be delivered in manufacturer's sealed containers and shall contain manufacturer's printed instructions for use.

B. Antidesiccant shall be equal to the following:

Product	Manufacturer
Wilt-Pruf	Wilt-Pruf Products, Inc. P.O. Box 469 Essex, CT 06426

2.12 FUNGICIDE

A. Fungicide shall be zinc ethylene bisdithiocarbonate (Zineb), or equal.

PART 3 – EXECUTION

3.1 EXAMINATION OF SUBGRADE

A. Examine subgrade and rough grading before planting. Alert Engineer/Landscape Architect to unacceptable rough grading or subgrade.

3.2 DRAINAGE OF SOILS

A. Test drainage of five plant beds and pits chosen by the Engineer/Landscape Architect shall be done by filling with water twice in succession. The time at which water is put into the pit or bed for a second filling shall be noted. Engineer/Landscape Architect shall then be notified of the time it takes for pit or bed to drain completely. Planting operations shall not proceed until Engineer/Landscape Architect has reviewed test drainage results.

B. Notify the Engineer/Landscape Architect in writing of all soil or drainage conditions that he considers detrimental to growth of plant material. Submit proposal and cost estimate for correction of the conditions for Engineer/Landscape Architect's approval before starting work.

3.3 TRANSPLANTING – GENERAL

A. Condition: Deciduous trees 4 in. caliper and larger shall be moved by boxing, be balled and burlapped, or with a tree spade during dormant periods. Deciduous trees smaller than 4 in. caliper shall be moved balled and burlapped or with a tree spade during dormant periods. The size of the tree spade shall be no less than 11 inches diameter per inch of tree caliper.

B. Digging, Wrapping, and Handling: Plants shall be dug and prepared for moving in a manner that will not cause damage to branches, shape, root system, and development during storage.

C. Balled and Burlapped Plants: Balls shall be firmly wrapped with burlap or approved cloth substitute. No balled plant will be acceptable if the ball is cracked or broken, or if the stem is loose in the ball, either before or during transplanting. Balled plants shall be lifted and handled from the bottom of the ball. Protect ball and deliver to the relocation site, plant immediately, and water thoroughly. Ball sizes shall be as recommended in ANSI Z60.1.

D. Bare Root Plants: Plants shall be dug and prepared in such a manner as to provide optimum root mass. Material shall be dormant when dug and root systems shall be kept covered and moist at all times. Upon delivery to relocation site, plant immediately, and water thoroughly. Root spread shall be as recommended in ANSI Z60.1.

3.4 TRANSPLANTING WITH MECHANICAL TREE SPADE

A. Dig hole for tree with same sized equipment as will dig the plant material and transport it to site.

B. Thoroughly mix a slurry mix of the following in the tree pit:*

Material	Quantity*
Planting soil	5 cu. ft.
Fertilizer	Per mfr's recommendation for tree caliper
Water	Enough to fill bottom third of tree pit

* Quantities listed are for 66 in. tree spade. For larger or smaller units, quantities shall be adjusted accordingly.

C. Prior to digging the plant material, all lower branches shall be tied up so that the machine will not damage any limbs during digging.

D. Tree trunk shall be centered in the unit prior to digging.

E. After digging plant material, and prior to transporting, tie tree limbs down and protect tree from drying out during transport. Trees shall be protected by anti-desiccant spray and/or a plastic or fabric cover.

F. Position tree in hole as directed by Landscape Architect or Owner and remove tree spade.

G. Immediately after removal of tree spade, the tree shall be watered completely, all air gaps in slurry mixture shall be filled by working a spade handle or other tool around the entire perimeter of the ball.

H. Tree shall be watered via injection into root ball until entire ball is saturated.

3.5 LAYOUT OF PLANTING AREAS

A. Individual plant locations and outlines of shrub and ground cover areas to be planted shall be staked by the Contractor in ample time to allow inspection by the Engineer/Landscape Architect.

B. Digging shall not begin until locations are approved by the Engineer/Landscape Architect.

C. Location of trees shall be staked using color-coded stakes. A different stake color shall be used for each tree species.

3.6 PREPARATION OF SUBGRADE

A. Subgrade of planting areas shall be loosened or scarified to a minimum depth of 3 in. prior to spreading planting soil. Subgrade shall be brought to true and uniform grade and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

3.7 PLANT PIT EXCAVATION

A. Planting pits for trees and shrubs shall be excavated to the depth and dimension indicated on the Drawings.

B. Excavation shall not begin until locations are approved by the Engineer/Landscape Architect.

3.8 FILTER FABRIC

A. Filter fabric shall be installed where indicated on the Drawings. Unless otherwise indicated on the Drawings, filter fabric shall be overlapped 6 in. along all edges.

3.9 SPREADING OF PLANTING SOIL

A. Planting soil shall be spread and placed to required depths.

1. General areas: 6 inches.
2. Groundcover and perennial beds: 12 inches.
3. Finish surface elevation of planting soil in planted areas below edge of pavement or top of curb: 4 inches.

B. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

3.10 PLANTING

A. Walls of plant pits shall be dug so that they are vertical and scarified.

B. Plants shall be set as indicated on Drawings. Plants shall have same relationship to finished grade as in the nursery.

C. Plants shall be turned to the desired orientation when required by Engineer/Landscape Architect.

D. Containerized plants shall be removed from container taking care not to damage roots. The side of the root ball shall be scarified to prevent root-bound condition and plant positioned in planting pit.

E. Planting shall be positioned in center of planting pit, set plumb, and rigidly braced in position until all planting soil has been tamped solidly around the ball.

F. Pits shall be backfilled with planting soil. Soil shall be worked carefully into voids and pockets, tamping lightly every 6 in.

1. When pit is two-thirds full, plants shall be watered thoroughly, and water left to soak in before proceeding.
2. At this time, ropes or strings on top of ball shall be cut and shall be pulled back. Burlap or cloth wrapping shall be left intact around ball except that the portions of wrap that are exposed at top of ball shall be turned under and buried. Non-biodegradable ball wrapping and support wire shall be totally removed from ball and planting pit.
3. Remove nursery plant identification tags.

G. Backfilling and tamping shall then be finished and a saucer formed around plant pits as indicated on the Drawings.

H. Saucer shall be filled with water and water left to soak in. Saucer shall then be filled with water again.

I. Following planting of aquatic plant material, 3 in. layer of gravel shall be spread to stabilize soil beneath.

3.11 BULBS AND HERBACEOUS PERENNIALS

A. Prepare flowering plant planting bed by application of fertilizers and pH-altering amendments and thoroughly rototilling into the top 12 in. prior to planting bulbs and flowering plants.

3.12 APPLICATION OF FERTILIZER

A. Fertilizer shall be applied when planting pits are backfilled two-thirds full. Fertilizer application shall be of the type, rate, and timing recommended by the testing agency for each plant type.

B. Slow-release fertilizer

1. Fertilization schedule for trees and shrubs using slow release 4 oz. packet system shall be per manufacturer's recommendations.
2. Fertilizer packets shall be placed 6 to 8 in. deep below top of planting soil around root balls of plants. Packets shall be spaced evenly depending on the number of packets required.

3.13 CHEMICAL APPLICATIONS

A. Immediately after planting, all trunks of deciduous trees shall be sprayed with fungicide, applied as directed by chemical manufacturer.

B. In areas designated for plantings, remedial and preventative measures shall be taken to provide a weed-free and non-toxic media for planting and as a finished landscape product. If necessary, a systemic post-emergent herbicide shall be applied to existing and emergent weeds in prepared planting beds. Applications shall commence well in advance of planting to eliminate competitive weed growth and provide a safe media for planting.

C. Pre-emergent herbicides are recommended for preventative use in areas not seeded.

3.14 STAKING AND GUYING

A. Each tree shall be staked or guyed immediately following planting. Plants shall stand plumb after staking or guying.

B. Duckbill Tree Support Systems shall be installed in strict conformance with manufacturer's published installation instructions.

C. Duckbill Root Ball Fixing Systems shall be installed in strict conformance with manufacturer's published installation instructions.

3.15 MULCHING

A. Mulch shall be applied as follows (entire area listed shall be mulched):

Plant Type	Mulch Area	Mulch Depth, in.
Tree	Saucer	3
Shrub	Saucer or Bed	3
Ground Cover	Bed	3

3.16 PRUNING

A. Each tree and shrub shall be pruned to preserve the natural character of the plant. Pruning shall be done after delivery of plants and after plants have been inspected and approved by the Engineer/Landscape Architect. Pruning procedures shall be reviewed with Engineer/ Landscape Architect before proceeding.

B. Pruning shall be done with clean, sharp tools. Cuts shall be made flush, leaving no stubs. No tree paint shall be used.

C. Dead wood, suckers, and broken and badly bruised branches shall be removed.

3.17 MAINTENANCE OF PLANTING

A. Maintenance shall begin immediately after each plant is planted and shall continue until Final Acceptance. The Contractor shall provide water for irrigation if none is available on site.

B. Maintenance shall consist of pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, repairing and replacing of damaged tree wrap material, resetting plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings free of insects and disease, and in a healthy growing condition.

C. Planting areas shall be kept free of weeds, grass, and other undesired vegetative growth.

D. Note: Extend maintenance beyond Substantial or Final Acceptance of Project if necessary to meet above requirements. Engineer/Landscape Architect may withhold funds from Substantial and Final Completion payments as necessary to assure proper performance of maintenance operations.

END OF SECTION 02950

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.

B. Related Sections include the following:
1. Division 05 Section "Structural Steel" for anchor bolts.
2. Division 7 Section "Joint Sealants" for sealants in concrete joints.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, vapor retarder, protective coating, sealer, and others if requested by Architect.
1. Submit a letter from the manufacturer of the curing compound certifying that the curing compound will not inhibit the bond of successive floor treatments.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
   a. Include statement indicating costs for each product having recycled content.

2. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements, and for equivalent concrete mixtures that do not contain portland cement replacements.

C. Concrete Mix Design: Submit proposed design mixes for each different type and strength of concrete to be used. Provide separate mix designs for any change in ingredients. Include the following items:
   1. Mix proportions for all ingredients of the mix. Designate within the submittal where each mix is proposed to be used. Proportions shall be established by one of the following methods in accordance with ACI 301.
      a. Field experience.
      b. Trial batch
      c. Water/cement ratios specified in this section.
   2. Cement type.
   3. Aggregate gradations taken within 3 months from the date of submission. Specify size of coarse aggregate in accordance with ASTM size numbers.
   4. Provide data for all proprietary items incorporated into the mix including, but not limited to admixtures.
   5. Compressive strength results from an independent testing laboratory for mixes designed in accordance with trial batch or field experience methods.
      a. Trial batches shall be tested within 12 months from the date of submission.
      b. Submit quantity of tests in accordance with ACI 301. Note that mix designs developed in accordance with the field experience method must include a minimum of 30 consecutive tests, with an allowance for 10 to 30 consecutive tests with a higher average strength required.
      c. Slump and air content shall be consistent with specifications for this project within tolerances specified within ACI 301.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Elevated Slab Construction Joint Layout Drawings: Submit a proposed layout of construction joints at each elevated slab for review. Indicate sequence and schedule of concrete placements.

F. Material Certificates: For each of the following, signed by manufacturers:

   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Waterstops.
   6. Curing compounds.
   7. Floor and slab treatments.
   8. Bonding agents.
   9. Adhesives.
   10. Vapor retarders.
   11. Semirigid joint filler.
   12. Joint-filler strips.

13. Repair materials.

G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

H. Field quality-control test and inspection reports.

I. Manufacturer Certification: Submit verification of the certification of the concrete supplier for compliance with paragraph 1.5.B.1.

J. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: If the trial batch method is used to design concrete mixes, testing shall be performed by an independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 318, "Building Code Requirements for Structural Concrete."
4. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete subcontractor.
    e. Testing agency responsible for field quality control.
    f. Structural Engineer of Record.
    g. Special Inspector.

2. Review testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I, Type II, or Type I/II, gray:

a. Fly Ash: ASTM C 618, Class C or F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: Comply with the size limits in ACI 301.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

2.7 WATERSTOPS

A. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

1. Products:

a. Greenstreak; Hydrotite.

2.8 VAPOR RETARDER

A. Plastic Vapor Retarder: ASTM E 1745, Class A, with integral geotextile fabric bonded to vapor retarder. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fortifiber Corporation; Moistop Ultra 15.
   b. Raven Industries Inc.; Vapor Block 15.
   c. Reef Industries, Inc.; Griffolyn Type-65G.

2.9 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Available Products:

   a. Burke by Edoco; Titan Hard.
   b. ChemMasters; Chemisil Plus.
   c. ChemTec International; ChemTec One.
   d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
   e. Curecrete Distribution Inc.; Ashford Formula.
   f. Dayton Superior Corporation; Day-Chem Sure Hard.
   g. Euclid Chemical Company (The); Euco Diamond Hard.
   h. Kaufman Products, Inc.; SureHard.
   i. L&M Construction Chemicals, Inc.; Seal Hard.
   j. Meadows, W. R., Inc.; Liqui-Hard.
   k. Metalcrete Industries; Floorsaver.
   l. Nox-Crete Products Group, Kinsman Corporation; Duranox.
   m. Symons Corporation, a Dayton Superior Company; Buff Hard.
   n. US Mix Products Company; US Spec Industraseal.
   o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS.

B. Sealer (Protective Coating) for Exterior Slabs: Siloxane PD from Prosoco, Inc., or an approved equal.

2.10 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Available Products:

   a. Axim Concrete Technologies; Cimfilm.
   b. Burke by Edoco; BurkeFilm.
   c. ChemMasters; Spray-Film.
   d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
   e. Dayton Superior Corporation; Sure Film.
   f. Euclid Chemical Company (The); Eucobar.

g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, Div. of ChemRex; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Available Products:

a. Burke by Edoco; Spartan Cote WB II 20 Percent.
b. ChemMasters; Safe-Cure Clear.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
e. Euclid Chemical Company (The); Diamond Clear VOX.
f. Kaufman Products, Inc.; SureCure Emulsion.

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Dovetail Anchor Slots: Stainless steel sheet, not less than 0.0336 inch (0.85 mm) thick. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
1. Provide dovetail slots from the same manufacturer as veneer anchors to be embedded in masonry.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture, field test data, or default water-cement ratio given below, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. When acceptable data is not available for either field experience or trial batch design methods, provide normal weight concrete with the following properties:

1. 4000 psi 28-day compressive strength; water-cement ratio, 0.44 maximum (non-air entrained), 0.35 maximum (air-entrained).
2. 3000 psi, 28-day compressive strength; water-cement ratio, 0.58 maximum (non-air entrained), 0.46 maximum (air-entrained).

C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing admixtures in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use high range water-reducing admixture in 4000 psi, air entrained concrete, unless otherwise approved in mix designs prepared by trial batch or field experience methods.
4. Use air entraining admixture in perimeter foundations, exterior slabs, and other locations where concrete will be exposed to freeze-thaw cycles.

F. Air Content: Add air-entraining admixture to concrete exposed to freeze-thaw conditions at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:

1. Air Content: 5.5 percent for 1-1/2-inch- (38-mm-) nominal maximum aggregate size.
2. Air Content: 6 percent for 1-inch- (25-mm-) nominal maximum aggregate size.
3. Air Content: 6 percent for 3/4-inch- (19-mm-) nominal maximum aggregate size.

G. Do not air entrain normal-weight concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings, Foundation Wall, and Piers: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (20.7 MPa) at 28 days.
2. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).

3. Air Content: As specified in paragraph 2.12.F. for concrete exposed to freeze-thaw conditions in service.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture plus or minus 1 inch (25 mm).
3. Air Content:
   a. Do not allow air content of troweled finished interior floors to exceed 3 percent.
   b. Provide air entrainment for exterior slabs as specified in paragraph 2.12 F.

C. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days. lb/cu. ft. (48.1 kg/cu. m) as determined by ASTM C 567.
2. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture plus or minus 1 inch (25 mm).
3. Air Content: 3 percent maximum.

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information. Clearly indicate on the batch ticket the time the cement is added to the mix.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
2. Mixing time will be measured from the time the cement is added to the mix.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   a. Secure anchor bolts to templates before concrete placement. Do not force anchor bolts into concrete after it has begun to set.

2. Install dovetail anchor slots in concrete structures as indicated.

3. Install angles and other metal fabrications with integral embedments in accordance with approved shop drawings. Secure to formwork prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
1. Install vapor retarder with geotextile side down.
2. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
   1. Support welded wire fabric on chairs or other approved methods. The use of lifting hooks to set the position of welded wire fabric is prohibited.
   2. At elevated slabs with structural steel supports, locate supports for welded wire fabric directly over steel framing with intermediate supports, between framing as required to maintain specified tolerances, but not to exceed 3'-0" on center.
   3. The maximum spacing between welded wire fabric supports shall be 3'-0".

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete. Width of keys shall be equal to 1/3 of the member thickness unless otherwise noted.
   3. Space vertical joints in walls as indicated on typical details on the Drawings.
      a. Control joints may be substituted for construction joints unless otherwise noted.
   4. Elevated Slabs on Metal Deck: Locate construction joints at midspan between structural steel framing. Provide dowels at mid-depth, #4, 2 feet, 6 inches long, at 24 inches on center. Welded wire fabric shall be continuous through construction joints.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Sawcuts must be made within 12 hours of concrete placement.

3. Contraction joints may be used interchangeably with construction joints at the contractor's option.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, and other locations, as indicated.
1. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
3. At isolation joints surrounding steel columns, omit joint filler strips. Break bond with an approved material and tool edges to permit installation of joint sealant.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Maintain a minimum of 2 working vibrators on the jobsite during each concrete placement.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration

to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. Maintain the temperature of concrete above 50 deg F (10 deg C) for seven days after placement.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range as follows:
   a. 55 degrees F for sections less than 12 inches in the least dimension.
   b. 50 degrees F for all other concrete members.
   c. Do not exceed the minimum concrete temperatures stated above plus 20 degrees.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
4. The use of high early strength concrete, if approved, will reduce heating time to 3 days.
5. Protection of Footings against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, sealer, or built-up epoxy flooring.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

   a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing. Maintain concrete continuously moist, with the temperature above 50 deg F (10 deg C) for seven days after placement.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less

than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Protective Coating (Sealer) for Exterior Slabs: Prepare surface and apply in accordance with the manufacturer's specifications. Remove curing compound and other surface contaminants before application. Delay application until as late as practicable in the project schedule, a minimum of 28 days after concrete placement, but prior to the application of deicing salts. Apply in two (2) coats.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least three months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to

manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a Special Inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Anchor bolts.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture, plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M.

   a. Cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one laboratory-cured specimen at 7 days and two specimens at 28 days. Retain the fourth specimen for testing at 56 days in the event that the 28-day strength does not attain the specified strength.
   a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

13. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

END OF SECTION 033000

2. Fire-Resistance Rating: Provide components to meet the following fire ratings:
   a. Columns: 2.0 Hr.
   b. Walls: 2.0 Hr.
   c. Beams & Dbl Tees: 2.0 Hr.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

   a. Include statement indicating costs for each product having recycled content.

2. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.

C. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

D. Shop Drawings: Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement. Detail fabrication and installation of precast structural concrete units.

1. Indicate welded connections by AWS standard symbols. Show size, length, and type of each weld.
2. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
3. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
4. Include and locate openings larger than by 10 inches (250 mm).
5. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
6. Indicate relationship of precast structural concrete units to adjacent materials.
7. Indicate estimated camber for precast floor slabs with concrete toppings.
8. Indicate shim sizes and grouting sequence.
9. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

E. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: For Installer and fabricator.

G. Welding certificates.

H. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.

I. Material Test Reports: For aggregates.

J. Source quality-control reports.

K. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Participates in PCI's Plant Certification program and is designated a PCI-certified plant as follows:

a. Group C, Category C4.

B. Installer Qualifications: A precast concrete erector qualified, as evidenced by PCI's Certificate of Compliance, to erect Category S2.

C. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D.1.1M, "Structural Welding Code - Steel."
2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."

F. Fire-Resistance Calculations: Where indicated, provide precast structural concrete units whose fire resistance meets the prescriptive requirements of authorities having jurisdiction or has been calculated according to PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," and is acceptable to authorities having jurisdiction.

G. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
2. Place adequate dunnage of even thickness between each unit.
3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses that would cause cracking or damage.

D. Lift and support units only at designated points shown on Shop Drawings.

1.7 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.2 REINFORCING MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from galvanized-steel wire into flat sheets.

F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

G. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.3 PRESTRESSING TENDONS

A. Pretensioning Strand: ASTM A 416/A 416M, Grade 250 (Grade 1720) or Grade 270 (Grade 1860), uncoated, 7-wire or ASTM A 886/A 886M, Grade 270 (Grade 1860), indented, 7-wire, low-relaxation strand.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, gray.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin Admixture: ASTM C 618, Class N.
3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M.

G. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Rheocrete 222+.
b. Grace Construction Products, W. R. Grace & Co.; DCI-S.
c. Sika Corporation; FerroGard 901.

2.5 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A 283/A 283M.

D. Malleable-Iron Castings: ASTM A 47/A 47M.

E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).

F. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.

G. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.

H. Zinc-Coated Finish: For all embedded steel connection components not specified to be stainless steel, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.

1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

I. Welding Electrodes: Comply with AWS standards.

J. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.6 STAINLESS-STEEL CONNECTION MATERIALS

A. Provide stainless-steel components for all flange connections of double tees to each other and to other framing.

B. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.

C. Stainess-Steel Bolts and Studs: ASTM F 593, Alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.

D. Stainless-Steel-Headed Studs: ASTM A 276, with minimum mechanical properties of PCI MNL 116.

2.7 BEARING PADS

A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test 1 specimen for every 200 pads used in Project.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; 80 to 100 Shore, Type A durometer hardness, ASTM D 2240; complying with AASHTO's "AASHTO Load and Resistance Factor Design (LRFD) Bridge Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
4. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to stainless- or mild-steel plate, of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.8 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.9 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
2. Limit use of fly ash to 25 percent replacement of portland cement by weight and granulated blast-furnace slag to 40 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
2. Maximum Water-Cementitious Materials Ratio: 0.40.

E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 116.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116 for "severe exposure."

G. Add non-set-accelerating corrosion-inhibiting admixture to double-tees and concrete beams with surfaces exposed to the parking deck.

1. Add at the dosage rate recommended by the manufacturer to provide protection from a chloride concentration of 13.0 lbs/cy (7.72 kg/cu.m).

H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

I. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.10 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Edge and Corner Treatment: Uniformly chamfered.

2.11 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.

SECTION 042000

UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Face brick.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Cavity-wall insulation.

B. Related Sections include the following:

1. Division 4 Section "Plant Precast Architectural Concrete" for elements to be installed within masonry veneers.
2. Division 7 Section Fluid-Applied Air Barrier for air barrier applied to back-up masonry walls.
3. Division 7 Section "Through-Penetration Firestop Systems" for firestopping at openings in masonry walls.
4. Division 7 Section "Fire-Resistive Joint Systems" for fire-resistive joint systems at heads of masonry walls.
5. Division 7 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.

C. Products furnished, but not installed, under this Section include the following:

1. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section "Structural Steel."
2. Hollow metal frames in unit masonry openings, furnished under Division 8.

D. Products installed, but not furnished, under this Section include the following:

1. Precast concrete trim components, furnished under Division 3 Section "Plant Cast Architectural Precast Concrete."
2. Steel lintels for unit masonry, furnished under Division 5 Section "Metal Fabrications."

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry by testing masonry prisms according to ASTM C 1314:
   1. For Concrete Unit Masonry: f'm = 1500 psi (10.3 MPa).

1.5 SUBMITTALS

A. Product Data: For each different masonry unit, accessory and other manufactured product specified.

B. LEED Submittals:

   1. Product Certificates for Credit MR 5.1 and Credit MR 5.2: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Shop Drawings: For the following:

   1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls. Coordinate reinforcement layout with masonry coursing. Indicate splice lengths and locations.

D. Samples for Initial Selection: For the following:

   1. Face brick, in the form of straps of five or more bricks.
   2. Colored mortar.
   3. Weep holes/vents.

E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

   1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include material test report for efflorescence according to ASTM C 67.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Joint reinforcement.
4. Anchors, ties, and metal accessories.

F. Mix Designs: For each type of mortar and grout. Include aggregate gradations taken within 2 months of the submission.

G. Preconstruction Testing Results: Perform the following preconstruction testing to verify acceptability of products proposed for use on the project. Submit test results for approval. Submitted test reports shall be dated within 2 months of the submission.
1. Aggregate gradations for materials intended for use in mortar and grout.
2. Clay Masonry Unit Test: For each type of clay masonry unit indicated, per ASTM C67.
   a. Test for initial rate of absorption and resistance of efflorescence.
3. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C140.
4. Prism Test: For each type of concrete masonry wall construction indicated, per ASTM C1314.
5. Mortar Test: For mortar properties per ASTM C270.
6. Grout Test: For compressive strength per ASTM C1019.

H. Fire Resistance Ratings: Submit independent lab certification that proposed masonry units are manufactured to comply with specified ratings for assemblies. Submit designs for each rated wall type showing rating, block, grout, and calculated equivalent thickness to achieve design fire resistance.

I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

C. Preconstruction Testing Service: The general contractor shall engage a qualified independent testing agency to perform the specified preconstruction testing. The testing agency shall be an independent agency qualified according to ASTM C 1093 for testing indicated for each product required.

D. Mockup: Build mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Provide the following mockup wall:
      a. Exterior brick veneer wall with concrete masonry backup, architectural pre-cast elements, window(s) and pre-cast coping. Construct mock-up as detailed in construction documents.
   2. The wall mockup shall be approximately 48 inches (1500 mm) long by 72 inches (1800 mm) high by full thickness, including face masonry and backup construction and accessories.
      a. Include a vertical control or expansion joint at one jamb of the window opening. Install all elements as required for the complete joint assembly.
      b. Include a window opening in the wall mockup. Make openings approximately 2'-8" square. Include steel lintels and headers for back-up construction, flashings and fluid-applied membrane air barrier, etc. for complete assembly of the required construction.
      c. Include through-wall flashing installed at the bottoms of mockup.
      d. Include complete assemblies of back-up wall construction including reinforced masonry, veneer anchors, flashing, fluid-applied air barrier, mortar drain and weep holes in exterior masonry-veneer wall mockup as applicable.
      e. Brace mockups to resist wind loads. Maintain bracing in place until mockup removal.
   3. Construct concrete foundations for the support of mockup. Foundations do not need to include footings nor extend below the frost line.
   4. Clean half of exposed face of mockup with masonry cleaner.
   5. Protect accepted mockup from the elements with weather-resistant membrane.
   6. Approval of mockup under Division 1 Section "Submittal Procedures" is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
      a. Approval of mockup is also for other material and construction qualities of back-up wall construction.
      b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
   7. Demolish and remove mockups when directed.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with the following requirements:

1. Cold-Weather Construction: When the anticipated daytime low temperature is within the limits indicated, use the following procedures:
   a. 40 to 32degF (4 to 0degC): Heat mixing water or sand to produce mortar temperatures between 40 and 120degF (4 and 49degC).
   b. 32 to 25deg F (0 to –4degC): Heat mixing water and sand to produce mortar temperatures between 40 and 120degF (4 and 49degC). Heat grout materials to produce grout temperatures between 40 and 120deg F (4 and 49degC). Maintain mortar and grout above freezing until used in masonry. Use heat on both sides of walls under construction. Coordinate with General Contractor for heating both sides of walls under construction.

c. 25 to 20degF (-4 to –7degC): Heat mixing water and sand to produce mortar temperatures between 40 and 120degF (4 and 49degC). Heat grout materials to produce grout temperatures between 40 and 120degF (4 and 49degC). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40degF (4degC) if grouting. Coordinate with General Contractor to provide enclosures and heat both sides of walls under construction to maintain temperatures above 32degF (0degC) within the enclosures.

d. 20degF (-7degC) and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120degF (4 and 49degC). Heat grout materials to produce grout temperatures between 40 and 120deg F (4 and 49degC). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40degF (4degC). Coordinate with General Contractor to provide enclosures and heat both sides of walls under construction to maintain temperatures above 32degF (0degC) within the enclosures.

2. Cold-Weather Protection: When the anticipated daytime low temperature is within the limits indicated, coordinate with the General Contractor to provide the following protection. This is in addition to construction procedures specified above:
   a. 40 to 32degF (4 to 0degC): Cover masonry with insulating blankets for 48 hours after construction.
   b. 32degF (0degC) and Below: Provide enclosure and heat to maintain temperatures above 32degF (0degC) within the enclosure for 72 hours after construction.
3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Coordinate with the General Contractor to protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
   1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide exterior units (first and second floor level walls) made with integral water repellent.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.

a. Available Products:

1) Addiment Incorporated; Block Plus W-10.
2) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
3) Master Builders, Inc.; Rheopel.

C. Concrete Masonry Units: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Weight Classification: Normal weight unless otherwise indicated or required to attain specified fire-rated construction.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Special Units: Provide 1" diameter bull-nose corner units for all vertical outside corners of concrete masonry walls.

2.4 MASONRY LINTELS

A. General: Provide masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support lintels until cured.

B. Accurately place reinforcement as indicated. Maintain ½ inch minimum clearance between the steel reinforcement and the face of the masonry unit. Secure reinforcement to maintain position during grout placement.

2.5 BRICK

A. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C216, Grade SW, Type FBS.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa)
2. Initial Rate of Absorption: Less than 20 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 3-5/8 inches (92 mm) high by 7-5/8 inches (194 mm) long.
5. Products, subject to compliance with requirements:

    a. Face Brick: Morin Brick Co., Auburn, ME. "Royal River, Narrow Flashed/Red, (Mingled Range)".

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar. Mortar to match color of mortar at Marine Hospital as closely as possible.

1. Available Products:

a. Solomon Grind-Chem Services, Inc.; SGS H-Series Mortar Colors.
   1) Color Range: 10 to 41.

E. Aggregate for Mortar: ASTM C 144.

F. Aggregate for Grout: ASTM C 404.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Available Products:

   a. Addiment Incorporated; Mortar Kick.
   b. Euclid Chemical Company (The); Accelguard 80.
   c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
   d. Sonneborn, Div. of ChemRex; Trimix-NCA.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

1. Available Products:

   a. Addiment Incorporated; Mortar Tite.
   b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
   c. Master Builders, Inc.; Rheomix Rheopel.

I. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Mill-galvanized, carbon steel.
2. Exterior Walls: Stainless steel.
3. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter except as otherwise indicated.
4. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
5. Wire Size for Veneer Ties: W2.8 or 0.188-inch (4.8-mm) diameter.
6. Spacing of Cross Rods, and Cross Ties: Not more than 16 inches (407 mm) o.c.
7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

1. Provide reinforcement above lintel bearings where the end of the lintel does not align with the crack control joint above. Reinforce short bearing length for three courses above lintel end.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, ladder design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.

2.8 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
3. Stainless Steel Wire: ASTM A 580/A 580M, Type 304 or 316.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
6. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
7. Stainless Steel Sheet: ASTM A 666, Type 304 or 316.
8. Steel Plates, Shapes and Bars: ASTM A 36/A 36M.
9. Stainless Steel Bars: ASTM A 276 or A 666 Type 304.

B. Wire Ties, General: Size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend a minimum of 2 inches (50 mm) parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
2. Use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
3. Wire: Fabricate from 3/16-inch (4.8 mm) diameter, stainless steel wire.

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Straps ¾" wide x 12 gauge thick with length allowing 4" of adjustment. Provide hot-dip galvanized steel for anchors used in connection with exterior walls. Mill-galvanized carbon-steel may be used at interior walls.
2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.188-inch- (4.8-mm-) hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls.

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.105-inch-thick, stainless steel sheet.

   a. 0.108-inch- (2.74-mm-) thick, galvanized sheet may be used at interior walls unless otherwise indicated.

2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.25-inch- (6.35-mm-) diameter, stainless-steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

F. Partition Top anchors: 0.097-inch- (2.5-mm-) thick metal plate with 3/8-inch- (10-mm-) diameter metal rod 6 inches (150 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by ¼ inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

H. Adjustable Masonry-Veneer Anchors for Multi-Wythe Walls
1. General:
   a. HB Ladder Type 270 with adjustable eye-wires.

2.9 MISCELLANEOUS ANCHORS

A. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch (0.86-mm), stainless steel sheet.

B. Anchor Bolts: L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

C. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in

concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
2. Corrosion Protection: Hot-dipped galvanized components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

D. Joint Stabilization Anchors: Hot-dipped galvanized. anchors designed to span expansion joints, resisting differential movement perpendicular to the wall surface while permitting movement parallel to the wall surface.
1. Acceptable Products:
   a. Dur-O-Wal D/A 2200.
   b. Hohmann and Barnard # Slip-Set Stabilizer.

2.10 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry as "THRU-WALL FLASHING."

   a. Available Products:

      1) Advanced Building Products Inc.; Copper Fabric Flashing.
      2) AFCO Products Inc.; Copper Fabric.
      3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
      4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
      5) Polytite Manufacturing Corp.; Copper Fabric Flashing.
      6) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
      7) York Manufacturing, Inc.; York Copper Fabric Flashing.

2. Metal Flashing. Provide metal flashing, complying with SMACNA's "Architectural Sheet Metal Manual", where indicated on drawings as "THRU-WALL FLASHING."
   a. Lead Coated Copper Sheet Flashing: ASTM B 101, Temper H00 and H01, cold-rolled copper sheet, of weight (thickness) indicated below, coated both sides with lead weighing not less than 12 lb/100 sq. ft. (0.59 kg/sq. m) nor more than 15 lb/100 sq. ft. (0.73 kg/sq. m) of copper sheet (total weight of lead applied equally to both sides).

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use one of the following, unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of brick head joint and 3-5/8 inch high at concrete masonry head joints with depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

a. Available Products:

1) Advanced Building Products Inc.; Mortar Maze weep vent.
2) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
3) Heckmann Building Products Inc.; No. 85 Cell Vent.
4) Hohmann & Barnard, Inc.; Quadro-Vent.
5) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Provide one of the following configurations:

a. Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep that prevent mesh from being clogged with mortar droppings.
b. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.

2. Available Products:

a. Advanced Building Products Inc.; Mortar Break II.
b. Mortar Net USA, Ltd.; Mortar Net.

F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated. Provide units sized to fit specified reinforcing steel sizes, oversized by ¼ inch.

1. Available Products:

   a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
   b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
   c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
   d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

G. Grout Mesh: Material designed to lay in the mortar joint without reducing bond, to block the flow of grout to lower cores.
   1. Available Products:
      a. Hohmann and Barnard MGS.
      b. AA Wire Products AA3260.
      c. Dur-O-Wal Dur-O-Stop.

2.12 CAVITY-WALL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.13 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

   1. Available Manufacturers:

      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless specifically approved by the Architect.

   1. Do not use calcium chloride in mortar or grout.
   2. Limit cementitious materials in mortar to portland cement and lime. The use of masonry cement is not permitted.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type S.
2. For all concrete masonry, use Type S.
3. For masonry veneer above grade, use Type N.

D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match existing mortar at Marine Hospital.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

2.15 SOURCE QUALITY CONTROL

A. The Construction Manager will engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Clay Masonry Unit Test: For each type of unit furnished, per ASTM C 67.

C. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. If unsatisfactory conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Review shop drawings for Plant Manufactured Precast Concrete prior to fabrication, and coordinate dimensions and details for precast concrete items to be placed in masonry assemblies. Upon delivery, inspect each precast concrete component for size and finish. Do not place damaged or mistakenly manufactured precast concrete.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed. Do not use units less than on-half of a unit.

E. Where a field of one-color masonry units is indicated, select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Where masonry patterns are indicated, select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures within each component of the pattern indicated. Mix units from several pallets or cubes as they are placed for each color within the pattern.
1. Lay brick in patterns indicated, matching approved mock-up appearance.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.

3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
   1. Provide soldier bonds where indicated.

C. Lay concealed masonry with all units in a wythe in running bond. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of specified grout mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Where steel beams or joists bear in masonry, encase the end in grouted masonry.

J. Where steel beams or joists pass through a masonry wall without bearing, provide a minimum of 1" of clearance beneath the framing member and at sides to permit framing to deflect without bearing.

K. Where masonry extends below grade, fully grout all cells and cavities to create a solid unit, free of voids.

L. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c., unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 7 Section "Fire-Resistive Joint Systems."

M. Where masonry walls intersect in a "T" configuration and a control joint is not specified, build one wall in continuous running bond. Tie the intersection wall to the continuous wall with the specified rigid anchors at a maximum vertical spacing of 24 inches (610 mm) on center.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and concrete masonry units as follows:
1. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Strike joints flush at masonry units to be covered with air barrier (in cavity.)

3.5 MULTI-WYTHE CAVITY WALLS

A. Bond wythes of cavity walls together using the following method:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. (0.16 sq. m) of wall area spaced not to exceed 16 inches (406 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 8 inches (203 mm) apart around perimeter of openings. At

intersecting and abutting walls, provide ties at no more than 16 inches (406 mm) o.c. vertically.

a. Use adjustable (two-piece) type ties designed to clamp insulation in place.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
   a. Use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Coat cavity face of backup wythe to comply with Division 7 Section "Fluid-Applied Air Barrier" at medical office level and penthouse.

D. Installing Cavity-Wall Insulation: Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown and place pintles to hold insulation tightly.
   1. Fill cracks and open gaps in insulation with crack sealer or adhesive compatible with insulation and masonry for a continuous insulative barrier.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement as indicated on the Drawings but not more than 16 inches (406 mm) o.c.
2. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.

   a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
1. Install preformed control-joint gaskets designed to fit standard sash block.
2. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
3. Joint reinforcement shall be discontinuous at control joints.
4. Structural bond beam reinforcement shall be continuous through control joints.
5. Locate vertical control joints at locations indicated on the drawings or, if not indicated, at a maximum spacing of 24 feet on center at façade units and 30 feet on center at all other masonry.

C. Form expansion joints in brick made from clay or shale as follows:

1. Form open joint full depth of brick wythe and of width indicated, but not less than ½ inch (13 mm) for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants."
2. Install joint stabilization anchors at 16 inches on center.

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants," but not less than 3/8 inch (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 STEEL LINTELS

A. Install steel lintels at openings in concrete masonry veneer wider than 16 inches (406 mm) and at openings in brick veneer wider than 8 inches (203 mm) and elsewhere as indicated.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

C. Where crack control joints are set back from the bearing end of a lintel, wrap the top and bottom of the lintel bottom flange with sheet metal flashing to provide a slip joint and prevent mortar from bonding to lintel outside of the crack control joint.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at the tops of walls.

B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and 1-1/2 inches (38 mm) into the inner wythe. Form 1/4-inch (6-mm) hook in edge of flashing embedded in inner wythe.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper, vapor/air barrier, or counter-flashing, lapping at least 4 inches (100 mm).
4. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) into a mortar joint to form end dams to direct moisture to weeps.
5. Install formed 3.5" hemmed metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c. at brick veneer and 32 inches (813 mm) at concrete masonry veneer and single wythe masonry, unless otherwise indicated.
3. Locate 2-1/2 inch high cell vent weep holes on top of flashing for veneer. Fill the mortar joint above the weep hole with mortar and tool to match adjacent units.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

F. Install vents in head joints at the tops of walls in exterior wythes at 48 inches (1220 mm) on center. Use specified weep/vent products to form vents.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
1. Layout vertical reinforcement with specified jamb reinforcement 4" from each corner, control joint, and opening jamb. Space bars between at a uniform spacing that does not exceed the spacing specified, rounded to the nearest 8". Maximum spacing shall not exceed 48" in any location.
   a. Where steel lintels are specified over openings, locate vertical jamb reinforcement at 12" from the opening, unless otherwise indicated.
2. Minimum splice length for deformed bar reinforcement shall be 48 bar diameters. Secure lap splices by tying with wire, except as permitted for vertical bars in paragraph 3.12.B.3.b.
3. Secure reinforcement in place before placing grout, For vertical reinforcement, use one of the following methods:
   a. Secure bar at the bottom of each grout lift by tying to dowels. Build masonry around reinforcement. Install rebar positioners at the top of each bar and at a maximum spacing of 192 bar diameters.
   b. Install rebar positioner at the bottom course of the grout lift, located within 4 inches of the dowel to be spliced. Lay up masonry units. Set vertical bar in the rebar positioner. Install additional rebar positioners at the top of the bar, and at a maximum spacing of 192 bar diameters.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Definitions:
   a. Grout Lift - Grout placed in one continuous operation. The maximum time span for the grout placement in one lift is 1-1/2 hours measured from the time water is added to the grout mix. The minimum time span between successive grout lifts is one hour.
   b. Grout Pour - The height of masonry to be grouted prior to the erection of additional masonry.
3. Do not exceed the following pour heights for fine grout:
   a. For minimum widths of grout spaces of 3/4 inch (19 mm) or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches (38 by 51 mm), pour height of 12 inches (305 mm).

b. For minimum widths of grout spaces of 2 inches (51 mm) or for minimum grout space of hollow unit cells of 2 by 3 inches (51 by 76 mm), pour height of 60 inches (1524 mm).
c. For minimum widths of grout spaces of 2-1/2 inches (63 mm) or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches (63 by 76 mm), pour height of 12 feet (3.6 m).
d. For minimum widths of grout spaces of 3 inches (76 mm) or for minimum grout space of hollow unit cells of 3 by 3 inches (76 by 76 mm), pour height of 24 feet (7.3 m).

4. Do not exceed the following pour heights for coarse grout:
   a. For minimum widths of grout spaces of 1-1/2 inches (38 mm) or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches (38 by 76 mm), pour height of 12 inches (305 mm).
   b. For minimum widths of grout spaces of 2 inches (51 mm) or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches (63 by 76 mm), pour height of 60 inches (1524 mm).
   c. For minimum widths of grout spaces of 2-1/2 inches (63 mm) or for minimum grout space of hollow unit cells of 3 by 3 inches (76 by 76 mm), pour height of 12 feet (3.6 m).
   d. For minimum widths of grout spaces of 3 inches (76 mm) or for minimum grout space of hollow unit cells of 3 by 4 inches (76 by 101 mm), pour height of 24 feet (7.3 m).
5. Provide cleanout holes at least 3 inches (76 mm) in least dimension for grout pours over 60 inches (1524 mm) in height.
   a. Provide cleanout holes at each vertical reinforcing bar.
6. Consolidate grout with a mechanical vibrator.
   a. Use a low velocity vibrator with a 3/4 inch head.
   b. Vibrate each cell in concrete masonry units twice. Insert vibrator to bottom of lift and activate for 1 to 2 seconds.
   c. Perform initial consolidation at each cell immediately after grout placement.
   d. Perform reconsolidation in each cell by reinserting vibrator when grout is still plastic.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 2 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.

F. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

G. Mortar Test: For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test: For each mix provided, per ASTM C 1019. Test for slump and compressive strength.

I. Prism Test: For each type of construction provided, per ASTM C 1314 at 28 days.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042000

SECTION 047200

CAST STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast stone trim including the following:
   a. Coping.
   b. Water tables/Window sills.
   c. Dedication stone.

B. Related Sections:
1. Division 04 Section "Unit Masonry" for installing cast stone units in unit masonry.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. LEED Submittals:

1. Product Certificates for Credit MR 5.1: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

D. Samples for Initial Selection: For colored mortar.

E. Samples for Verification:

1. For each color and texture of cast stone required, 10 inches (250 mm) square in size.
2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project.

F. Qualification Data: For manufacturer and testing agency.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

G. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous two years.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, The Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Mockups: Furnish cast stone for installation in mockups specified in Division 04 Section "Unit Masonry."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60 (Grade 420). Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of cast stone material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

2.2 CAST STONE UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. MGA Cast Stone, New Gloucester, Maine.

B. Regional Materials: Provide cast stone units that have been manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

C. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

D. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide drips on projecting elements unless otherwise indicated.

E. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch (3 mm).
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.

F. Cure units as follows:

1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

    a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.
    b. No fewer than six days at mean daily temperature of 60 deg F (16 deg C) or above.
    c. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.
    d. No fewer than eight days at mean daily temperature of 45 deg F (7 deg C) or above.

G. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

H. Colors and Textures: Match Architect's samples.

2.3 CORNER STONE

1. Finish: Provide a smooth honed finish.
2. Size: 8" high x 16" wide x 4" deep.
3. Engraving: Engrave face of corner stone with year date, 2010. Font: Helvetica. Size: 3".

2.4 MORTAR MATERIALS

A. Provide mortar materials that comply with Division 04 Section "Unit Masonry."

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

B. Dowels: 1/2-inch- (12-mm-) diameter, round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.

2.6 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.

1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Division 04 Section "Unit Masonry."

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 1/4 to 3/8 inch (6 to 10 mm) wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

H. Provide sealant joints at copings and other horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch (10 mm).
4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Division 07 Section "Joint Sealants."

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200

SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Structural steel.
   2. Architecturally exposed structural steel.
   3. Grout.

B. Related Sections include the following:

   1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Division 05 Section "Steel Decking" for field installation of shear connectors.
   3. Division 05 Section "Metal Fabrications" for steel lintels, miscellaneous steel fabrications, and other metal items not defined as structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel on the Contract Documents.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: The fabricator is responsible for the design and detailing of all connections in accordance with notes, loads, and details on the Drawings.
   1. Where specific connection details are provided with weld sizes and lengths, and bolt sizes, grade, and quantity indicated, fabricate as shown. Where typical details are indicated without specific information, design connections for loading as indicated to comply with typical aspects indicated.
   2. Connection design may utilize either Load and Resistance Factor Design or Allowable Stress Design Specifications.

3. All connection designs and details are subject to approval by the structural engineer of record.

B. Construction: Simple shear connections are typical unless otherwise noted.
1. Where indicated, provide type FR, fully restrained moment connections. Where specific details as shown on the drawings, fabricate connections in accordance with the details provided. Where details are not shown, design connections to resist end moments shown.

1.5 SUBMITTALS

A. Product Data: For each type of product utilized in structural steel fabrication or erection including, but not limited to, primer paint, non-shrink grout, and anchorage devices.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

C. Connection Design: Refer to "Steel Connection Notes" on Drawing SG001.

D. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Provide complete details of fabricator-designed connections. Include field welds and other requirements for proper erection.
6. Identify components that are to be incorporated into the Seismic Load Resisting System.
   a. Indicate locations of "demand critical" welds.
   b. Indicate locations and dimensions of "protected zones."
   c. Indicate locations of pretensioned bolts.
   d. Indicate welding requirements in accordance with the March 9, 2005 edition of "Seismic Provisions for Structural Steel Buildings" (ANSI/AISC 341-05) Appendix W, Sections W2.2 and W2.3).

E. Welds for Seismic Load Resisting System: Where welded joints are part of the Seismic Resisting System, submit the following:
1. Welding Procedure Specifications per AWS D1.1. Include definition of power source (constant current or constant voltage). Include electrode manufacturer and trade name for "demand critical" welds.
2. Copies of the manufacturer's typical certificate of conformance for all electrodes, fluxes, and shielding gases to be used. Certificates of conformance shall satisfy the applicable AWS A5 requirements.

3. Verification of compliance with notch toughness requirements. Submit verification by one of the following methods:
   a. AWS A5 test method as appropriate for electrodes and procedures to be used.
   b. Manufacturer certification.
4. Product data for SMAW, FCAW, and GMAW composite (cored) filler metals to be used. Include description of product, limitations of use, recommended welding parameters, and storage and exposure requirements, including baking, if applicable.

F. Welding certificates.

G. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Shear stud connectors.
4. Non-shrink grout.

H. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

I. Source quality-control test reports.

J. Certifications: Submit documentation verifying compliance with fabricator and erector certifications specified in Section 1.6

K. Certification of Compliance: After completion of fabrication, the fabricator shall submit a letter certifying that the fabricated steel conforms with the construction documents for the project.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Structural Steel Buildings and Bridges, dated March 18, 2005" (AISC 303-05).
2. AISC's "Seismic Provisions for Structural Steel Buildings, dated March 9, 2005" (ANSI/AISC 341-05) including "Supplement No. 1 dated November 16, 2005" (ANSI/AISC 341s1-05).
3. AISC's "Specification for Structural Steel Buildings, dated March 9, 2005" (ANSI/AISC 360-05)
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
5. AISC's "Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications," dated December 13, 2005 (ANSI/AISC 358-05).

E. Preinstallation Conference: Conduct conference at Project site prior to shop drawing preparation to comply with requirements in Division 01 Section "Project Management and Coordination."
1. The following personnel are required to attend:
   a. Contractor's Project Manager
   b. Fabricator's Project Manager
   c. Detailer
   d. Erector's Foreman
   e. Structural Engineer of Record
   f. Special Inspector

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. W-Shapes: ASTM A 992/A 992M or ASTM A 572/A 572M, Grade 50 (345).

C. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50 (345).

D. Plate and Bar: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50 (345).

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: Standard, unless otherwise specified on the Drawings.
2. Finish: Black, except where indicated to be galvanized.

G. Welding Electrodes: Comply with AWS requirements and, where welds are part of the Seismic Load Resisting System, comply with the March 9, 2005 edition of "Seismic Provisions for Structural Steel Buildings" (ANSI/AISC 341-05), Appendix W.

1. All welds used in members and connections in the Seismic Load Resisting System shall be made with a filler metal that can produce welds that have a minimum Charpy V-Notch toughness of 20 ft-lb (27J) at 0 degrees F (minus 18 degrees C) as determined by appropriate AWS A5 classification test method or manufacturer certification.
2. Welds identified as "demand critical" shall be made with a filler metal capable of providing minimum Charpy V-Notch toughness as follows:
   a. 20 ft-lb (27J) at –20 degrees F (-29 degrees C) as determined by the appropriate AWS classification test method or manufacturer certification.
   b. 40 ft-lb (54J) at 70 degrees F (21 degrees C) as determined by the March 9, 2005 edition of "Seismic Provisions for Structural Steel Buildings," Appendix X.
   c. SMAW electrodes classified in AWS A5.1 as E7018 or E7018-X, SMAW electrodes classified in AWS A5.5 as E7018-C3L or E8018-C3, and GMAW solid electrodes are exempt from production lot testing when the CVN toughness of the electrode equals or exceeds 20 ft-lb (27J) at a temperature not exceeding –20 degrees F (-29 degrees C) as determined by AWS classification test methods. The manufacturer's certificate of compliance shall be considered sufficient evidence of meeting this requirement.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain, except provide hot-dip zinc coating, ASTM A 153/A 153M, Class C for connections to galvanized structural steel.

2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
   a. Finish: Plain, except provide mechanically deposited zinc coating, ASTM B 695, Class 50 for connections to galvanized structural steel.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex or round head steel structural bolts with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain, except provide mechanically deposited zinc coating, ASTM B 695, Class 50 for connections to galvanized structural steel.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Hooked.
2. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Finish: Plain.

E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain.

F. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M) hardened or ASTM A 36/A 36M carbon steel.
3. Finish: Plain.

G. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

H. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

I. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

J. Expansion Bolts: Wedge anchor appropriate for solid masonry or concrete of size as noted on the Drawings, or if not noted, as required to withstand required loading. Acceptable products include, but are not limited to, the following.

1. Hilti Kwik-Bolt II Stud Anchors
2. Red Head Wedge Anchors
3. Rawl Power-Fast Anchors

4. Fastenal Stud Anchors

K. Adhesive Anchors: Threaded anchors with a chemical capsule containing premeasured amounts of liquid polyester resin, quartz aggregate and a catalyst. Size and embedment depth shall be as noted on the Drawings, or if not noted, as required to withstand required loading. Acceptable products include, but are not limited to, the following:

1. Hilti HVA Adhesive Anchors
2. Rawl Needle-Capsule Anchor System

2.3 PRIMER

A. Primer for Interior Applications: Alkyd or modified alkyd primer, compatible with topcoat; Tnemec 394 Perime Prime or an approved equal.

B. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:
   a. 100 Non-Shrink Grout (Non-Metallic); Conspec, Inc.
   b. Supreme Grout; Cormix, Inc.
   c. Sure Grip Grout; Dayton Superior
   d. Euco N.S.; Euclid Chemical Co.
   e. Crystex; L & M Construction Chemicals, Inc.
   f. Masterflow 713; Master Builders
   g. Sealtight 588 Grout; W.R. Meadows
   h. Propak; Protex Industries, Inc.
   i. Set Non-Shrink; Set Products, Inc.
   j. Five Star Grout; U.S. Grout Corp.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.

3. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's Code of Standard Practice for Steel Buildings and Bridges for structural steel identified as architecturally exposed structural steel.
1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
3. Comply with the Supplement to May 2003 "Modern Steel Construction" titled "Architecturally Exposed Structural Steel."

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning, SSPC-SP 2, "Hand Tool Cleaning, or SSPC-SP 3, "Power Tool Cleaning."

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

H. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened except where pretensioned and slip critical joints are specified.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Galvanized surfaces.
5. Top Flanges of beams specified to receive field-welded shear connectors.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 3, "Power Tool Cleaning" for interior applications.
2. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" for exterior applications.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 2.0 mils for interior applications and 3.0 mils for exterior applications. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize shelf angles attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

2. Owner may waive shop inspections upon receipt of required fabricator certification.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. At bolted connections that are part of the Seismic Load Resisting System, testing and inspection shall include requirements stated in the March 9, 2005 edition of the "Seismic Provisions for Structural Steel Buildings" (ANSI/AISC 341-05), Appendix Q, Section Q5.3.

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.
5. At welds that are part of the Seismic Load Resisting System, testing and inspection shall include requirements stated in the March 9, 2005 edition of "Seismic Provisions for Structural Steel Buildings" (ANSI/AISC 341-05), Appendix Q, Section Q5.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. The building relies on the presence of steel deck to be stable. Maintain temporary bracing as required for stability until all decking is fastened in place.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings."

B. Base Plates: Clean concrete- bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.

1. Set base plates for structural members on wedges, shims, or setting nuts as required.
2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
3. Promptly pack non-shrink grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
4. Alternatively, 1/4" thick leveling plates, with plan dimensions equal to the specified base plates, may be set on non-shrink grout. Leveling plates shall bear uniformly on nonshrink grout with the required anchor bolts projecting through them and with the top surface level in all directions. Base plates will then be set directly on the leveling plate. Tighten anchor bolts after all members are set in their final position and plumb.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
1. For architecturally exposed structural steel, comply with the Supplement to the May 2003 "Modern Steel Construction" titled "Architecturally Exposed Structural Steel."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened except where pretensioned or slip critical joints are specified.

2. Bolted Connections that are part of the Seismic Load Resisting System: All bolts shall be pretensioned and shall meet the requirements for slip-critical faying surfaces in accordance with AISC specification J3.8 with a Class A surface. Bolts shall be installed in standard holes.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Where indicated on the Drawings or approved Shop Drawings, remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   1. At bolted connections that are part of the Seismic Load Resisting System, testing and inspection shall include requirements stated in the March 9, 2005 edition of the "Seismic Provisions for Structural Steel Buildings" (ANSI/AISC 341-05), Appendix Q, Section Q5.3.

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

   1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
      a. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      b. Ultrasonic Inspection: ASTM E 164.
   2. At welds that are part of the Seismic Load Resisting System, testing and inspection shall include requirements stated in the March 9, 2005 edition of "Seismic Provisions for Structural Steel Buildings" (ANSI/AISC 341-05), Appendix Q, Section Q5.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

   1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural steel.

   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   2. Apply primer of same type as shop primer used on adjacent surfaces. Apply to a minimum dry film thickness of 2.5 mils.

END OF SECTION 051200

SECTION 052100

STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. K-series steel joists.
2. KCS-type, K-Series steel joists.
3. Joist accessories.

B. Related Sections include the following:

1. Division 1 Section: "Sustainable Design Requirements" for recycled content and regionally manufactured material goals.
2. Division 1 Section: "Construction Waste Management and Disposal" for recycling and salvage of construction waste requirements.

1.3 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Joists requiring modification by the manufacturer to support nonuniform, unequal, or special loading conditions that invalidate SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads within limits and under conditions indicated.

B. Design special joists to withstand design loads with deflections no greater than the following:

1. Vertical deflection of 1/360 of the span live load and 1/240 of the span under total load.
2. Wind Uplift Loads: Wind uplift loads for the design of roof joists are specified on the Drawings. Modify joist design and bridging layout as required to resist specified loads.

1.5 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

a. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories; connection details; and attachments to other construction.
1. Indicate locations and details of bearing plates to be embedded in other construction.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Certification of Compliance: After completion of fabrication, the fabricator shall submit a letter certifying that the fabricated steel joists conform with the construction documents for the project.

F. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

G. Qualification Data: Submit verification of SJI Certification.

H. Field quality-control test and inspection reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.

1. Manufacturer must be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.
2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
3. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in Maine and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of joists that are similar to those indicated for this Project in material, design, and extent.

B. SJI Specifications: Comply with SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, "Specifications"), applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.3 "Structural Welding Code--Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for chord and web members.

1. Recycled Content: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Bearing Plates: ASTM A 36/A 36M.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

D. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, Type I, red oxide; FS TT-P-636, red oxide; or manufacturer's standard shop primer complying with performance requirements of either of these red-oxide primers.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord; of joist type indicated.

1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or --channel members.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type R top-chord extensions, where indicated, complying with SJI's "Specifications."
   1. Provide top chord extensions or extended ends of capacity equal to the joist capacity for the span indicated, unless otherwise specified on drawings.

E. Camber joists according to SJI's "Specifications."

F. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

G. Provide bottom chord extension at columns and elsewhere as indicated on the drawings.

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."

C. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.

D. Supply miscellaneous accessories, as required to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Space, adjust, and align joists accurately in location before permanently fastening.
2. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
3. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel and bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists longer than 40 feet to supporting steel framework using carbon-steel bolts. Field weld joist seats to supports after all joists within the bay are bolted.

E. Bolt tie joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated. Field weld after surrounding joists are welded.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

1. Do not apply construction loads to joist substitutes until steel decking is secured to top flanges.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Field welds will be visually inspected according to AWS D1.1.

C. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following procedures, as applicable:

1. Magnetic Particle Inspection: ASTM E 709.

D. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, and abutting structural steel.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer, which ensures joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 053100

STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Composite floor deck.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated. Include structural data as required to verify compliance with structural requirements.

B. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

    a. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, recessed sump pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1. Provide a layout drawing indicating spacing for shear connectors for composite slabs. Show spacing coordinated with layout of deck ribs.

D. Product Certificates: For each type of steel deck, signed by product manufacturer.

E. Welding certificates.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A manufacturer certified by the Steel Deck Institute to manufacture steel deck complying with applicable standard specifications and load tables published by the Steel Deck Institute.

C. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

E. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

F. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.6 COORDINATION

A. Coordinate steel deck installation with work of other trades. In as much as possible, install steel deck before the installation of perimeter wall systems. Provide additional temporary horizontal bracing when steel deck installation cannot precede perimeter wall installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Deck:

   a. ASC Profiles, Inc.
   b. Canam Steel Corp.;The Canam Manac Group.
   c. Consolidated Systems, Inc.
   d. DACS, Inc.
   e. D-Mac Industries Inc.
   f. Epic Metals Corporation.
   g. Marlyn Steel Decks, Inc.
   h. New Millennium Building Systems, LLC.
   i. Nucor Corp.; Vulcraft Division.
   j. Roof Deck, Inc.
   k. United Steel Deck, Inc.
   l. Valley Joist; Division of EBSCO Industries, Inc.
   m. Verco Manufacturing Co.
   n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches (38 mm).
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (275), G60 (Z180) zinc coating.
2. Profile Depth: As indicated.

3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: Triple span or more.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile indicated or, if not indicated, recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and sloped recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

I. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-laps.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection, except as required to fasten to sloped framing.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to structural steel and steel joist supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated on the Drawings.

B. Side-Lap Fastening: Fasten side laps of panels between structural steel and steel joist supports, at intervals indicated on the Drawings and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

C. Perimeter Edge Fastening: Fasten perimeter edges to structural steel supports with 5/8 inch (16 mm) diameter puddle welds at 6 inches (152 mm) on center, unless otherwise indicated on the Drawings.

D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum.

E. Roof Sump Pans: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space welds as indicated on Drawings.
3. Where shear connectors are welded through steel floor deck, shear connector welds can serve as deck welds.

B. Side-Lap Fastening: Fasten side laps of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (910 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

C. Perimeter Edge Fastening: Fasten perimeter edges of floor deck, parallel with the deck span, with 5/8 inch (16 mm) diameter puddle welds at 12 inches (305 mm) on center, unless otherwise specified on the Drawings.

D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Butted.

E. Shear Connectors: Weld shear connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Butt end joints of deck panels; do not overlap. Remove and discard arc shields after welding shear connectors.

F. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

G. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing wall framing.
2. Roof rafter framing.
3. Exterior non-load-bearing curtain-wall framing.
4. Exterior ceiling and soffit framing.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing metal-stud framing and ceiling-suspension assemblies.
3. Division 9 Section "Gypsum Sheathing" for sheathing and air infiltration barrier.

1.3 DEFINITIONS

A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

1.4 PERFORMANCE REQUIREMENTS

A. Design Responsibility: The contractor is required to provide the complete design and detailing of the walls, rafters and exterior soffit framing systems to resist specified loads within deflection limits specified where cold-formed metal framing is indicated. Where necessary or desirable, the contractor may substitute structural steel components for increased strength or stiffness. Such substitutions will be included in the design and detailing submittal and shall be provided at no additional cost to the Owner. Size limitations identified on the drawings pertain to both cold-formed metal framing and structural steel components. All design and detailing of

structural steel and cold-formed metal framing is subject to approval by the Structural Engineer of record.

B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As shown on Structural Drawings

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Roof Rafter Framing: Horizontal deflection of 1/360 of the horizontally projected span.
b. Exterior Wall Framing: Horizontal deflection of 1/360 of the stud length under wind load.
c. Exterior Ceiling and Soffit Framing: Vertical deflection of 1/360 of the span under wind uplift load.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

a. Downward movement of 3/4 inch at floor levels.

b. Downward movement of 1-1/2" inch at roof level.

C. Design exterior non-load-bearing curtain-wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.5 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

a. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Shop Drawings shall be signed and sealed by the qualified professional engineer responsible for the design.

D. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Expansion anchors.
2. Power-actuated anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.
5. Miscellaneous structural clips and accessories.

H. Research/Evaluation Reports: Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and galvanized-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

G. AISI Specifications: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" or "Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members" and the following for calculating structural characteristics of cold-formed metal framing:

1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

1.8 SEQUENCE

A. Install cold-formed metal exterior non-load bearing wall studs after dead loads from concrete floors and/or roof deck are in place at the level below and directly above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
1. Clark Steel Framing Industries.
2. Dale Industries, Inc.
3. Dietrich Industries, Inc.
4. MarinoWare; Div. of Ware Industries, Inc.
5. Scafco Corp.

6. Unimast, Inc.
7. Super Stud Building Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating:
   a. G90 (Z275) at exterior non-load bearing studs supporting masonry veneer.
   b. G60 (Z180) at all other cold-formed metal framing.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.

2. Coating: G90 (Z275).

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-5/8 inches (41 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch .
2. Flange Width: 1-5/8 inches (41 mm).

2.4 NON-LOAD-BEARING CURTAIN-WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: 0.0428 inch (18 gauge).
2. Flange Width: 1-5/8 inches

3. Uncoated steel thickness, flange width, and stud spacing shall be as required to suit design loads.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: Matching steel studs.
2. Flange Width: 2 inches

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:.

1. Minimum Uncoated-Steel Thickness: 0.0428 inch.
2. Flange Width: 2 inches.

D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads, and as follows:

a. Minimum Uncoated-Steel Thickness: 0.0428 inch.
b. Flange Width: 2 inches

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Uncoated-Steel Thickness: 0.0428 inch.
b. Flange Width: As required such that the minimum base width equals to the sum of outer deflection track width, vertical deflection, fastener diameter, and minimum fastener edge distance.

E. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure.

2.5 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-5/8 inches, minimum.

B. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section joist track, with unstiffened flanges; unpunched; of web depths indicated; and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-5/8 inches, minimum.

2.6 CEILING AND SOFFIT FRAMING

A. Steel Ceiling Joists: At exterior ceilings and soffits, provide manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).

2. Minimum Flange Width: 1-5/8 inches (41 mm)

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Stud kickers.
8. Hole reinforcing plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153 Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2. Minimum size; No. 10-16 (D=.190"), with length adequate for 3 threads to project through the connected members.

F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

E. Thermal Insulation: ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

2.10 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

E. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

F. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

G. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

H. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

I. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

J. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 NON-LOAD-BEARING CURTAIN-WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to infill studs and anchor to primary building structure.

E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 54 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

a. Install solid blocking at every other stud.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace Work that does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 055000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel ladders.
2. Loose bearing and leveling plates.
3. Steel framing and supports for mechanical and electrical equipment as detailed.
4. Steel components, framing, and supports for applications where framing and supports are not specified in other Sections.
5. Miscellaneous metal trim.
6. Elevator Sump-pit cover.
7. Site bollards, interior bollards, and corner guards.
8. Steel door frames in masonry openings.

B. Related Sections include the following:

1. Division 5 Section "Structural Steel" for structural-steel framing system components.
2. Division 9 Section "Painting" for finish paint.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide templates for anchors and bolts specified for installation under other Sections.

C. Samples: Submit bolt samples for exposed exterior bolts in steel trim.

D. Mock-Up: For all exterior galvanized components, provide a mock-up of one component for each item to be hot-dip galvanized. Obtain approval of mock-up prior to galvanizing other components. Approval will be given if mock-up is free of heat distortions.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. Architectural Exposed Steel: Comply with the Fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for all exposed exterior steel.

D. Mock-up: Provide mock-up samples of all fabrications to be hot-dip galvanized prior to proceeding with galvanizing work. Mock-up samples will be reviewed for material resistance to deformation due to heat of galvanizing process. Proceed with hot-dip galvanizing only after written approval of mock-up.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500, Grade B.

C. Steel Pipe: ASTM A 53, Type E or S, Grade B, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).

E. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

F. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 PAINT

A. Shop Primer for Ferrous Metal:

1. For exterior applications where galvanizing is not indicated, provide an organic zinc-rich primer complying with SSPC Print 20 and compatible with topcoat specified under Division 9 Section "Painting." Subject to compliance with requirements, provide one of the following

a. Tneme-Zinc 90-97; Tnemec Company, Inc.

2. For interior applications, provide fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FASTENERS

A. General: Provide fasteners of materials compatible with connected parts. Where galvanized fasteners are indicated, provide zinc-plated fasteners with coating complying with ASTM B633, Class Fe/Zn5. Select fasteners for type, grade, and class required to withstand loading and atmospheric conditions anticipated in service.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and flat washers; ASTM F593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 2 (A4).

1. Provide stainless steel bolts and nuts where bolt or nut will be exposed and unfinished at exterior locations.

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

1. Provide stainless steel Alloy Group 2 (Type 316) stainless steel machine screws where anchor is to be exposed and unfinished at exterior locations.

F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

1. Provide stainless steel Alloy Group 2 (Type 316) stainless steel lag bolts where anchor is to be exposed and unfinished at exterior locations.

G. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

1. Provide stainless steel Alloy Group 2 (Type 316) stainless steel screw where anchor is to be exposed and unfinished at exterior locations.

H. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).

1. Provide stainless steel Alloy Group 2 (Type 316) stainless steel washer where anchor is to be exposed and unfinished at exterior locations.

I. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).

1. Provide stainless steel Alloy Group 2 (Type 316) stainless steel lock washer where anchor is to be exposed and unfinished at exterior locations.

J. Adhesive Anchors: Threaded anchors with a chemical capsule containing prepared amounts of liquid polyester resin, quartz aggregate, and a catalyst. Size and embedment depth shall be as noted on the drawings, or if not noted, as required to withstand required loading. Acceptable products include, but are not limited to:

a. Hilti HVA Adhesive Anchors
b. Red Head Redi-Chem Anchors
c. Rawl Needle-Capsule Anchors System
d. Fastenal Chemical Capsule Anchors

2. Provide stainless steel Alloy Group 2 (Type 316) stainless steel adhesive anchors where anchor is to be exposed and unfinished at exterior locations.

K. Sleeve Anchors: Hilti or Rawl Lok/Bolt with Hex Nut (HX). Provide tamperproof nut as indicated.

1. Provide stainless steel Alloy Group 2 (Type 316) stainless steel anchors where anchor is to be exposed and unfinished at exterior locations.

L. Renovation Anchors: Hilti, HIT C-20 system, female type.

1. Provide stainless steel Alloy Group 2 (Type 316) stainless steel anchors where anchor is to be exposed and unfinished at exterior locations.

M. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Alloy Group 2 stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).
3. Products:
   a. Hilti Kwik-Bolt II Stud Anchors
   b. Red Head Wedge Anchors
   c. Rawl Power-Fast Anchors
   d. Fastenal Stud Anchors

N. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

1. Provide stainless steel Alloy Group 2 (Type 316) stainless steel toggle bolts where anchor is to be exposed and unfinished at exterior locations.

2.5 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate. Fabricate joints that will be exposed to inmates in a man-

ner to provide no concealed spaces in which foreign objects might be concealed including flat metal pieces.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Remove sharp or rough areas on exposed surfaces. Fabricate with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust, scale, rolled trade names and roughness. Before cleaning, treating, galvanizing, or shop priming, remove blemishes by filling or grinding or by welding and grinding.

J. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, security, flat-head (countersunk) screws or bolts. Locate joints where least conspicuous. Back-up exposed joints to remove access to voids within fabrications.

2.8 STEEL LADDERS

A. General: Fabricate ladders for locations shown.

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1. Provide ladder with first rung not more than 1'-0" above the pit floor, and with additional rungs at no more than 1'-0" on center. Align the top rung with the access floor level. Extend side rails 4'-6" above the access floor level.
3. For attic ladders, comply with OSHA. Provide ladder with first rung at 1'-0" above finish floor, with additional rungs at 1'-0" on center. Extend side rails to within 1" of attic access hatch.

B. Fabricate ladders from materials as detailed on the drawings or if not indicated, as follows:

1. Rung Ladder Siderails: Continuous, 1/2-by-2-1/2-inch (12-by-64-mm) steel flat bars, with eased edges, spaced 18 inches (457 mm) apart.
2. Bar Rungs: 3/4-inch- (19-mm-) diameter steel bars, spaced equally but no more than 12 inches (300 mm) o.c. Align rungs with adjacent floors or standing surfaces.
3. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
4. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long at 24 inches (600 mm) o.c., unless otherwise indicated.
2. Furnish inserts if units must be installed after concrete is placed.

C. Galvanize miscellaneous framing and supports (including door frames) at exterior locations. Exterior locations shall include areas on top of roofing membranes and outside of exterior wall gypsum sheathing.

2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim at exterior locations, typically.

2.12 BOLLARDS

A. Fabricate pipe bollards from 8" diameter Schedule 80 steel pipe. Size pipe length for 4'-0" height above floor or pavement with concrete embedment of 3'-6" at vehicle and exterior applications.

B. Fabricate door operator bollards from tube steel of the size indicated, or if not indicated of 5" square tube steel. Size length for 4'-0" height above floor or pavement with a concrete embedment of 2'-0", and with top of concrete recessed below exterior pavements. Provide 3/16" steel

plate cap welded all around. Coordinate with electrical for cut-outs for devices, and for conduit feeds to control devices.

C. Hot-dip galvanize all exterior bollards.

2.13 SUMP PIT COVERS

A. Diamond Plate Covers: Form to configurations shown from raised-pattern (diamond) steel floor plate of thickness necessary to support indicated loads, but not less than 3/16 inch (4 mm).

B. Hot-dip Galvanize sump pit covers.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint. Coat surfaces of steel which are to be placed in contact with soil with a heavy coat of bituminous paint.

3.2 SETTING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use non-shrink, nonmetallic grout unless otherwise indicated.

C. Where bearing plates are indicated with integral anchors, set in cement grout while grout is fluid. Level the surface and provide temporary support while grout hardens. Do not force anchors in partially hardened grout.

1. Where non-shrink grout is indicated, pack between bearing surfaces as indicated above.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.4 INSTALLING BOLLARDS

A. Coordinate for conduit placement prior to installing switch bollards. Anchor bollards in place with 24" diameter x 48" deep concrete footings set beneath pavements or slabs. Where located on structural slab, provide 1/4" x 12" base plate with countersunk fasteners.

B. Fill safety pipe bollards solidly with concrete, mounding top surface and tooling to provide a smooth domed surface ready for paint.

C. Apply heavy bituminous dampproofing coating to all steel to be concealed by pavements or soil. Refer to Division 7 Section "Bituminous Dampproofing" for product.

3.5 INSTALLING SUMP PIT COVERS

A. Provide edge angle anchored to edge of hole on not less than two sides and screw fasten plate to angle with stainless steel flat head screws. Set edge angle so that cover sets flush with adjacent top surface.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 057000

DECORATIVE METAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Decorative grilles and frames.

B. Related Sections:

   1. Division 05 Section "Metal Fabrications" for non-decorative metal fabrications framing to support decorative grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, including finishing materials.

B. LEED Submittals:

   1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show fabrication and installation details for decorative metal.

   1. Include plans, elevations, component details, and attachments to other work.
   2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

D. Samples for Initial Selection: For products involving selection of color, texture, or design.

E. Samples for Verification: For each type of exposed finish required.

   1. Samples of welded joints showing quality of workmanship.

F. Welding certificates.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. Provide materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.2 STEEL AND IRON

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2.3 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
1. Galvanized-Steel Items: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless exposed fasteners are unavoidable.

1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.5 FABRICATION, GENERAL

A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

E. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.

F. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

G. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

H. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.

1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 Welds: completely sanded joint, some undercutting and pinholes okay.

2.6 DECORATIVE GRILLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ametco, Stadium Design.
2. Orsogril, Pleione Design.

B. Fabricate grille frames from steel bars and rods. Color galvanize over hot-dip galvanizing panels with additional clear topcoat.

1. Drawings indicate grille layout required and are based on products of one manufacturer. Similar frame profiles produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.8 STEEL AND IRON FINISHES

A. Color Galvanize Finish: Prepare, treat, and coat galvanized metal:

1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply color galvanizing with clear topcoat finish.
4. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal grilles.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure decorative metal grilles to in-place construction.

B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

E. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

F. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

G. Field Brazing: Comply with requirements for brazing and for finishing brazed connections in "Fabrication, General" Article. Braze connections that are not to be left as exposed joints but cannot be shop brazed because of shipping size limitations.

3.3 INSTALLING DECORATIVE GRILLES

A. Fasten grille frames to concrete and masonry walls with cast-in-place or postinstalled anchors.

3.4 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

C. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.

D. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057000

SECTION 061053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Plywood backing panels.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:
1. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
2. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.

a. Include statement indicating costs for each certified wood product.

1.5 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
1. Miscellaneous lumber.
2. Plywood.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
1. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings, and the following:
1. Concealed blocking.
2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content of any species.

C. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content and any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB, or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as

determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 061600

SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wall sheathing. (Also to be used at Parking Deck ceiling on 2nd Level)

2. Composite nail base insulated roof sheathing
3. Sheathing joint-and-penetration treatment.

B. Related Sections include the following:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.
2. Division 06 Section "Miscellaneous Rough Carpentry" for plywood backing panels.
3. Division 07 Section "Fluid-Applied Membrane Air Barriers" for vapor permeable air barriers applied to sheathing and flexible flashings at openings in sheathing and at joints behind metal composite installation.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

B. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for construction adhesives and sealants, including printed statement of VOC content.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL AND PARKING GARAGE CEILING SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation.
2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 120 inches (1219 by 3048 mm).

2.2 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

A. Vented, Plywood-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation complying with ASTM C 1289, Type II, Class 1, with oriented strand board adhered to spacers on one face.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Atlas Roofing Corporation.
    b. Cornell Corporation.
    c. Dow Chemical Company (The).
    d. Hunter Panel, Cool-Vent.
    e. Johns Manville; Berkshire Hathaway Inc.
    f. Rmax, Inc.

2. Polyisocyanurate-Foam Thickness: 6- inches (152 mm).
3. Oriented Strand board Nominal Thickness: 5/8 inch (15.9 mm).
4. Spacers: Wood furring strips or blocks not less than 3/4 inch (19 mm) thick and spaced not more than 12 inches (300 mm) o.c.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. For wall sheathing, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached,

with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch (0.835 mm) thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.

E. Screws for Fastening Plywood-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

C. Sheathing Compound: ToughRock 90 setting compound. Embed sheathing tape in setting compound. Also to be used for skim coating. (At Parking Deck ceiling.)

D. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
2. Shapes:

   a. Cornerbead.
   b. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening. At parking garage ceiling, a seal must be provided behind the control joint.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

D. Horizontal Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 6 inches o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

3.3 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Roof Sheathing:
   a. Screw to cold-formed metal framing.
   b. Space panels 1/8 inch (3 mm) apart at edges and ends.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
2. At 2nd Level Parking ceiling, embed fiberglass mesh tape in ToughRock 90 setting compound and provide smooth skim coat of the same setting compound. Refer to Division 9 Section "Interior and Exterior Painting" for finish coat.

END OF SECTION 061600

SECTION 064023

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Flush wood paneling and wainscots.
3. Plastic-laminate cabinets.
4. Plastic-laminate countertops.
5. Solid-surfacing-material countertops.
6. Shop finishing of interior woodwork.

B. Related Sections include the following:

1. Division 06 Section "Miscellaneous Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.

2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures and faucets installed in architectural woodwork.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Shop-applied opaque finishes.
3. Plastic laminates.
4. PVC edge material.
5. Thermoset decorative panels.
6. Solid-surfacing materials.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 5 inches (125 mm) wide by 24 inches (600 mm) long, for each species and cut, finished on 1 side and 1 edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
3. Veneer-faced panel products with or for transparent finish, 8 by 10 inches (200 by 250 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.

E. LEED Submittals:

1. Product Data for Credit EQ 4.1: For installation adhesives, including printed statement of VOC content.
2. Product Data for Credit EQ 4.4:

    a. For each composite-wood product used, documentation indicating that the bonding agent contains no urea formaldehyde.
    b. For each adhesive used, documentation indicating that the adhesive contains no urea formaldehyde.

3. Product Data for Credit(s) MR 4.1: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content

    a. Include statement indicating costs for each product having recycled content.

4. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.

    a. Include statement indicating costs for each certified wood product.

F. Product Certificates: For each type of product, signed by product manufacturer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: Select White Birch.

C. Wood Products: Comply with the following:

1. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 80 percent.
2. Hardboard: AHA A135.4.
3. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
4. Particleboard: ANSI A208.1, Grade M-2.
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
   a. Formica Corporation.
   b. Lamin-Art, Inc.
   c. Nevamar Company, LLC; Decorative Products Div.
   d. Panolam Industries International Incorporated.
   e. Wilsonart International; Div. of Premark International, Inc.

E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. E. I. du Pont de Nemours and Company.
   b. Formica Corporation.
   c. LG Chemical, Ltd.
   d. Meganite Inc.; a division of the Pyrochem Group.
   e. Nevamar Company, LLC; Decorative Products Div.
   f. Wilsonart International; Div. of Premark International, Inc.

2. Type: Standard type or Veneer type made from material complying with requirements for Standard type, as indicated, unless Special Purpose type is indicated.
3. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Pulls: Back mounted, solid metal, similar to Siro Cabinet Hardware – Polished Stainless Steel Collection – 128 mm Bow Pull (SIR-551442).

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.

F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

G. Drawer Slides: BHMA A156.9, B05091.
1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Wood Species and Cut: Select White Birch.

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

E. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

2.6 FLUSH WOOD PANELING AND WAINSCOTS

A. Grade: Custom.

B. Wood Species and Cut: Select White Birch.

1. Lumber Trim and Edges: At fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction compatible with grain and color of veneered panels.

C. Matching of Adjacent Veneer Leaves: Book match.

D. Veneer Matching within Panel Face: Running match.

2.7 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Vertical Surfaces: Grade HGS.
3. Edges: PVC T-mold matching laminate in color, pattern, and finish.

D. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.

a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

2. Drawer Sides and Backs: Thermoset decorative panels.
3. Drawer Bottoms: Thermoset decorative panels.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish.
b. Wood grains, matte finish.
c. Patterns, matte finish.

G. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.8 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Architect from manufacturer's full range in the following categories:
a. Wood grains, matte finish.
b. Patterns, matte finish.

D. Edge Treatment: As indicated.

E. Core Material: Particleboard or medium-density fiberboard.

F. Core Material at Sinks: Particleboard made with exterior glue.

G. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.9 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Custom.

B. Solid-Surfacing-Material Thickness: 1/2 inch (13 mm).

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with loose backsplashes for field application.

E. Drill holes in countertops for plumbing fittings in shop.

2.10 CLOSET SHELVING

A. Grade: Custom.

B. Shelf Material: 3/4-inch (19-mm) thermoset decorative panel with PVC or polyester edge banding.

C. Cleats: 3/4-inch (19-mm) solid lumber, where adjustable shelves are not indicated.

2.11 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section.

D. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

E. Transparent Finish:

1. Grade: Custom.
2. AWI Finish System: Catalyzed polyurethane.
3. Staining: None required.
4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches (1500 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

G. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips or splined connection strips. Do not use face fastening, unless otherwise indicated.

1. Install flush paneling with no more than 1/16 inch in 96-inch (1.5 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.

H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 071416

COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Two-component unmodified latex-rubber waterproofing.

B. Related Section:

   1. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Product Test Reports: For waterproofing, based on evaluation of comprehensive tests performed by a qualified testing agency.

C. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that is acceptable to waterproofing manufacturer for installation of waterproofing required for this Project.

B. Preinstallation Conference: Conduct conference at Project site.

   1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.

1. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.7 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which waterproofing manufacturer and Installer agree to repair or replace waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate that exceed 1/16 inch (1.6 mm) in width.
2. Warranty Period: Five years from date of Substantial Completion.

B. Special Installer's Warranty: Specified form, on warranty form at end of this Section, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 LATEX-RUBBER WATERPROOFING

A. Two-Component, Unreinforced, Latex-Rubber Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Grace, W. R. & Co.; Procor.

2.2 AUXILIARY MATERIALS

A. General: Provide auxiliary materials recommended by manufacturer to be compatible with one another and with waterproofing, as demonstrated by waterproofing manufacturer, based on testing and field experience.

2.3 PROTECTION COURSE

A. Protection Course: Hydroduct 220 Drainage Composite as manufactured by W.R. Grace. Install when waterproofing is tacky.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage or overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.

D. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

3.3 PREPARATION AT TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves according to ASTM C 898 and manufacturer's written instructions.

3.4 JOINT AND CRACK TREATMENT

A. Prepare,. treat, rout, and fill joints and cracks in substrate according to ASTM C 898 and waterproofing manufacturer's written instructions. Remove dust and dirt from joints and cracks, complying with ASTM D 4258, before coating surfaces.

1. Comply with ASTM C 1193 for joint-sealant installation.
2. Apply bond breaker between sealant and preparation strip.
3. Prime substrate and apply a single thickness of preparation strip extending a minimum of 3 inches (75 mm) along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.

3.5 WATERPROOFING APPLICATION

A. Apply waterproofing according to ASTM C 898 and manufacturer's written instructions.

B. Start installing waterproofing in presence of manufacturer's technical representative.

C. Apply primer over prepared substrate.

D. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.

1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases, with an average dry film thickness of 60 mils (1.5 mm).
2. Apply waterproofing to prepared wall terminations and vertical surfaces.
3. Verify wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).

E. Install protection course with butted joints over nominally cured membrane before starting subsequent construction operations.

3.6 CURING, PROTECTION, AND CLEANING

A. Cure waterproofing according to manufacturer's written recommendations, taking care to prevent contamination and damage during application stages and curing.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071416

SECTION 072100

THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Mineral-Wool board insulation.
3. Glass-fiber blanket insulation.

B. Related Sections:
1. Division 07 Section "Cold Fluid-Applied Waterproofing" for insulated drainage panels installed with waterproofing.
2. Division 07 Section(s) "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv Building Products.

2. Type IV, 25 psi (173 kPa).

2.2 MINERAL-WOOL BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Fibrex Insulations Inc.
2. Isolatek International.
3. Owens Corning.
4. Roxul Inc.
5. Thermafiber.

B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Nominal density of 4 lb/cu. ft. (64 kg/cu. m), Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).

C. Foil-Faced, Mineral-Wool Board Insulation: ASTM C 612; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 25 and 5, respectively, per ASTM E 84.

1. Nominal density of 4 lb/cu. ft. (64 kg/cu. m), Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).

2.3 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.4 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
b. Gemco; Spindle Type.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.

3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; RC150.
b. Gemco; R-150.

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
a. Ceiling plenums.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; TACTOO Adhesive.
b. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry."

3.5 INSTALLATION OF MINERAL-WOOL BOARD INSULATION

A. Mineral-Wool board insulation: Install in framed ceiling plenum for thermal and fire resistive assembly. Board to be installed in two layers with staggered joints.

3.6 INSTALLATION OF GLASS-FIBER INSULATION

A. Glass-Fiber or Mineral-Wool Blanket Insulation: Used only in areas that are void and rigid insulation cannot be installed:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

3.7 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072726

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fluid-applied membrane air barrier, vapor retarding.

B. Related Sections include the following:
1. Division 04 Section "Unit Masonry" for embedded flashings.
2. Division 06 Section "Sheathing" for wall sheathings, wall sheathing joint-and-penetration treatments, building paper, and building wraps.
3. Division 07 Section "Thermal Insulation" for foam-plastic board insulation.
4. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
5. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air Barrier Assembly Air Leakage: Not to exceed 0.0008 cfm x sq. ft. of surface area at 1.57 lbf/sq. ft. (0.004 L/s x sq. m of surface area at 75 Pa); ASTM E 2357.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

B. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

C. Qualification Data: For Applicator.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance and that is an ABAA-licensed contractor, employs certified and registered installers, and complies with ABAA's Quality Assurance Program.

B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly shown on Drawings, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
   1. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
   2. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

C. Preinstallation Conference: Conduct conference at Project site.

   1. Include installers of other construction connecting to air barrier, including roofing, waterproofing, architectural precast concrete, masonry, sealants, windows, glazed curtain walls, and door frames.
   2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store rolls according to manufacturer's written instructions.

D. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Synthetic polymer membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Synthetic Polymer Membrane:

1) Grace, W. R. & Co.; Perm-A-Barrier Liquid.

3. Physical and Performance Properties:

a. Membrane Air Permeance: Not to exceed 0.0002 cfm x sq. ft. of surface area at 1.57-lbf/sq. ft. (0.001 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
b. Membrane Vapor Permeance: Not to exceed 0.08 perm (4.6 ng/Pa x s x sq. m); ASTM E 96.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Flexible Membrane Wall Flashing: 0.8 mm (32 mils), self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a minimum 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

C. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

D. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft (24 to 32 kg/cu. m) density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

E. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.

B. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials .

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Apply Perma-A-Barrier Wall Flashing and Detail Membrane so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.5 AIR BARRIER MEMBRANE INSTALLATION

A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

C. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.

1. Vapor-Retarding Membrane Air Barrier: 60-mil (1.5-mm) dry film thickness.

D. Apply according to air barrier manufacturer's written instructions.

E. Do not cover air barrier until it has been inspected.

F. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.6 FIELD QUALITY CONTROL

A. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
7. Termination mastic has been applied on cut edges.
8. Strips and transition strips have been firmly adhered to substrate.
9. Compatible materials have been used.
10. Transitions at changes in direction and structural support at gaps have been provided.

11. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
12. All penetrations have been sealed.

B. Remove and replace deficient air barrier components.

3.7 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 60 days.
2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074213

METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Concealed-fastener, lap-seam metal wall panels.
2. Metal liner panels.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for support framing, including girts, studs, and bracing.
2. Division 07 Section "Composite Wall Panels" for metal-faced composite wall panels.
3. Division 07 Section "Sheet Metal Flashing and Trim" for flashing and other sheet metal work that is not part of metal wall panel assemblies.

1.3 DEFINITION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12 lbf/sq. ft. (575 Pa).

1. Water Leakage: As defined according to AAMA 501.1.
2. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

E. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:
   a. Uniform pressure as indicated on Drawings.

2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 of the span.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

   a. Flashing and trim.
   b. Anchorage systems.

C. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Wall Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
2. Trim and Closures: 12 inches (305 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- (305-mm-) long Samples for each type of accessory.

E. Maintenance Data: For metal wall panels to include in maintenance manuals.

F. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of metal wall panel from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review temporary protection requirements for metal wall panel assembly during and after installation.
7. Review wall panel observation and repair procedures after metal wall panel installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, and studs, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Surface: Smooth, flat finish.
3. Exposed Coil-Coated Finish:

a. 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 FIELD-INSTALLED THERMAL INSULATION

A. Refer to Division 07 Section "Thermal Insulation."

2.3 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.4 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Metenco-Morin Design F-12-1 or comparable product by one of the following:
   a. Berridge Manufacturing Company.
   b. MBCI; Div. of NCI Building Systems.

2. Material: Zinc-coated (galvanized) steel sheet, 0.040-inch (1.02-mm) (20 gage) nominal thickness.

   a. Exterior Finish: 3-coat fluoropolymer.
   b. Color: Match Architect's sample.

3. Panel Coverage: 12 inches (305 mm).
4. Panel Height: 1.5 inches (38 mm).

2.5 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.018-inch (0.46-mm) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.6 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal wall panels.
2. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal wall panel work proceeds.
6. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
7. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

E. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.

7. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

F. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from sheathing for thickness of insulation indicated.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

SECTION 074243

COMPOSITE WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes metal-faced composite wall panels with mounting system. Panel mounting system includes anchorages, shims, furring, fasteners, gaskets and sealants, related flashing adaptors, and masking (as required) for a complete installation.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal-faced composite wall panels.
2. Division 06 Section "Sheathing."
3. Division 07 Section "Sheet Metal Flashing and Trim."
4. Division 07 Section "Joint Sealants."

1.3 DEFINITION

A. Metal-Faced Composite Wall Panel Assembly: Metal-faced composite wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal-faced composite wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

C. Water Penetration Under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Structural Performance: Provide metal-faced composite wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:
   a. Uniform pressure as indicated on Drawings.

2. Deflection Limits: Metal-faced composite wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal-faced composite wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

   a. Flashing and trim.
   b. Anchorage systems.

C. Samples for Initial Selection: For each type of metal-faced composite wall panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal-Faced Composite Wall Panels: Minimum 12 x 12 inches (300 x 300 mm). Include fasteners, closures, and other metal-faced composite wall panel accessories.

2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
4. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.

E. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Wall panels and attachments.
2. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
3. Penetrations of wall by pipes and utilities.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

H. Maintenance Data: For metal wall panels to include in maintenance manuals.

I. Warranties: Samples of special warranties.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Source Limitations: Obtain each type of metal-faced composite wall panel from single source from single manufacturer.

C. Composite wall panel manufacturer shall have a minimum of 5 years of experience in the manufacturing of this product.

D. The fabricator/installer shall be acceptable to the composite panel manufacturer.

E. Panel fabricator/installer shall assume responsibility for all components of the exterior panel system including, but not limited to attachment to sub-construction, panel to panel joinery, panel to dissimilar joinery and joint seal associated with the panel system.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal-faced composite wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.

B. Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F (49 deg C).

D. Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal-faced composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal-faced composite wall panel fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate metal-faced composite wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-faced composite wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal-faced composite wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finishes:
   a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Panel Sealants:

1. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

2. Provide custom color sealant to match panel color selection.

C. Subgirts: Manufacturer's standard C- or Z-shaped sections 0.064-inch (1.63-mm) nominal thickness.

D. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.

E. Base or Sill Angles: 0.079-inch (2.01-mm) nominal thickness.

F. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.2 MISCELLANEOUS MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated.

B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.3 METAL-FACED COMPOSITE WALL PANELS

A. General: Provide factory-formed and -assembled, metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Alcan Composites USA Inc.; Alucobond.
   b. Alcoa Inc.; Reynobond PE.
   c. ALPOLIC, Division of Mitsubishi Chemical America, Inc.; ALPOLIC.

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch thick, coil-coated aluminum sheet facings.

1. Exterior Finish: 3-coat fluoropolymer.

   a. Color: Match Architect's samples.

C. Attachment System Components: Formed from extruded aluminum.

2.4 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.

B. Flashing and Trim: Formed from 0.018-inch- (0.46-mm-) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.

2.5 FABRICATION

A. General: Fabricate and finish metal-faced composite wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal-faced composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Metal-Faced Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.

1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
4. Dimensional Tolerances:

    a. Panel Bow: 0.8 percent maximum of panel length or width.
    b. Squareness: 0.25 inch (5 mm) maximum.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal-faced composite wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal-faced composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

3.3 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

A. General: Install metal-faced composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal-faced composite wall panels.
2. Flash and seal metal-faced composite wall panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
3. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
4. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal-faced composite wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.

1. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

E. Attachment System Installation, General: Install attachment system required to support metal-faced composite wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.

F. Track-Support Installation: Provide manufacturer's standard horizontal and vertical tracks that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach panels to wall by interlocking tracks with perimeter extrusions attached to wall panels. Fully engage integral gaskets and leave horizontal and vertical joints with open reveal.

1. Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
2. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
3. System: Rout and Return Wet. System must provide a wet seal (caulked) reveal joint as Drawings. System shall have integral weep holes and drainage.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal-faced composite wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal-faced composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal-faced composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

B. After metal-faced composite wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal-faced composite wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074243

SECTION 074600

METAL SOFFITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Aluminum soffit.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Division 06 Section "Sheathing" for wall sheathing and weather-resistive barriers.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For soffit including related accessories.

C. Samples for Verification:
1. 12-inch- (300-mm-) long-by-actual-width Sample of soffit.

D. Maintenance Data: For each type of soffit and related accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain soffit, including related accessories, from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a dry, well-ventilated, weathertight place.

1.6 COORDINATION

A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.7 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace soffit that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking, deforming.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 10 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of soffit including related accessories, in a quantity equal to 2 percent of amount installed.

PART 2 - PRODUCTS

2.1 ALUMINUM SOFFIT

A. General: Formed and coated aluminum soffit complying with AAMA 1402.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Hunter Douglas Contract, Series 150F Exterior Soffit system with perforations.

B. Pattern: 6-inch (152-mm) exposure.

C. Ventilation: Provide perforated soffit.

D. Nominal Thickness: 1" nominal.

E. Finish: Manufacturer's standard Luxacote paint finish.

1. Colors: Custom color to match architect's sample.

2.2 ACCESSORIES

A. Aluminum Accessories: Where aluminum accessories are indicated, provide accessories complying with AAMA 1402.

1. Provide 150F Panel Clip for Surface Mount detail.

B. Fasteners:
1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch (6 mm), or three screw-threads, into substrate.
2. For fastening aluminum, use aluminum fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of soffit and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with soffit manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Center nails in elongated nailing slots without binding siding to allow for thermal movement.

B. Install aluminum soffit and related accessories according to AAMA 1402.

1. Install fasteners no more than 48 inches o.c.

C. Install joint sealants as specified in Division 07 Section "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074600

SECTION 075323

ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Loosely laid and ballasted EPDM membrane roofing system.
2. Roof insulation.

B. Related Sections:
1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
3. Division 07 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Division 22 Section "Plumbing Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

1. Corner and Canopy Uplift Pressure: 50 lbf/s.f.
2. Perimeter Uplift Pressure: 40 lbf/sq. ft.
3. Field-of-Roof Uplift Pressure: 32 lbf/sq. ft.

D. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Test Reports for Credit SS 7.2: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement.
2. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

D. Samples for Verification: For the following products, in manufacturer's standard sizes:
1. Roof insulation.
2. 10 lb (4.5 kg) of aggregate ballast in gradation and color indicated.
3. Roof paver in each color and texture required.
4. Termination bars.

E. Qualification Data: For qualified Installer and manufacturer.

F. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

H. Maintenance Data: For membrane roofing system to include in maintenance manuals.

I. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including roof insulation for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements for deck substrate conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, roof pavers, and other components of membrane roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle SynTec Incorporated.
b. Firestone Building Products.
c. GAF Materials Corporation.
d. GenFlex Roofing Systems.
e. Johns Manville.
f. Versico Incorporated.

2. Thickness: 60 mils (1.5 mm), nominal.
3. Exposed Face Color: Black.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesive: 80 g/L.
f. Single-Ply Roof Membrane Sealants: 450 g/L.
g. Nonmembrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.
i. Sealant Primers for Porous Substrates: 775 g/L.
j. Other Adhesives and Sealants: 250 g/L.

B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.

C. Protection Sheet: Epichlorohydrin or neoprene non-reinforced flexible sheet, 55- to 60-mil- (1.4- to 1.5-mm-) thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

D. Bonding Adhesive: Manufacturer's standard, water-based.

E. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.

F. Lap Sealant: Manufacturer's standard, single-component sealant.

G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

H. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, compressible tubes, reinforced EPDM securement strips, tapered edge strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.4 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

2.5 ASPHALT MATERIALS

A. Roofing Asphalt: ASTM D 312, Type III or Type IV.

B. Asphalt Primer: ASTM D 41.

2.6 AGGREGATE BALLAST

A. Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following type and size:

1. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone.
2. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
3. Color: Ballast to be as light in color as possible (78 SRI) for LEED Credit.

2.7 ROOF PAVERS

A. Lightweight Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Hanover Architectural Products.
b. Rapid Building Systems.
c. Roofblok Limited.
d. Westile Roofing Products.

2. Size: 23-1/2 inches x 23-1/2 inches.
3. Weight: 15 lbs./s.f.
4. Colors and Textures: Natural color with diamond finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

3.4 LOOSELY LAID AND BALLASTED MEMBRANE ROOFING INSTALLATION

A. Loosely lay membrane roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

1. Comply with requirements in SPRI RP-4 for System 1.

B. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically fasten or adhere perimeter of membrane roofing according to requirements in SPRI RP-4.

E. Mechanically fasten membrane roofing at corners, perimeters, and transitions according to requirements in SPRI RP-4.

1. At corners and perimeters, omit aggregate ballast leaving membrane roofing exposed.
2. At corners and perimeters, adhere a second layer of membrane roofing

F. Apply membrane roofing with side laps shingled with slope of deck where possible.

G. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.

1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.

H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.

I. Leave seams uncovered until inspected by membrane roofing system manufacturer.

J. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

K. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

L. Install protection mat over membrane roofing, overlapping a minimum of 6 inches (150 mm). Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of 12 inches (300 mm).

M. Aggregate Ballast: Apply uniformly over membrane roofing at the rate required by membrane roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to membrane roofing system. Lay ballast as membrane roofing is installed, leaving membrane roofing ballasted at the end of the workday.

1. Ballast Weight: Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m).

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 WALKWAY INSTALLATION

A. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers. Install protection mat below pavers.

3.7 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

3.8 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 ROOFING INSTALLER'S WARRANTY

A. WHEREAS **<Insert name>** of **<Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: **<Insert name of Owner.>**
2. Address: **<Insert address.>**
3. Building Name/Type: **<Insert information.>**
4. Address: **<Insert address.>**
5. Area of Work: **<Insert information.>**
6. Acceptance Date: **<Insert date.>**
7. Warranty Period: **<Insert time.>**
8. Expiration Date: **<Insert date.>**

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

   a. Lightning;
   b. Peak gust wind speed exceeding **<Insert wind speed>** mph (m/sec);
   c. Fire;
   d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. Vapor condensation on bottom of roofing; and
   g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work

according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>, <Insert year>**.

1. Authorized Signature: **<Insert signature>**.
2. Name: **<Insert name>**.
3. Title: **<Insert title>**.

END OF SECTION 075323

SECTION 076100

SHEET METAL ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Standing-seam metal roofing, on-site, roll formed.

B. Related Sections:

1. Division 06 Section "Sheathing" for composite nail base insulated roof sheathing.
2. Division 07 Section "Joint Sealants" for field-applied sealants adjoining sheet metal roofing.
3. Division 07 Section "Sheet Metal Flashing and Trim" for trim components.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Sheet metal roofing system including, but not limited to, metal roof panels, cleats, clips, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, underlayment, and accessories shall comply with requirements indicated without failure due to defective manufacture, fabrication, installation, or other defects in construction. Sheet metal roofing shall remain watertight.

B. Thermal Movements: Provide sheet metal roofing that allows for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, expansion joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Details for forming sheet metal roofing, including seams and dimensions.
2. Details for joining and securing sheet metal roofing, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
3. Details of termination points and assemblies, including fixed points.
4. Details of expansion joints, including showing direction of expansion and contraction.
5. Details of roof penetrations.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail the following accessory items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

    a. Flashing and trim.

C. Samples for Initial Selection: For each type of sheet metal roofing indicated, with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Coordination Drawings: Roof plans drawn to scale with coordinated details for penetrations and roof-mounted items. Show the following:

1. Sheet metal roofing and attachments.
2. Roof-mounted items including pipe supports and penetrations, and other items mounted on sheet metal roofing.

E. Maintenance Data: For roofing sheet metals and accessories to include in maintenance manuals.

F. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Custom-Fabricated Sheet Metal Roofing Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal roofing similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, sheet metal roofing Installer and metal deck Installer, and installers whose work interfaces with or affects sheet metal roofing including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to sheet metal roofing installation.
4. Examine metal deck conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of metal deck during and after roofing installation.
6. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal roofing.
7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for sheet metal roofing during and after roofing installation.
9. Review roof observation and repair procedures after sheet metal roofing installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal roofing materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal roofing installation.

1.7 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in other Sections.

B. Coordinate sheet metal roofing with rain drainage work, flashing, trim, and construction of metal decks, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

A. Special Warranty: Warranty form at the end of this Section in which Installer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures, including but not limited to rupturing, cracking, or puncturing.
   b. Wrinkling or buckling.

c. Loose parts.
d. Failure to remain weathertight, including uncontrolled water leakage.
e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including non-uniformity of color or finish.
f. Galvanic action between sheet metal roofing and dissimilar materials.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROOFING SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Aluminum-Zinc-Coated Steel Sheet: Galvalume.
2. Thickness: Nominal 0.022 inch (0.56 mm) unless otherwise indicated.
3. Surface: Smooth, flat.
4. Exposed Coil-Coated Finish:

a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

5. Color: Match Architect's samples.
6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
3. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High-Temperature Underlayment.

B. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

B. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. General:

a. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
c. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Zinc-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M, ASTM F 2329, or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 ACCESSORIES

A. Sheet Metal Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.

1. Provide accessories as recommended by portable roll-forming equipment manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
2. Cleats: For mechanically seaming into joints and formed from the following materials:

   a. Metallic-Coated Steel Roofing: 0.0250-inch- (0.64-mm-) thick stainless steel.

3. Clips: Minimum 0.0625-inch- (1.6-mm-) thick, stainless-steel panel clips designed to withstand negative-load requirements.
4. Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA.
5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible-closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
6. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 inch (0.46 mm) thick.

2.5 FABRICATION

A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.
   1. Standing-Seam Roofing: Form standing-seam panels with finished seam height of 1-1/2 inches.

B. General: Fabricate roll-formed sheet metal roofing panels with UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article. Fabricate roll-formed sheet metal according to equipment manufacturer's written instructions and to comply with details shown.

C. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

D. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks; true to line and levels indicated; and with exposed edges folded back to form hems.

E. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

F. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards.

G. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of the metals in contact.

H. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

1. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

I. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances required for finished roofing installation.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for drainage, flashings, and penetrations through sheet metal roofing.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof, in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

B. Install flashings to cover underlayment to comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."

C. Apply slip sheet before installing sheet metal roofing.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

1. Field cutting of sheet metal roofing by torch is not permitted.
2. Provide metal closures at peaks, eaves and each side of ridge caps.
3. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.
5. Install ridge caps as sheet metal roofing work proceeds.
6. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition. Install backing plates at roofing splices.

7. Install sealant tape where indicated.
8. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.
9. Do not use graphite pencils to mark metal surfaces.

B. Thermal Movement. Rigidly fasten metal roof panels to structure at only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction.

1. Point of Fixity: Fasten each panel along a single line of fixing located at ridge.
2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.

C. Fasteners: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by SMACNA.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Fasciae: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.4 ON-SITE, ROLL-FORMED SHEET METAL ROOFING INSTALLATION

A. General: Install on-site, roll-formed sheet metal roofing fabricated from UL-certified equipment to comply with equipment manufacturer's written instructions for UL wind-uplift resistance class indicated. Provide sheet metal roofing of full length from eave to ridge unless otherwise restricted by on-site or shipping limitations.

B. Standing-Seam Sheet Metal Roofing: Fasten sheet metal roofing to supports with concealed clips at each standing-seam joint at location, at spacing, and with fasteners recommended by manufacturer of portable roll-forming equipment.

1. Install clips to substrate with self-tapping fasteners.
2. Install pressure plates at locations indicated in equipment manufacturer's written installation instructions.
3. Before panels are joined, apply continuous bead of sealant to top of flange of lower panel.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so cleat, sheet metal roofing, and field-applied sealant are completely engaged.

C. Seal joints as shown and as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.5 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete sheet metal roofing assembly including trim, copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.
2. Install accessories integral to sheet metal roofing that are specified in Division 07 Section "Sheet Metal Flashing and Trim" to comply with that Section's requirements.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual," and where indicated on Drawings.
3. Install exposed flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
4. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, and filled with butyl sealant concealed within joints.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer. Maintain sheet metal roofing in a clean condition during construction.

E. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.8 ROOFING INSTALLER'S WARRANTY

A. WHEREAS **<Insert name>** of **<Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: **<Insert name of Owner>**.
2. Address: **<Insert address>**.
3. Building Name/Type: **<Insert information>**.
4. Address: **<Insert address>**.
5. Area of Work: **<Insert information>**.
6. Acceptance Date: **<Insert date>**.
7. Warranty Period: **<Insert time>**.
8. Expiration Date: **<Insert date>**.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

a. Lightning;
b. Peak gust wind speed exceeding **<Insert wind speed>** mph (m/sec);
c. Fire;

d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. Vapor condensation on bottom of roofing; and
g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.

1. Authorized Signature: **<Insert signature>**.
2. Name: **<Insert name>**.
3. Title: <Insert title>.

END OF SECTION 076100

SECTION 076200

FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed Products:
   a. Formed low-slope roof sheet metal fabrications.
   b. Formed wall sheet metal fabrications.

B. Related Sections:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for installing sheet metal flashing and trim integral with membrane roofing.
3. Division 07 Section "Sheet Metal Roofing" for custom-formed sheet metal flashing and trim integral with sheet metal roofing.
4. Division 07 Section "Fluid-Applied Membrane Air Barriers" for installing vapor permeable air barrier.
5. Division 07 Section "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft. (1.00 to 1.44 kPa): 60-lbf/sq. ft. (2.87-kPa) perimeter uplift force, 90-lbf/sq. ft. (4.31-kPa) corner uplift force, and 30-lbf/sq. ft. (1.44-kPa) outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

E. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Copper Sheet Metal Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation. Mock-ups should cover all details for all roofing conditions included in construction documents.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Lead Coated Copper Coil: ASTM B 101.

1. 16 ounce by width required for flashings.

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
1. Surface: Smooth, flat.

2. Exposed Coil-Coated Finishes:

a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: Match Architect's samples.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Lead-coated Copper Sheet: Copper, hardware bronze or Series 300 stainless steel.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Solder:

1. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

I. Self-Adhering Underlayment Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
3. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High-Temperature Underlayment.

2.3 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

I. Do not use graphite pencils to mark metal surfaces.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings and Fascias: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Coping and Fascia Profile: Per drawings.
2. Joint Style: Butt, with 12-inch- (300-mm-) wide, concealed backup plate.
3. Fabricate from the following materials:
   a. Aluminum: 0.050 inch (1.27 mm) thick.

B. Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fabricate from the following materials:
1. Aluminum: 0.032 inch (0.81 mm) thick.

2.5 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, at shelf angles, and where indicated. Install strip of self-adhering underlayment over end laps in flashings. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high, end dams where flashing is discontinuous. Fabricate from the following materials:

1. Lead-coated Copper: 16 oz./sq. ft. (0.55 mm thick).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch (600-mm) centers.
2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch (600-mm) centers..

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 078413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.3 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire barriers and smoke barriers.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

   a. Penetrations located outside wall cavities.
   b. Penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft (0.01524cu. m/s x sq. m) at both ambient temperatures and 400 deg F (204 deg C).

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

D. Qualification Data: For Installer.

E. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.

F. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.

B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers:

1. A/D Fire Protection Systems Inc.
2. Grace, W. R. & Co. - Conn.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. RectorSeal Corporation (The).
8. Specified Technologies Inc.
9. 3M; Fire Protection Products Division.
10. Tremco; Sealant/Weatherproofing Division.
11. USG Corporation.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:

a. Slag-/rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

E. Intumescent Putties and Putty Pads: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.

3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.6 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

A. Firestop Systems with No Penetrating Items:
   1. Type of Fill Materials: One or more of the following:
      a. Latex sealant.
      b. Silicone sealant.
      c. Intumescent putty.

B. Firestop Systems for Metallic Pipes, Conduit, or Tubing:
   1. Type of Fill Materials: One or more of the following:
      a. Latex sealant.
      b. Silicone sealant.
      c. Intumescent putty.

C. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:
   1. Type of Fill Materials: One or more of the following:
      a. Latex sealant.
      b. Silicone sealant.
      c. Intumescent putty.
      d. Intumescent wrap strips.
      e. Firestop device.

D. Firestop Systems for Electrical Cables:
   1. Type of Fill Materials: One or more of the following:
      a. Latex sealant.
      b. Silicone sealant.
      c. Intumescent putty.
      d. Silicone foam.
      e. Pillows/bags.

E. Firestop Systems for Cable Trays:
   1. Type of Fill Materials:
      a. Pillows/bags.

F. Firestop Systems for Insulated Pipes:
   1. Type of Fill Materials: One or more of the following:
      a. Latex sealant.
      b. Intumescent putty.

c. Silicone foam.
d. Intumescent wrap strips.

G. Firestop Systems for Miscellaneous Electrical Penetrants:
1. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Intumescent putty.

H. Firestop Systems for Miscellaneous Mechanical Penetrants:
1. Type of Fill Materials: One or both of the following:

a. Latex sealant.

I. Firestop Systems for Groupings of Penetrants:
1. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Mortar.
c. Intumescent wrap strips.
d. Firestop device.
e. Intumescent composite sheet.

END OF SECTION 078413

SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants for the following applications:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Control and expansion joints in unit masonry.
   b. Joints between metal panels.
   c. Joints between different materials listed above.
   d. Perimeter joints between materials listed above and frames of doors, windows and louvers.
   e. Control and expansion joints in ceilings and other overhead surfaces.
   f. Other joints as indicated.

2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings where indicated.
   c. Tile control and expansion joints.
   d. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
   e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   f. Other joints as indicated.

3. Exterior joints in the following horizontal traffic surfaces:
   a. Joints in pre-cast concrete parking deck.

4. Interior joints in the following horizontal traffic surfaces:
   a. Isolation joints in cast-in-place concrete slabs.
   b. Control and expansion joints in stone and tile flooring.

B. Related Sections include the following:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.

2. Division 08 Section "Glazing" for glazing sealants.
3. Division 09 Section "Tiling" for sealing tile joints.
4. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for interior sealants, including printed statement of VOC content.

D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

B. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range or custom color(s) as specified in other material sections.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:

1. Available Products:

   a. Pecora Corporation; 898.
   b. Tremco; Tremsil 600 White.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.

4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G and A.

D. Multicomponent Nonsag Urethane Sealant:

1. Available Products:

a. Pecora Corporation; Dynatrol II.
b. Tremco; Dymeric 511.
c. Tremco; Vulkem 922.

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 50.
4. Uses Related to Exposure: NT (nontraffic) and T (traffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: Aluminum coated with a high-performance coating, brick, granite, ceramic tile.

E. Immersible Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T and I.

1. Available Products:

a. LymTal International, Inc.: Iso-Flex 880 GB.
b. Tremco; Vulkem 245.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

B. Available Products:

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2. Available Products:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2.6 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each type of elastomeric sealant and joint substrate.
    b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
4. Inspect tested joints and report on the following:

   a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
   b. Whether sealants filled joint cavities and are free of voids.
   c. Whether sealant dimensions and configurations comply with specified requirements.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior vertical control and expansion joints in unit masonry.

1. Joint Sealant: Multicomponent nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B. Joint-Sealant Application: Exterior butt joints between metal composite wall panels.

1. Joint Sealant: Multicomponent nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

C. Joint-Sealant Application: Exterior vertical joints between different materials listed above.

1. Joint Sealant: Multicomponent nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

D. Joint-Sealant Application: Exterior perimeter joints between unit masonry and metal composite wall panels and frames of doors and windows.

1. Joint Sealant: Multicomponent nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

E. Joint-Sealant Application: Exterior control and expansion joints in ceilings and other overhead surfaces.

1. Joint Sealant: Multicomponent nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

F. Joint-Sealant Application: Exterior joints in parking deck surfaces.

1. Joint Sealant: Multicomponent pourable urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

G. Joint-Sealant Application: Vertical control and expansion joints on exposed interior surfaces of exterior walls.

1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

H. Joint-Sealant Application: Interior perimeter joints of exterior openings.

1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

I. Joint-Sealant Application: Interior ceramic and dimension stone tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.

1. Joint Sealant: Multicomponent pourable urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

J. Joint-Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

K. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.

1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

L. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Location:

   a. Acoustical joints where indicated.
   b. Other joints as indicated.

2. Joint Sealant: Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Door Hardware (Scheduled by Describing Products)" for door hardware for hollow metal doors.
3. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Kewanee Corporation (The).
5. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Division 08 Section "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

a. Fire Door Core: As required to provide fire-protection ratings indicated.
b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) when tested according to ASTM C 1363.

1) Locations: All doors at parking levels including stair doors in elevator lobbies.

3. Vertical Edges for Single-Acting Doors: Beveled edge.

a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush).

a. Width: 1-3/4 inches (44.5 mm).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as knocked down unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 1 Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
5. Frames for Wood Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
6. Frames for Borrowed Lights: Same as adjacent door frame.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
   1) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.

b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
   1) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
   2) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
   3) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.

d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.

5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for

securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

   a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:
1. Division 08 Section "Glazing" for glass view panels in flush wood doors.
2. Division 13 Section "Radiation Protection" for lead-lined flush wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. LEED Submittals:

1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

    a. Include statement indicating costs for each certified wood product.

2. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate doors to be factory finished and finish requirements.

4. Indicate fire-protection ratings for fire-rated doors.

D. Samples for Initial Selection: For factory-finished doors.

E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

C. Forest Certification: Provide doors made with not less than 70 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Graham; an Assa Abloy Group company.
4. Lambton Doors.
5. Marshfield Door Systems, Inc.
6. Mohawk Flush Doors, Inc.; a Masonite company.
7. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Heavy Duty.

1. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces Custom (Grade A faces).
2. Species: Select white birch.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Exposed Vertical Edges: Same species as faces.
6. Core: Particleboard.
7. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
8. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

C. Transparent Finish:

1. Grade: Custom.
2. Finish: AWI conversion varnish or catalyzed polyurethane system.
3. Staining: As selected by Architect from manufacturer's full range.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Access doors and frames for walls and ceilings.
2. Floor access doors and frames.

B. Related Sections include the following:
1. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

D. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following

test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 or UL 263 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

1. ASTM A 123/A 123M, for galvanizing steel and iron products
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

D. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

E. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. Bar-Co, Inc. Div.; Alfab, Inc.
4. Dur-Red Products.
5. Jensen Industries.
6. J. L. Industries, Inc.
7. Karp Associates, Inc.
8. Larsen's Manufacturing Company.
9. Milcor Inc.
10. Nystrom, Inc.

C. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch- (25-mm-) wide, surface-mounted trim.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Cam latch operated by screwdriver with interior release.

D. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
4. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch- (25-mm-) wide, surface-mounted trim.
5. Hinges: Concealed-pin type.
6. Automatic Closer: Spring type.
7. Latch: Self-latching device operated by flush key with interior release.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083326

OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Closed-curtain overhead coiling grilles.

B. Related Sections:

   1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
   2. Division 26 Sections for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling grilles, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Operation Cycles: Provide overhead coiling grille components and operators capable of operating for not less than number of cycles indicated for each grille. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

1.4 SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory. Include the following:

   1. Construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
   2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Closed-Curtain Grille: 18-inch- (457-mm-) square assembly with full-size components consisting of ribs and infill as required to illustrate each assembly.

E. Qualification Data: For qualified Installer.

F. Seismic Qualification Certificates: For overhead coiling grilles, accessories, and components, from manufacturer.

G. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling grilles from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling grille manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. Closed-Curtain Grilles: Fabricate curtain as a series of horizontal double-C ribs, spaced at regular intervals, that alternate with continuous horizontal infill panels secured by the ribs.

1. Aluminum Horizontal Ribs: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
2. Aluminum Panels: ASTM B 209 (ASTM B 209M), alloy and temper standard with manufacturer for type of use and finish indicated; manufacturer's standard panel dimensions and thickness; finished to match ribs.

B. Endlocks: Continuous end links, chains, or other devices at ends of rods; locking and retaining grille curtain in guides against excessive pressures, maintaining grille curtain alignment, and preventing lateral movement.

C. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, finished to match grille.

1. Astragal: Equip each grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
2. Provide motor-operated grilles with combination bottom astragal and sensor edge.

D. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.2 HOODS AND ACCESSORIES

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

B. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A 36/A 36M structural-steel tubes or shapes, hot-dip galvanized per ASTM A 123/A 123M; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

C. Push/Pull Handles: Equip each push-up-operated or emergency-operated grille with lifting handles on each side of grille, finished to match grille.

1. Provide pull-down straps or pole hooks for grilles more than 84 inches (2130 mm) high.

2.3 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" and keyed to building keying system.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.5 ELECTRIC GRILLE OPERATORS

A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.

C. Grille Operator Location(s): Operator location indicated for each grille.

1. Top-of-Hood Mounted: Operator is mounted to the right or left grille head plate with the operator on top of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.

D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements for Equipment" unless otherwise indicated.

1. Electrical Characteristics:

a. Phase: Single phase.
b. Volts: 115 V.
c. Hertz: 60.

2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.

F. Obstruction Detection Device: Equip motorized grille with indicated external automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in grille opening without contact between grille and obstruction.

a. Self-Monitoring Type: Designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, grille closes only with sustained pressure on close button.

G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf (111 N).

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.6 CLOSED-CURTAIN GRILLE ASSEMBLY

A. Closed-Curtain Grille: Overhead coiling grille with a curtain having a series of horizontal ribs alternating with continuous horizontal infill panels secured by the ribs.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dynaflair Corporation.
   b. Dynamic Closures Corp.
   c. QMI Security Solutions.

B. Operation Cycles: Not less than 20,000.

1. Include tamperproof cycle counter.

C. Grille Curtain Material: Aluminum ribs with continuous inserts indicated.

1. Space ribs at approximately 3 inches (76 mm) o.c.
2. Inserts: Solid aluminum panels.

D. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

E. Hood: Aluminum.

1. Shape: Square.
2. Mounting: Above ceiling as shown on Drawings.

F. Locking Devices: Equip grille with locking device assembly.

1. Locking Device Assembly: Cremone type, both jamb sides] locking bars, operable from inside and outside with cylinders.

G. Electric Grille Operator:

1. Usage Classification: Light duty, up to 10 cycles per hour.
2. Operator Location: Top of hood.
3. Motor Exposure: Interior.

4. Emergency Manual Operation: Push-up type.
5. Obstruction-Detection Device: Automatic photoelectric sensor.

   a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.

6. Remote-Control Station: Interior, where shown on Drawings.

H. Grille Finish:

1. Aluminum Finish: Clear anodized.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling grilles, hoods, and operators at the mounting locations indicated for each grille.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that grilles operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 083326

SECTION 084113

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for window walls.
3. Storefront framing for punched openings.
4. Exterior and interior manual-swing entrance doors and door-frame units.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and by thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.

h. Failure of operating units.

B. Structural Loads:

1. Wind Loads

a. Basic Wind Speed: 100 mph (44 m/s).
b. Importance Factor: 1.00.
c. Exposure Category: C.

2. Seismic Loads: As indicated on Drawings.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

G. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures.

Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
    b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).

3. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) when tested according to AAMA 1503.

K. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

L. Structural-Sealant Joints: Designed to produce tensile or shear stress of less than 20 psi (138 kPa).

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content and chemical components.

C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

D. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

F. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

G. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Vistawall Architectural Products, FG6000 Multipline with sill pan accessory with 6-inch depth or comparable product by one of the following:
1. TRACO.
2. Kawneer.
3. Tubelite.

4. United States Aluminum.
5. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

    a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Medium stile; reference construction documents for door dimensions.

    a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide nonremovable glazing stops on outside of door.

2.6 DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.

2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

    a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
    b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.

B. Opening-Force Requirements:
1. Latches and Exit Devices: Not more than 15 lbf (67 N) required to release latch.

C. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
2. Exterior Hinges: Stainless steel, with stainless-steel pin.
3. Quantities:

    a. For doors up to 87 inches (2210 mm) high, provide 3 hinges per leaf.
    b. For doors more than 87 and up to 120 inches (2210 and up to 3048 mm) high, provide 4 hinges per leaf.

D. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

E. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

F. Cylinders: As specified in Division 08 Section "Door Hardware."

G. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

H. Operating Trim: BHMA A156.6.

I. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to meet field conditions and requirements for opening force.

J. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

K. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

L. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

M. Silencers: BHMA A156.16, Grade 1.

N. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (13 mm).

O. Brake Metal Adaptors at Horizontal: To match aluminum frames where required at door frames with transoms above.

P. Sill Pan: Sill pan to be integral with aluminum window frames.

Q. Strap Anchors: Fabricate strap anchors of 1/8" thick aluminum brake metal. Install minimum 3 per window/door jamb at perimeter.

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using shear-block system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.

SECTION 084523

FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes assemblies incorporating fiberglass sandwich panels and aluminum frame systems as follows:
   1. Roof (sloped, overhead) assemblies.

B. Related Sections include the following:

   1. Division 05 Section "Structural Steel Framing" for steel framing that supports skin-system assemblies.
   2. Division 07 Section "Sheet Metal Flashing and Trim" for metal flashings installed at perimeters of assemblies.
   3. Division 07 Section "Joint Sealants" for sealants installed at perimeters of assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:

   1. Structural loads.
   2. Thermal movements.
   3. Movements of supporting structure.
   4. Dimensional tolerances of building frame and other adjacent construction.

B. Failure includes the following:

   1. Deflection exceeding specified limits.
   2. Water leakage.
   3. Thermal stresses transferred to building structure.
   4. Noise or vibration created by wind and thermal and structural movements.
   5. Loosening or weakening of fasteners, attachments, and other components.
   6. Delamination of fiberglass-sandwich-panel faces from panel cores.

C. Structural Loads:

1. Wind Loads: 100 mph.
2. Snow Loads: 51 psf. (See details on drawings for drift loads.)
3. Seismic Loads: As indicated by earthquake design data on Drawings.

D. Deflection of Assemblies:
   1. Overhead Assemblies: Limited to 1/180 of clear span for each assembly component.

E. Roof Assemblies: Class A per ASTM E 108 or UL 790.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 PERFORMANCE TESTING

A. Provide assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for assemblies.

B. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.

   1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.

E. Maintenance Data: For assemblies to include in maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Entity capable of assuming engineering responsibility, including preparation of Shop Drawings, and performing work of this Section and who is acceptable to manufacturer.

B. Manufacturer Qualifications: For fiberglass sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICBO ES AC04, "Sandwich Panels."

C. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Fire-Test-Response Characteristics: Where fire-test-response characteristics are indicated for assemblies and components, provide products identical to those tested per test method indicated by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

F. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

G. NFRC Certification: Provide fiberglass sandwich panels that are certified for U-factors indicated according to NFRC 100 and listed in its "National Fenestration Council Incorporated - Certified Products Directory."

1.7 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Water leakage.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.

1. Defects include, but are not limited to, the following:

   a. Fiberbloom.
   b. Delamination of coating, if any, from exterior face sheet.
   c. Discoloration of exterior face sheet of more than 8.0 units Delta E when measured according ASTM D 2244.
   d. Delamination of panel face sheets from panel cores.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for assemblies is based on Kalwall Corporation panels. Skylight to be a 25 degree slope pyramid, 8' x 8', pre-assembled, thermally broken.

2.2 ALUMINUM FRAME SYSTEMS

A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.

B. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken; framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by a material of low thermal conductance.

C. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch (1.016 mm) thick.

D. Frame-System Gaskets: Manufacturer's standard.

E. Frame-System Sealants: As recommended in writing by manufacturer.

F. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.

1. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
2. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

G. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hot-dip zinc coating, ASTM A 153/A 153M, Class C.

H. Frame System Fabrication:

1. Fabricate components before finishing.
2. Fabricate components that, when assembled, have the following characteristics:

a. Profiles that are sharp, straight, and free of defects or deformations.
b. Accurately fitted joints with ends coped or mitered.
c. Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within the assembly to exterior.

3. Fabricate sill closures with weep holes and for installation as continuous component.
4. Reinforce components as required to receive fastener threads.
5. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.3 FIBERGLASS SANDWICH PANELS

A. Panel Construction: Assembly of uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core and complying with requirements applicable to panel materials in ICBO ES AC04, "Sandwich Panels."

1. Face-Sheet, Self-Ignition Temperature: 650 deg F (343 deg C) or more per ASTM D 1929.
2. Face-Sheet Burning Extent: 1 inch (25 mm) or less per ASTM D 635.
3. Face-Sheet, Smoke-Developed Index: 450 or less per ASTM E 84.
4. Interior Face-Sheet, Flame-Spread Index: Not more than 25 per ASTM E 84.
5. Roof-Covering Class: Class A per ASTM E 108 or UL 790.

B. Panel Thickness: 2-3/4 inches (70 mm).

C. Panel U-Factor: Not more than 0.23, measured in Btu/sq. ft. x h x deg F (W/sq. m x K) according to NFRC 100 or ASTM C 1363 using procedures described in ASTM C 1199 and ASTM E 1423.

D. Panel Strength Characteristics:

1. Maximum Panel Deflection: 3-1/2 inches (89 mm) when a 4-by-12-foot (1.2-by-3.6-m) panel is tested according to ASTM E 72 at 34 lbf/ sq. ft. (1.6 kPa), with a maximum 0.090-inch (2.3-mm) set deflection after 5 minutes.
2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf (1334 N) concentrated load when applied to a 3-inch- (76-mm-) diameter disk according to ASTM E 661.

E. Grid Core: Mechanically interlocked extruded-aluminum I-beams, with a minimum flange width of 7/16 inch (11.1 mm).

1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), in alloy and temper recommended in writing by manufacturer.
2. I-Beam Construction: Thermally broken; two separate extruded-aluminum components permanently bonded by a material of low thermal conductance.
3. Grid Pattern: Inline rectangle, nominal 12 by 24 inches (305 by 610 mm).

F. Exterior Face Sheet:

1. Thickness: 0.070 inches.
2. Color: Crystal on exterior face. .
3. Color Stability: Not more than 3.0 units Delta E when measured according to ASTM D 2244 after outdoor weathering in southern Florida according to procedures in ASTM D 1435 with panels mounted facing south and as follows:

4. Erosion Protection: Manufacturer's standard super weathering product.

G. Interior Face Sheet:

1. Thickness: 0.045 inch.
2. Color: White.

H. Fiberglass-Sandwich-Panel Adhesive: ASTM D 2559.

1. Compatible with facing and core materials.
2. Tensile and shear bond strength of aged adhesive ensures permanent adhesion of facings to cores, as evidenced by testing according to ASTM C 297 and ASTM D 1002 after accelerated aging procedures that comply with aging requirements for adhesives with high resistance to moisture in ICBO ES AC05, "Sandwich Panel Adhesives."

I. Panel Fabrication: Factory assemble and seal panels.

1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.

a. White spots indicating lack of bond at intersections of grid-core members are limited in number to 4 for every 40 sq. ft. (3.7 sq. m) of panel and limited in diameter to 3/64 inch (1.2 mm).

2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
3. Fabricate panel to allow condensation within panel to escape.
4. Reinforce panel corners.

2.4 ACCESSORY MATERIALS

A. Insulating Materials: Specified in Division 07 Section "Thermal Insulation."

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Finish to be manufacturer's standard mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

6. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints watertight, unless otherwise indicated.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.

D. Install components to drain water passing joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.

E. Install components plumb and true in alignment with established lines and elevations.

F. Install insulation materials as specified in Division 07 Section "Thermal Insulation."

G. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:

1. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (13 mm) over total length.

H. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

END OF SECTION 084523

SECTION 087111

DOOR HARDWARE (SCHEDULED BY DESCRIBING PRODUCTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:
    a. Swinging doors.
    b. Non-fire-rated sliding doors.
    c. Other doors to the extent indicated.
2. Cylinders for doors specified in other Sections.
3. Electrified door hardware.

B. Related Sections include the following:

1. Division 08 Section "Hollow Metal Doors and Frames" for astragals provided as part of fire-rated labeled assemblies and for door silencers provided as part of hollow-metal frames.
2. Division 08 Section "Flush Wood Doors" for integral intumescent seals provided as part of fire-rated labeled assemblies.
3. Division 08 Section "Overhead Coiling Grilles" for door hardware provided as part of overhead grille assemblies.
4. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, except cylinders.
5. Division 26 Sections for connections to electrical power system and for low-voltage wiring work.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Cylinders for locks specified in other Sections.
2. Permanent cores to be installed by Owner.

1.3 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: Power, signal, and control wiring. Include the following:

a. System schematic.
b. Point-to-point wiring diagram.
c. Riser diagram.
d. Elevation of each door.

2. Detail interface between electrified door hardware and access control system.

C. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

D. Warranty: Special warranty specified in this Section.

E. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
c. Content: Include the following information:

1) Identification number, location, hand, fire rating, and material of each door and frame.
2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
3) Complete designations of every item required for each door or opening including name and manufacturer.
4) Fastenings and other pertinent information.
5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) Door and frame sizes and materials.
9) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

10) List of related door devices specified in other Sections for each door and frame.

d. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware, and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
2. Installer shall have warehousing facilities in Project's vicinity.
3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.

D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner, Construction Manager and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate

keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

1.6 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies for access control system.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including excessive deflection, cracking, or breakage.
   b. Faulty operation of operators and door hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, except as follows:
   a. Exit Devices: Two years from date of Substantial Completion.
   b. Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in door and frame schedule and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 2.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
3. Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Standard-weight hinges.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Stainless steel, with stainless-steel pin.
3. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.

E. Hinge Options: Where indicated in door hardware sets or on Drawings:
1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
2. Corners: Square.

F. Electrified Functions for Hinges: Comply with the following:

1. 8-wire electric hinge at exit devices and locks with card reader devices.

G. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

2.3 HINGES

A. Butts and Hinges: Listed under Category A in BHMA's "Certified Product Directory."

B. Template Hinge Dimensions: BHMA A156.7.

C. Available Manufacturers:

1. Baldwin Hardware Corporation.
2. Hager Companies.
3. Lawrence Brothers, Inc.
4. McKinney Products Company; an ASSA ABLOY Group company.
5. Stanley Commercial Hardware; Div. of The Stanley Works.

D. Antifriction-Bearing, Full-Mortise (Butt) Hinges: BHMA A156.1, heavy weight; Grade 1, with 4 ball bearings; button tips; nonrising removable pins; and base metal as follows:

1. Base Metal: Cast, forged, or extruded brass or bronze.

E. Plain-Bearing, Standard-Weight, Full-Mortise (Butt) Hinges: BHMA A156.1, Grade 3, button tips, nonrising removable pins, and base metal as follows:

1. Base Metal: Cast, forged, or extruded brass or bronze.

2.4 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Electrified Locking Devices: BHMA A156.25.

D. Lock Trim:

1. Levers: J Style, solid.

a. Sargent 8200 Series.

b. Sargent 10 Line Cylindrical Lever Locks.
2. Escutcheons (Roses): LN or L.
3. Dummy Trim: Match lever lock trim and escutcheons.

E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
2. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

F. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Auxiliary Deadlocks: BHMA A156.5.

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
1. Mortise Locks: BHMA A156.13.

B. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
a. Basis-of-Design Product: Subject to compliance with requirements, provide Sargent 10 Line Series.

C. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1.

1. Available Manufacturers:
   a. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.6 DOOR BOLTS, GENERAL

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Mortise Flush Bolts: Minimum 3/4-inch (19-mm) throw.

B. Dustproof Strikes: BHMA A156.16, Grade 1.

C. Manual Flush Bolts: BHMA A156.16, Grade 1; designed for mortising into door edge.

   1. Available Manufacturers:
      a. Burns Manufacturing Incorporated.
      b. Don-Jo Mfg., Inc.
      c. Hager Companies.
      d. IVES Hardware; an Ingersoll-Rand Company.
      e. Stanley Commercial Hardware; Div. of The Stanley Works.
      f. Trimco.

2.7 DOOR BOLTS

A. Manual-Extension Flush Bolts: Fabricated from extruded brass or aluminum, with 12-inch (305-mm) rod actuated by flat lever; listed and labeled for fire-rated doors. Provide matching strike.

B. Dustproof Strikes:

   1. Jamb Type: Polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.
   2. Floor Type: Polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.

2.8 EXIT DEVICES, GENERAL

A. Exit Devices: BHMA A156.3, Grade 1.

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

D. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

E. Outside Trim: Pull with cylinder; material and finish to match locksets, unless otherwise indicated.

F. Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors and fire-rated wood doors.

G. Available Manufacturers:
1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
2. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
3. Von Duprin; an Ingersoll-Rand Company.
4. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.

2.9 EXIT DEVICES

A. Rim Exit Devices:

1. Type: BHMA A156.3, Type 1, rim.
2. Actuating Bar: Narrow-stile push pad.
3. Material: Stainless steel.

B. Electrified Exit Device Options: Types and functions indicated as follows:

1. Electric Latch Retraction: Remote signal activates continuous-duty solenoid that retracts latch. Similar to Sargent 80 Series.

2.10 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Five.
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Construction Keying: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

a. Replace construction cores with permanent cores as indicated in keying schedule.

E. Manufacturer: Same manufacturer as for locks and latches.

2.11 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
1. Existing System: Master key or grand master key locks to Owner's existing system (Sargent Grand Master.)

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Grand Master Keys: Five.

2.12 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5, Grade 1; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2. Available Manufacturers:

a. Key Control Systems, Inc.
b. Lund Equipment Co., Inc.
c. MMF Industries.
d. Sunroc Corporation.

B. Key Lock Boxes: To be provided by Owner and installed by Contractor.

2.13 ELECTRIC STRIKES

A. Standard: BHMA A156.31, Grade 1.

B. General: Use fail-secure electric strikes with fire-rated devices.

1. Material: Forged stainless steel.
2. Mounting: Mortised.
3. Monitoring: Mechanical latchbolt.

C. Available Manufacturers:

1. Adams Rite Manufacturing Co.
2. Folger Adam Security, Inc.; an ASSA ABLOY Group company.
3. HES, Inc.; an ASSA ABLOY Group company.
4. Locknetics; an Ingersoll-Rand Company.
5. Precision Hardware, Inc.
6. Von Duprin; an Ingersoll-Rand Company.

2.14 OPERATING TRIM, GENERAL

A. Standard: BHMA A156.6.

B. Materials: Fabricate from stainless steel, unless otherwise indicated.

C. Available Manufacturers:
1. Don-Jo Mfg., Inc.
2. Hager Companies.
3. IVES Hardware; an Ingersoll-Rand Company.
4. Rockwood Manufacturing Company.
5. Trimco.

2.15 CLOSERS, GENERAL

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

D. Surface Closers: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

1. Available Manufacturers:
   a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
   b. LCN Closers; an Ingersoll-Rand Company.
   c. Norton Door Controls; an ASSA ABLOY Group company.
   d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
   e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
   f. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.

2.16 CLOSERS

A. Modern-Type-with-Cover Surface Closers: Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; with forged-steel main arm; enclosed in cover indicated; complying with the following:

1. Mounting: Hinge side.
2. Type: Regular arm.
3. Backcheck: Adjustable, effective between 60 and 85 degrees of door opening.
4. Cover Material: Molded plastic.
5. Closing Power Adjustment: At least 50 percent more than minimum tested value.

2.17 PROTECTIVE TRIM UNITS, GENERAL

A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in door hardware sets.

B. Fasteners: Manufacturer's standard machine or self-tapping screws.

C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:

1. Material: 0.050-inch- (1.3-mm-) thick stainless steel.
2. Available Manufacturers:
   a. Don-Jo Mfg., Inc.
   b. Hager Companies.
   c. Hiawatha, Inc.
   d. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation.
   e. IVES Hardware; an Ingersoll-Rand Company.
   f. Pawling Corporation.
   g. Rockwood Manufacturing Company.
   h. Trimco.

2.18 PROTECTIVE TRIM UNITS

A. Armor Plates: 36 inches (914 mm) high by door width, with allowance for frame stops.

B. Kick Plates: 12 inches (305 mm) high by door width, with allowance for frame stops.

C. Mop Plates: 6 inches (152 mm) high by 1 inch (25 mm) less than door width.

2.19 STOPS AND HOLDERS, GENERAL

A. Stops and Bumpers: BHMA A156.16, Grade 1.

1. Provide wall bumpers for doors unless floor or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Available Manufacturers:
1. Don-Jo Mfg., Inc.
2. Hager Companies.
3. IVES Hardware; an Ingersoll-Rand Company.
4. Rockwood Manufacturing Company.
5. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
6. Stanley Commercial Hardware; Div. of The Stanley Works.
7. Trimco.

2.20 STOPS AND HOLDERS

A. Wall Bumpers: Polished cast brass or aluminum with rubber bumper; 2-1/2-inch (64-mm) diameter, minimum 3/4-inch (19-mm) projection from wall, with backplate for concealed fastener installation; with convex bumper configuration.

B. Dome-Type Floor Stops: Polished cast brass, bronze, or aluminum, with rubber bumper; and as follows:

1. Height: Minimum 1 inch (25 mm) high, for doors without threshold.
2. Riser: Extruded aluminum for carpet installations.

2.21 DOOR GASKETING, GENERAL

A. Standard: BHMA A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

2. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.

F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

I. Available Manufacturers:

1. Hager Companies.
2. National Guard Products.
3. Pemko Manufacturing Co.
4. Reese Enterprises.
5. Sealeze; a Unit of Jason Incorporated.
6. Zero International.

2.22 DOOR GASKETING

A. Adhesive-Backed Perimeter Gasketing: Gasket material applied to frame rabbet with self-adhesive.

1. Gasket Material: Vinyl bulb.

B. Automatic Door Bottoms: Gasket material held in place by metal housing that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

1. Gasket Material: Sponge neoprene.
2. Housing Material: Aluminum.
3. Mounting: Mortised into bottom of door.

4. Type: Low-closing-force type for doors required to meet accessibility requirements.

2.23 THRESHOLDS, GENERAL

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.

D. Available Manufacturers:

1. Hager Companies.
2. National Guard Products.
3. Pemko Manufacturing Co.
4. Reese Enterprises.
5. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
6. Sealeze; a Unit of Jason Incorporated.
7. Zero International.

2.24 THRESHOLDS

A. Saddle Thresholds: Type and base metal as follows:

1. Type: Thermal break and fluted top.
2. Base Metal: Aluminum.

2.25 SLIDING DOOR HARDWARE, GENERAL

A. General: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.

B. Bypassing Sliding Door Hardware: Rated for doors weighing up to 200 lb (91 kg). (Barn door style – wall-mounted.)

C. Available Manufacturers:
1. Henderson, P. C. Inc.; Div. of Hepworth PLC.
2. Johnson, L. E. Products, Inc.
3. Pemko

2.26 SLIDING DOOR HARDWARE

A. Horizontal Sliding Door Hardware: Wrought steel, unless otherwise indicated.

1. Box Rail: Without mounting brackets, anodized aluminum finish.
2. Rail Supports:
   a. Single Overhead Style: Face-mounted type.
3. Hanger Configuration: Three-wheel hanger assembly for even weight distrubution.
   a. Wheel Assembly: Steel wheels with ball bearings.
4. Accessories:
   a. End guide and stop.
   b. Bumper Shoe: Minimum 0.0598-inch (1.5-mm) thickness.
   c. Pulls: Flush, mortised into door on office side.

B. Pocket Sliding Door Hardware: Commercial grade, heavy-duty for solid-core doors.

2.27 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Flush Pull, #1115 and Grip, #1194-1 by Trimco or comparable product by one of the following:
   a. Don-Jo Mfg., Inc.
   b. Hager Companies.
   c. IVES Hardware; an Ingersoll-Rand company.
   d. Rockwood Manufacturing Company.

2.28 MISCELLANEOUS DOOR HARDWARE

A. Coat Hooks: Similar to Ives No. 572, Brass, Finish B26D. Install (2) on room side of all office doors.

B. Door and Frame Transfer Devices: Steel housing for mortise in hinge stile of door, with flexible tube for wiring bundle; accommodating doors that swing open to 120 degrees.

C. Door Position Indicators: Provide on all doors with card access devices.

2.29 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:

    a. Mortise hinges to doors.
    b. Strike plates to frames.
    c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

    a. Surface hinges to doors.
    b. Closers to doors and frames.
    c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.30 FINISHES

A. Standard: BHMA A156.18, US26B.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening.
2. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SETS

A. HW1 through HW3: Reference Division 08 Section " Aluminum-Framed Entrances and Storefronts."

B. HW4: Doors to have: Hinges, Rim Exit Device with electric latch retraction, Closer, Threshold, Weatherstripping, Stop, Door Position Indicator. (Card Access provided by Owner's vendor.)

C. HW5: Doors to have: Hinges, Mortise Lockset, Storage Function, Closer, Stop, Threshold, Weatherstripping.

D. HW6: Doors to have: Hinges, Rim Exit Device, Closer, Stop, Kickplate.

E. HW7: Doors to have: Hinges, Cylindrical Lockset, Office Function, Stop, Kickplate.

F. HW8: Doors to have: Hinges, Cylindrical Lockset, Privacy Function, Stop, (unless outswinging door), Kickplate.

G. HW9: Doors to have: Hinges, Cylindrical Lockset, Passage Function, Stop, Kickplate.

H. HW10: Doors to have: Hinges, Mortise Lockset, Office Function, Closer, Stop, Kickplate.

I. HW11: Each leaf to have: Hinges, Kickplate. Active leaf to have: Cylindrical Lockset, Storage Function. Inactive leaf to have: Flushbolts.

J. HW12: Doors to have: Hinges, Cylindrical Lockset, Office Function, Closer, Stop, Kickplate.

K. HW13: Doors to have: Sliding Door Hardware with accessories, Recessed Pull and Pull.

L. HW14: Each leaf to have: Hinges, Kickplate. Active leaf to have: Cylindrical Lockset, Privacy Function. Inactive Leaf (narrow leaf): Flushbolts.

M. HW15: Doors to have: Hinges, Mortise Lockset, Passage Function, Closer, Stop, Kickplate.

N. HW16: Doors to have: Hinges, Rim Exit Device with electric latch retraction, Closer, Stop, Door Position Indicator. (Card Access provided by Owner's vendor.)

O. HW17: Doors to have: Hinges, Mortise Lockset, Passage Function, Stop, Kickplate. (Refer to Electrical Drawings for Interlock Device.)

P. HW18: Doors to have: Pocket Slider Package, Recessed Pulls.

Q. HW19: Each leaf to have: Hinges, Pull, Roller Catch at door head.

R. HW20: Doors to have: Hinges, (1 electrified), Mortise lockset with electric strike, Passage Function, Closer, Kickplate, Stop, Door Position Switch. (Card access provided by Owner's vendor.)

S. HW21: Doors to have: Hinges, Pushbutton Lockset, Closer, Kickplate, Stop, Door Position Switch.

T. HW22: Overhead Grilles to have lock cylinder.

U. HW23: Doors to have: Hinges, Mortise Lockset, Storage Function, Closer, Stop, Kickplate.

V. HW24: Each leaf to have: Hinges, Mortise Lockset, Storage Function, Threshold, Weatherstripping. (Note pair of doors to have removable center mullion.)

END OF SECTION 087111

SECTION 087113

AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Power door operators.

B. Related Sections include the following:
   1. Division 08 door Sections for doors that need reinforcement for automatic door operators.
   2. Division 08 Section " Aluminum-Framed Entrances and Storefronts" for doors to receive automatic door operators.
   3. Division 26 Sections for electrical connections including conduit and wiring for automatic door operators.

1.3 DEFINITIONS

A. Activation Device: Device that, when actuated, sends electrical signal to automatic door operator to open door.

B. Safety Device: Device that prevents door from opening or closing.

1.4 PERFORMANCE REQUIREMENTS

A. Opening and Closing Forces: Not more than 15 lbf (67 N applied)1 inch (25 mm) from the latch edge of the door.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators and activation and safety devices.

B. Shop Drawings: Show fabrication and installation details for automatic door operators. Include locations and elevations of entrances showing activation.

1. Include plans, elevations, sections and details.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

D. Operation and Maintenance Data: For automatic door operators to include in emergency, operation, and maintenance manuals.

E. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than one hour normal travel time from Installer's place of business to Project site.

B. Manufacturer Qualifications: Company certificate issued by AAADM.

C. Testing Agency Qualifications: An independent agency with inspector certified by AAADM.

D. Source Limitations: Obtain automatic door operators through one source from a single manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. UL Standard: Comply with UL 325.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify door openings by field measurements before fabrication of exposed covers for automatic door operators and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies and security access control system.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty or sporadic operation of automatic door operator or activation and safety devices.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

2. Warranty Period: Two years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of automatic door operator Installer. Include quarterly planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Engage inspector certified by AAADM to perform safety inspection after each adjustment or repair and at end of maintenance period. Submit completed inspection form to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dor-O-Matic, Inc.; an Ingersoll-Rand Company.
2. Horton Automatics.
3. LCN Closers; an Ingersoll-Rand Company.
4. Stanley Access Technologies; Div. of The Stanley Works.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:

1. Sheet: ASTM B 209 (ASTM B 209M).
2. Extrusions: ASTM B 221 (ASTM B 221M, Alloy 6063-T5 or T-6).

B. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2.3 AUTOMATIC DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
1. Provide door operators that comply with NFPA 80 requirements for doors as emergency exits and that do not interfere with fire ratings.

B. Electromechanical Operating System: Unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, and with manual operation including spring closing with power off.

C. Hinge Operation: Refer to Division 08 Section "Door Hardware" to determine type of hinge for each door that door operator shall accommodate.

D. Housing: Fabricated from 0.125-inch- (3.2-mm-) thick extruded or formed aluminum.

E. Exposed Cover: Fabricated from 0.125-inch- (3.2-mm-) thick extruded aluminum; continuous over full width of door opening; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

1. Finish: Match door hardware.

2.4 POWER DOOR OPERATORS

A. Standard: Comply with BHMA A156.10.

B. Performance Requirements:

1. Not more than 40 lbf (180 N applied)1 inch (25 mm) from latch edge of door to prevent stopped door from opening or closing.
2. If power fails, not more than 30 lbf (133 N applied)1 inch (25 mm) from latch edge of door to manually open door.

C. Operation: Power opening and spring closing.

1. Power-Assisted Opening: Power-assisted opening that reduces force to open self-closing door. Pushing or pulling on door activates automatic door operator.

D. Operating System: Electromechanical.

E. Microprocessor Control Unit: Solid-state controls.

F. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time of not less than 0 to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Adjustable limit switch.
8. Obstruction recycle.

G. Mounting: Surface.

2.5 ACTIVATION AND SAFETY DEVICES

A. Remote Switch: Manufacturer's standard surface-mounted, door control switch; consisting of rectangular, flat push plate; of material indicated; and actuator mounted in junction box. Provide engraved message as indicated.

1. Material: Stainless steel.
2. Message: International symbol of accessibility.
3. Mounting: As indicated on Drawings.

B. Wireless or Remote Radio Control: Manufacturer's standard radio control consisting of a receiver and battery-operated transmitters of the following type:

1. Transmitter Type: Wall or post-mounted with push plate.

C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.6 ACCESSORIES

A. Automatic Door Operator Signage: Comply with BHMA A156.10.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame supports, and other conditions affecting performance of automatic door operators.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install complete automatic door operator system, including activation and safety devices, control wiring, and remote power units.

B. Power Door Operator Installation Standard: Comply with BHMA A156.10 for installation.

C. Automatic Door Operators: Install door operator system, including control wiring, as follows:

1. Refer to Division 26 Sections for connection to electrical power distribution system.

D. Activation and Safety Devices: Install devices and wiring, including connections to automatic door operators, according to BHMA A156.10 and as follows:
1. Wall Switches: Provide push plates on both sides of each opening indicated to receive automatic door operators.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 ADJUSTING

A. Adjust automatic door operators and activation and safety devices to operate smoothly, easily, and properly, and for safe operation and weathertight closure.

B. Lubricate operators, hardware, and other moving parts.

C. After completing installation of exposed, factory-finished automatic door operators, inspect exposed finishes and repair damaged finishes.

D. Readjust automatic door operators and activation and safety devices after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.

E. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.4 DEMONSTRATION

A. Installers shall train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 087113

SECTION 088000

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed entrances.
4. Interior borrowed lites.
5. Decorative architectural glass.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2006 International Building Code by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

a. Basic Wind Speed: 95 mph.
b. Importance Factor: 1.15.
c. Exposure Category: C.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.

C. Glass Samples: For each type of the following products; 12 inches (300 mm) square.
1. Insulating glass.
2. Spandrel glass.

D. Product Certificates: For glass and glazing products, from manufacturer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass, insulating glass, glazing sealants and glazing gaskets.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

F. Preconstruction adhesion and compatibility test report.

G. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Source Limitations for Glass: Obtain laminated glass and insulating glass from single source from single manufacturer for each glass type.

F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass

contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

B. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For laminated-glass lites, properties are based on products of construction indicated.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

B. Polished Wired Glass: ASTM C 1036, Type II, Class 1 (clear), Form 1, Quality-Q6, complying with ANSI Z97.1, Class C.

1. Mesh: M1 (diamond).

C. Ceramic-Coated Vision Glass: Heat-treated float glass, Condition C; with ceramic enamel applied by silk-screened process; complying with Specification No. 95-1-31 in GANA's Tempering Division's "Engineering Standards Manual" and with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Guardian Industries, Corp., 1" insulated unit with CrystalGray/AG50 Clear (3).

D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GCC (Glass Coatings and Concepts LLC) Color: SX3517E808 Gun Metal.

E. Patterned Glass (Decorative Architectural Glass): ASTM C 1036, Type II, Class 1 (clear), Form 3; Quality-Q6.

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:

DAG: Skyline Design, Organics, Brambles.

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Manufacturer's standard spacer material.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

B: Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Dow Corning Corporation; 790.
   b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
   c. May National Associates, Inc.; Bondaflex Sil 290.
   d. Pecora Corporation; 890.
   e. Sika Corporation, Construction Products Division; SikaSil-C990.
   f. Tremco Incorporated; Spectrem 1.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.9 MONOLITHIC-GLASS TYPES

A. Glass Type: Clear fully tempered float glass.

1. Thickness: 6.0 mm.
2. Provide safety glazing labeling.

B. Glass Type: Polished wired glass.

1. Thickness: 6.0 mm.

2.10 INSULATING-GLASS TYPES

A. Glass Type: Low-e-coated, tinted insulating glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Tinted (Guardian Industries, Corp. Crystal Gray), fully tempered float glass.
4. Interspace Content: Air.
5. Indoor Lite: Clear (Guardian Industries, Corp. AG50 Clear), fully tempered float glass.
6. Visible Light Transmittance: 36 percent minimum.
7. Winter Nighttime U-Factor: 0.30 maximum.
8. Summer Daytime U-Factor: 0.28 maximum.
9. Solar Heat Gain Coefficient: 0.26 maximum.
10. Provide safety glazing labeling.

B. Glass Type: Ceramic-coated, insulating spandrel glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass (Guardian Industries, Corp. Crystal Gray.)
4. Interspace Content: Air.
5. Indoor Lite: Fully tempered float glass.
6. Coating Location: Fourth surface.

2.11 INSULATING-LAMINATED-GLASS TYPES

A. Glass Type: Low-e-coated, clear insulating laminated glass.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Outdoor Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass, tinted (Guardian Industries, Corp. Crystal Gray)
4. Interspace Content: Air.
5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.

   a. Thickness of Each Glass Ply: 3.0 mm.
   b. Interlayer Thickness: 0.030 inch (0.76 mm).

6. Low-E Coating: Pyrolytic on second surface.
7. Visible Light Transmittance: 35 percent minimum.

8. Winter Nighttime U-Factor: 0.29 maximum.
9. Summer Daytime U-Factor: 0.28 maximum.
10. Solar Heat Gain Coefficient: 0.26 maximum.
11. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08800

SECTION 089000

LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

D. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
1. Component Importance Factor is 1.5.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Interior flange unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
2. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.

F. Provide subsills made of same material as louvers.

G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Storm-Resistant Louver:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Ruskin Company ELF6375DX or comparable product by one of the following:
   a. Airolite Company, LLC (The).
   b. American Warming and Ventilating, Inc.; a Mestek company.
   c. Construction Specialties, Inc.
   d. Greenheck Fan Corporation.
   e. Industrial Louvers, Inc.
   f. NCA Manufacturing, Inc.
   g. Nystrom Building Products.
   h. Reliable Products, Inc.

2. Louver Depth: 6 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
4. Louver Performance Ratings:

   a. Free Area: Not less than 57%.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

6. Louver Sizes and Shapes: As indicated on Architectural Elevation drawings.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Mill finish unless otherwise indicated.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:
1. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.6 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: To match architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000

SECTION 092116.23

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes gypsum board shaft-wall assemblies for the following:
   1. Chase enclosures.

B. Related Sections include the following:

   1. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board shaft-wall assemblies.

1.3 SUBMITTALS

A. Product Data: For each gypsum board shaft-wall assembly indicated.

B. LEED Submittals:

   1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
   2. Product Data for Credit MR 4.1: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

      a. Include statement indicating costs for each product having recycled content.

1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

C. Stack panels flat on leveled supports off floor or slab to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. G-P Gypsum.
2. National Gypsum Company.
3. USG Corporation.

2.2 GYPSUM BOARD SHAFT-WALL ASSEMBLIES, GENERAL

A. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.

1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

2.3 PANEL PRODUCTS

A. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 75 percent by weight.

B. Gypsum Liner Panels: Comply with ASTM C 442/C 442M.

1. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.

   a. Core: 1 inch (25.4 mm) thick.
   b. Long Edges: Double bevel.

2.4 NON-LOAD-BEARING STEEL FRAMING

A. Framing Members: Comply with ASTM C 754 for conditions indicated.

B. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

1. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section "Gypsum Board" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

C. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board."

D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

E. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

F. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 35 percent by weight.

G. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing agency.

B. Fire-Resistance Rating: 2 hours.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).

D. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm) long and in depth matching studs.

1. Minimum Base-Metal Thickness: Matching steel studs.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Dietrich Metal Framing; The System by Metal-Lite, Inc.
b. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.

F. Room-Side Finish: Gypsum board.

G. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft-wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:

1. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
2. Division 09 Section "Gypsum Board" for applying and finishing panels.

B. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.

D. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.

H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain

an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.

I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3mm) from the plane formed by faces of adjacent framing.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

SECTION 092216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

B. Related Sections include the following:

1. Division 05 Section "Cold-Formed Metal Framing" for exterior non-load-bearing wall studs.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    b. Chicago Metallic Corporation; Fire Front 650-C Drywall Furring System.
    c. USG Corporation; Drywall Suspension System.
3. System to be used in UL 2-Hour rated floor/ceiling assembly at Level 2 Parking ceiling.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
2. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Where required, provide one of the following:
1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

    a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

        1) Steel Network Inc. (The); VertiClip SLD Series.
        2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, provide one of the following:

    a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
    b. Metal-Lite, Inc.; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
2. Depth: 1-1/2 inches (38.1 mm).

F. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:
1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

C. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as indicated in Construction Document, partition types.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb, unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

E. Z-Furring Members:

1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c..
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900

GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Sections include the following:
1. Division 06 Section "Sheathing" for gypsum sheathing.
2. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
3. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4.1: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

a. Include statement indicating costs for each product having recycled content.

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 75 percent by weight.

B. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum Co.
b. BPB America Inc.
c. G-P Gypsum.
d. Lafarge North America Inc.
e. National Gypsum Company.

f. PABCO Gypsum.
g. Temple.
h. USG Corporation.

B. Type X:

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

D. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

E. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board:

1. Complying with ASTM C 1178/C 1178M.

a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.

2. Core: 5/8 inch (15.9 mm), Type X.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. Expansion (control) joint.
c. Curved-Edge Cornerbead: With notched or flexible flanges.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: Vertical surfaces, unless otherwise indicated.
   2. Ceiling Type: Ceiling surfaces.
   3. Abuse Resistant Type: As indicated on Drawings.
   4. Moisture- and Mold-Resistant Type: As indicated on Drawings at all sink locations.
   5. Tile Backing Panels: As indicated on Drawings.

B. Single-Layer Application:

   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view.

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000

TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Glass tile.
3. Stone thresholds.
4. Metal edge strips and cove strips.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Wet: greater or equal to 0.60. Dry: greater or equal to 0.70 per ASTM C1028.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.

D. Qualification Data: For qualified Installer.

E. Product Certificates: For each type of product, signed by product manufacturer.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Tile Type PCT1&PCT2: Paver tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide 1 Stonetech Series Forest (12" x 12") and Slate (12" x 24") by Apavisa Porcelanico as distributed by Stone Source or comparable product by one of the following:

a. American Olean; Division of Dal-Tile International Inc.
b. Crossville, Inc.
c. Daltile; Division of Dal-Tile International Inc.
d. GranitiFiandre; c/o Trans Ceramica, Ltd.

2. Composition: Porcelain.
3. Face Size: Pattern of 12" x 12" and 12" x 24" – see AF drawings for pattern.
4. Thickness: Approximately 5/16".
5. Face: Plain with square or cushion edges.
6. Grout Color: As selected by Architect from manufacturer's full range.

B. Tile Type PCT3: Paver tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Crossville, Inc. Cross Colors with Cross Sheen finish (12" x 12") and Slate (12" x 24") by Apavisa Porcelanico as distributed by Stone Source or comparable product by one of the following:
a. American Olean; Division of Dal-Tile International Inc.
b. Daltile; Division of Dal-Tile International Inc.
c. GranitiFiandre; c/o Trans Ceramica, Ltd.

2. Composition: Porcelain.
3. Face Size: Pattern of 11-3/4" x 11-3/4" – see AF drawings for pattern.
4. Thickness: Approximately 5/16".
5. Face: Plain with square or cushion edges.
6. Grout Color: As selected by Architect from manufacturer's full range.

C. Tile Type CT1: Factory-mounted unglazed ceramic mosaic tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile Keystones Group 1 and 2 or comparable product by one of the following:

a. American Olean; Division of Dal-Tile International Inc.
b. Crossville, Inc.

2. Composition: Porcelain.
3. Module Size: 2 by 2 inches (50.8 by 50.8 mm).
4. Thickness: 1/4 inch (6.35 mm).
5. Face: Plain with cushion edges.
6. Surface: Smooth, without abrasive admixture.
7. Finish: Mat, opaque glaze.
8. Tile Color and Pattern: To be selected from manufacturer's standard Group 1 and 2 colors.
9. Grout Color: As selected by Architect from manufacturer's full range.

D. Tile Type CT2: Glazed wall tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile Semi-Gloss Wall Tile or comparable product by one of the following:
a. American Olean; Division of Dal-Tile International Inc.
b. Florida Tile Industries, Inc.
c. United States Ceramic Tile Company.

2. Module Size: 6 by 6 inches (152 by 152 mm).
3. Thickness: 5/16 inch (8 mm).
4. Face: Plain with modified square edges.
5. Finish: Bright, opaque glaze.
6. Tile Color and Pattern: Reference Interior Elevations in Construction Drawings. Field to be selected from Price Group 1 or 2.
7. Grout Color: As selected by Architect from manufacturer's full range.
8. Mounting: Factory, back mounted.

E. Tile Type GT: Glass tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile Glass Reflections or comparable product by one of the following:
a. American Olean; Division of Dal-Tile International Inc.
b. Florida Tile Industries, Inc.
c. United States Ceramic Tile Company.

2. Module Size: 3 by 6 inches (76 by 152 mm).
3. Thickness: 5/16 inch (8 mm).
4. Face: Plain with cushion edges.
5. Tile Color and Pattern: Reference Interior Elevations in Construction Drawings.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Mounting: Factory, back mounted.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.4 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Bonsal American; an Oldcastle company.
   b. Bostik, Inc.
   c. C-Cure.
   d. Custom Building Products.
   e. Laticrete International, Inc.
   f. MAPEI Corporation.
   g. Southern Grouts & Mortars, Inc.
   h. Summitville Tiles, Inc.
   i. TEC; a subsidiary of H. B. Fuller Company.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2.5 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Bonsal American; an Oldcastle company.
   b. Bostik, Inc.
   c. C-Cure.
   d. Custom Building Products.
   e. Laticrete International, Inc.
   f. MAPEI Corporation.
   g. Southern Grouts & Mortars, Inc.
   h. Summitville Tiles, Inc.
   i. TEC; a subsidiary of H. B. Fuller Company.

2.6 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Bostik, Inc.; Chem-Calk 550.
b. Degussa Building Systems; Sonneborn Sonolastic SL 2.
c. Pecora Corporation; Dynatrol II-SG.
d. Sika Corporation; Sikaflex-2c SL.
e. Tremco Incorporated.; THC-900.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

C. Metal Cove Strips: Equal to Schluter Systems, DILEX-AHK in satin anodized aluminum for transition of ceramic tile on floors to walls.

D. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

F. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Bonsal American; an Oldcastle company; Grout Sealer.
b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
c. C-Cure; Penetrating Sealer 978.
d. Custom Building Products; Surfaceguard Grout and Tile Sealer.

e. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
f. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
g. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
h. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Paver Tile: 1/4 inch (6.35 mm).
2. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
3. Glazed Wall Tile: 1/16 inch (1.6 mm).

F. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

G. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

H. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Tile Installation F113: Thin-set mortar; TCA F113.

a. Tile Type: CT1 and CT2.
b. Thin-Set Mortar: Latex- portland cement mortar.
c. Grout: Polymer-modified sanded grout.

B. Interior Wall Installations, Metal Studs or Furring:

1. Tile Installation W245: Thin-set mortar on coated glass-mat, water-resistant gypsum backer board; TCA W245.

a. Tile Type: CT3.
b. Thin-Set Mortar: Latex- portland cement mortar.
c. Grout: Polymer-modified unsanded grout.

END OF SECTION 093000

SECTION 095113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

C. LEED Submittals:

1. Product Data for Credit MR 4.1: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

a. Include statement indicating costs for each product having recycled content.

2. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.

D. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.

C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
2. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 75 percent by weight.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (ACT)

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.; Ultima Tegular, #1911.
2. USG Interiors, Inc.; Mars Clima Plus, #86785.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 1 and 2, water felted; with vinyl overlay on face.
2. Pattern: E (lightly textured).

C. Color: White.

D. LR: Not less than 0.90.

E. NRC: Not less than 0.70.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension system members.

H. Thickness: 3/4 inch (19 mm).

I. Modular Size: 24 by 24 inches (610 by 610 mm).

J. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

I. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.; Prelude XL.
2. USG Interiors, Inc.; DX/DXL.

B. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide, aluminum caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. Face Design: Flat, flush.
3. Face Finish: Painted white.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Products: Subject to compliance with requirements, provide moldings by one of the following:

1. Armstrong World Industries, Inc.
2. USG Interiors, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.
2. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
3. Conversion-Coated Finish: AA-M12C42 (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating).

2.6 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation; SHEETROCK Acoustical Sealant.

C. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

D. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers,

without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

d. Roppe Corporation, USA.

B. Description: Transition strips.

C. Material: Vinyl.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer[**and as follows**]. Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096516

RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vinyl sheet floor covering, with backing.

B. Related Sections:

1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.
2. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives and chemical-bonding compounds, including printed statement of VOC content.

C. Samples for Initial Selection: For each type of floor covering indicated.

D. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each different color and pattern of floor covering required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.

E. Seam Samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.

F. Maintenance Data: For each type of floor covering to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive floor coverings during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Covering: Furnish quantity not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each color, pattern, and type of floor covering installed.

PART 2 - PRODUCTS

2.1 VINYL SHEET FLOOR COVERING

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Altro Group; AltroSmooth Ethos (SV1) for field and Suprema (SV2) for borders and flash cove base and rooms where scheduled.
2. Mannington Mills, Inc.; Realities (SV1) for field and Relay ER (SV2) for borders and flash cove base and rooms where scheduled.
3. TOLI International; Mature (SV1) for field and Opus (SV2) for borders and flash cove base and rooms where scheduled.

B. Vinyl Sheet Floor Covering with Backing: ASTM F 1303.

C. Wearing Surface: Smooth and Embossed.

D. Sheet Width: 6 feet (1.8 m).

E. Seaming Method: Heat welded.

F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.

1. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Color: Match floor covering.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch (25-mm) radius provided or approved by manufacturer.
2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by manufacturer.

E. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits.that might interfere with adhesion of floor coverings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
   a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor coverings until they are same temperature as space where they are to be installed.

1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 FLOOR COVERING INSTALLATION

A. Comply with manufacturer's written instructions for installing floor coverings.

B. Unroll floor coverings and allow them to stabilize before cutting and fitting.

C. Lay out floor coverings as follows:

1. Maintain uniformity of floor covering direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in floor covering substrates.
3. Match edges of floor coverings for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

H. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

J. Integral-Flash-Cove Base: Cove floor coverings 4 inches (152 mm) up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.

B. Perform the following operations immediately after completing floor covering installation:

1. Remove adhesive and other blemishes from floor covering surfaces.
2. Sweep and vacuum floor coverings thoroughly.
3. Damp-mop floor coverings to remove marks and soil.

C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor covering before applying liquid floor polish.

1. Apply two coat(s) or as recommended by manufacturer.

E. Cover floor coverings until Substantial Completion.

END OF SECTION 096516

SECTION 096519

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Vinyl composition floor tile.
2. Rubber floor tile.

B. Related Sections:

1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.
2. Division 09 Section "Resilient Sheet Flooring" for resilient sheet floor coverings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

E. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE - VCT

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Armstrong World Industries, Inc.; Migrations with Biostride.
2. Mannington Mills, Inc.; Solidpoint.

B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 12 by 12 inches (305 by 305 mm).

F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 RUBBER FLOOR TILE - RT

A. Products: Subject to compliance with requirements, provide the following:
1. Johnsonite; Hammered (HRTSP) finish on Artisan or Matera Collection.

B. Tile Standard: ASTM F 1344, Class I-B, homogeneous rubber tile, through mottled.

C. Wearing Surface: Textured - hammered.

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 24 by 24 inches (610 by 610 mm).

F. Seaming Method: Standard.

G. Colors and Patterns: As selected from Artisan or Matera Collection.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer **and as follows**. Proceed with installation only after substrates pass testing.
   a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply two coat(s).

E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813

TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes modular, tufted carpet tile, including walk-off mat tiles.

B. Related Sections include the following:
1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
2. Division 09 Section "Sheet Carpeting."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tiles: Full-size Sample.

C. LEED Submittal:

1. Product Data for Credit EQ 4.3:

a. For carpet tile, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
b. For installation adhesive, including printed statement of VOC content.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

G. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.7 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Warranty Period: Lifetime Wear Warranty, Moisture Barrier, Dimensional Stability, Delamination, Tuft Bind Failure (edge ravel, yarn pulls and zippering) and Lifetime Static Protection Warranty.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 CARPET TILE - CPT

A. Products: Subject to compliance with requirements, provide one the following:

1. Invision Carpet Systems, a Division of J&J Industries, Inc.

a. Color: As selected by Architect from manufacturer's full range.
b. Pattern: Flax, with Nexus Modular.

B. Fiber Type: 100% Ultron Nylon, Type 6.6 BCF.

C. Pile Characteristic: Textured loop pile.

D. Pile Thickness: 0.180 inches 4.57(mm)> for finished carpet tile.

E. Gage: 12 rows per inch.

F. Surface Pile Weight: 26 oz./sq. yd.

G. Secondary Backing: Nexus Modular.

H. Size: 24 by 24 inches (610 by 610 mm).

I. Applied Soil-Resistance Treatment: ProTex Fluorochemical.

J. Performance Characteristics: As follows:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
2. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.
3. Environmental Requirements: Provide carpet tile that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.2 CARPET TILE - WOM

A. Products: Subject to compliance with requirements, provide one the following:

1. Mats Inc.

a. Color: As selected by Architect from manufacturer's full range.
b. Pattern: Supreme Nop Tile.

B. Fiber Content: 100 percent polypropylene.

C. Pile Characteristic: Level-loop pile.

D. Pile Thickness: 7/16 inches for finished carpet tile.

E. Total Weight: 132.4 oz./sq. yd. for finished carpet tile.

F. Primary Backing/Backcoating: Bitumen.

G. Size: 19-11/16 inches by 19-11/16 inches.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness

characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.

2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders and quarter turn tiles.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

K. Applied Soil-Resistance Treatment: Sentry Plus.

L. Performance Characteristics: As follows:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
2. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.
3. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

1. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096816

SECTION 099120

PAINTING (PROFESSIONAL LINE PRODUCTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork.
b. Metal toilet enclosures.
c. Finished mechanical and electrical equipment.
d. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
a. Furred areas.
b. Ceiling plenums.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper and copper alloys.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
1. Division 5 Section "Structural Steel" for shop priming structural steel.
2. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
3. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. LEED Submittals:

1. Credit EQ 4.2: Manufacturers' product data for paint products, including printed statement of VOC content.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with an additional 3 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Benjamin Moore & Co. (Benjamin Moore).
2. Sherwin-Williams Co. (Sherwin-Williams).
3. ICI.
4. Tnemec.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As selected by Architect from manufacturer's full range.

2.3 EXTERIOR FERROUS METAL SYSTEM: (Surface Preparation: SSPC-SP6)

Coat 1: Tnemec Series 90-97 Tnemec-Zinc (shop applied) at 3.0 mils DFT
Coat 2: Tnemec 27 Typoxy (shop applied) at 3.0 mils DFT

burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
   a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or

unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

H. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

I. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

Coat 1: Tnemec Series 90-97 Tnemec-Zinc (shop applied) at 3.0 mils DFT
Coat 2: Tnemec 27 Typoxy (shop applied) at 3.0 mils DFT
Coat 3: Tnemec Series 73 Endura-Shield II at 3.0 mils DFT

Coat 4: Tnemec Series 1071/1072 Flouronar

B. Sheathing: Provide the following finish systems over exposed exterior sheathing surfaces:

1. Epoxy: Spray Application.

3.7 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior low-luster acrylic enamel.

B. Ferrous Metal and Gypsum Board where noted in Finish Schedule: Provide the following finish systems over ferrous metal:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior ferrous-metal primer (factory primed).
b. Finish Coats: Interior semigloss acrylic enamel.

C. Exposed Steel Deck and Structure: Provide the following finish systems:

1. Dry Fall Paint: One coat or to cover.
a. Finish Coat: Dry fall paint.

END OF SECTION 099120

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior Panel Signs.

B. Related Sections include the following:
1. Division 22 Section "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
2. Division 23 Section "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
3. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
4. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for signs.

1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1. Acrylic sheet.

D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
   1. Acrylic Sheet: 8 by 10 inches (200 by 250 mm) for each color required.

E. Sign Schedule: Use same designations indicated on Drawings.

F. Maintenance Data: For signs to include in maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

C. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:
      a. Deterioration of embedded graphic image colors and sign lamination.

   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. ACE Sign Systems, Inc.
   2. Advance Corporation; Braille-Tac Division.
   3. Allen Industries Architectural Signage
   4. Allenite Signs; Allen Marking Products, Inc.
   5. APCO Graphics, Inc.

6. ASI-Modulex, Inc.
7. Best Sign Systems Inc.
8. Bunting Graphics, Inc.
9. Fossil Industries, Inc.
10. Gemini Incorporated.
11. Grimco, Inc.
12. Innerface Sign Systems, Inc.
13. InPro Corporation
14. Matthews International Corporation; Bronze Division.
15. Mills Manufacturing Company.
16. Mohawk Sign Systems.
17. Nelson-Harkins Industries.
18. Seton Identification Products.
19. Signature Signs, Incorporated.
20. Supersine Company (The)

B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:
1. Laminated, Etched Photopolymer: Raised graphics with Braille 1/32 inch (0.8 mm) above surface with contrasting colors as selected by Architect from manufacturer's full range and laminated to acrylic back.
2. Edge Condition: Square cut.
3. Corner Condition: Square.
4. Mounting: Unframed.

   a. Wall mounted with two-face tape.
5. Color: As selected by Architect from manufacturer's full range.
6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.

C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

1. Panel Material: Photopolymer.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

D. Subsurface Copy: Apply minimum 4-mil- (0.10-mm-) thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free of rough edges.

E. Panel Sign Schedule:

1. Provide signs for all Toilets, Stairs, Elevators and Utility Rooms.

2.2 FINISHES, GENERAL

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.3 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102600

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall guards.
2. Impact-resistant handrails.
3. Corner guards.
4. Impact-resistant wall coverings.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for metal angle corner guards.
2. Division 08 Section "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
2. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
3. Uniform and concentrated loads need not be assumed to act concurrently.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength[, **fire-test-response characteristics**], dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. LEED Submittals:

1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood rails comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

a. Include statement indicating costs for each certified wood product.

2. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that products contain no urea formaldehyde.

C. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.

1. Include similar Samples of accent strips and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.[**Include Samples of accent strips to verify color selected.**]

1. **[Wall]** [**and**] [**Corner**] Guards: 12 inches (300 mm) long. Include examples of joinery, corners, [**end caps,**] [**top caps,**] and field splices.
2. Handrails: 12 inches (300 mm) long. Include examples of joinery, corners, and field splices.
3. Impact-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.
4. Door-Surface Protection: 6 by 6 inches (150 by 150 mm) square.
5. Door[**-Edge**] [**and**] [**-Frame**] Protectors: 12 inches (300 mm) long.
6. Door-Knob and -Lever Protectors: Full-size unit of each type.

F. Qualification Data: For qualified [**Installer**] [**testing agency**].

G. Material Certificates: For each impact-resistant plastic material, from manufacturer.

H. Material Test Reports: For each impact-resistant plastic material.

I. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

J. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Division 01 Section "Quality Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Forest Certification: Fabricate wood rails from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

E. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

F. Regulatory Requirements: Comply with applicable provisions in **[the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines] [and] [ICC/ANSI A117.1]**.

G. Preinstallation Conference: Conduct conference at **[Project site] <Insert location>**.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

a. Store corner-guard covers in a vertical position.
b. Store **[wall-guard] [bed-locator] [and] [handrail]** covers in a horizontal position.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: **[Five] <Insert number>** years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. **[Wall-Guard] [and] [Handrail]** Covers: Full-size plastic covers of maximum length equal to **[2] <Insert number>** percent of each type, color, and texture of units installed, but no fewer than **[two, 8-foot- (2.4-m-)] <Insert number and size>** long units.
2. Bed-Locator Covers: Full-size plastic covers equal to **[2] <Insert number>** percent of each type, color, and texture of units installed, but no fewer than **[two] <Insert number>** units.
3. Corner-Guard Covers: Full-size plastic covers of maximum length equal to **[2] <Insert number>** percent of each type, color, and texture of units installed, but no fewer than **[two, 4-foot- (1.2-m-)] <Insert number and size>** long units.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded material, thickness as indicated.
1. Self-extinguishing when tested according to ASTM D 635.
2. Flame-Spread Index: 25 or less.
3. Smoke-Developed Index: 450 or less.

B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.

C. Stainless-Steel Sheet: ASTM A 240/A 240M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.
b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
c. Adjust end caps as required to ensure tight seams.

B. Impact-Resistant Wall Covering: Install top and edge moldings, and corners as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Healthcare accessories.
4. Childcare accessories.
5. Custodial accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in specifications or comparable product by one of the following:
1. American Specialties, Inc.
2. Bradley Corporation.
3. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Toilet Tissue (Roll) Dispenser – T1:

1. Basis-of-Design Product: Bobrick, B-4388.
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Recessed.
4. Operation: Noncontrol delivery with standard spindle.
5. Capacity: Designed for rolls up to 5-1/4-inch diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Paper Towel (Folded) Dispenser T2:

1. Basis-of-Design Product: Bobrick, B-4262.
2. Mounting: Surface mounted.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicators: Pierced slots at sides or front.

D. Combination Towel (Folded) Dispenser/Waste Receptacle T3:

1. Basis-of-Design Product: B-4369.
2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
3. Mounting: Recessed with projecting receptacle.

    a. Designed for nominal 4-inch (100-mm) wall depth.

4. Minimum Towel-Dispenser Capacity: 350 C-fold or 475 multifold paper towels.
5. Minimum Waste-Receptacle Capacity: 2.6 gal. (9.8 L).
6. Material and Finish: Stainless steel, No. 4 finish (satin).
7. Liner: Reusable, vinyl waste-receptacle liner.
8. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.

E. Liquid-Soap Dispenser T4:

1. Basis-of-Design Product: B-4112.
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Horizontally oriented, surface mounted.
4. Capacity: 40 oz. (1.2 L).

5. Materials: Satin Finish Stainless Steel with corrosion-resistant valve.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

F. Hand Sanitizer Dispenser T5:

1. Basis-of-Design Product: Gojo Purell NXT Space Save Wall-Mount Dispenser.
2. Description: Designed for dispensing Purell.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 1000 mL.
5. Materials: Gray Plastic.
6. Refill Indicator: Window type.

G. Grab Bar T6 and T7:

1. Basis-of-Design Product: Bobrick B-5806 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches (32 mm).
5. Configuration and Length: T6 – 36" straight and T7 – 42" straight.

H. Sanitary-Napkin Disposal Unit T8:

1. Basis-of-Design Product: Bobrick B-270.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

I. Seat-Cover Dispenser T9:

1. Basis-of-Design Product: Bobrick B-4221.
2. Mounting: Surface mounted.
3. Minimum Capacity: 250 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.

J. Robe Hook T10:

1. Basis-of-Design Product: Bobrick, B-6717.
2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

K. Towel Pin T11:

1. Basis-of-Design Product: Bobrick, B-6777.
2. Description: Projecting minimum of 3-3/8-inches from wall surface.

3. Material and Finish: Stainless steel, No. 4 finish (satin).

L. Specimen Pass-Through Cabinet T12:

1. Basis-of-Design Product: Bobrick, .
2. Description: With self-closing doors on both sides, lock that prevents doors from both being opened at the same time, and removable stainless-steel tray.
3. Nominal Wall Opening: 12 by 11-1/4 inches (305 by 285 mm), width times height.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

M. Diaper-Changing Station T-13:

1. Basis-of-Design Product: KoalaKare Childcare Products by Bobrick, KB100-00.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

   a. Engineered to support a minimum of 250-lb (113-kg) static load when opened.

3. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE in manufacturer's standard color.
6. Liner Dispenser: Built in.

N. Utility Shelf T-14:

1. Basis-of-Design Product: Bobrick, B298 x 36.
2. Description: With exposed edges turned down not less than 1/2 inch (13 mm) and supported by two triangular brackets welded to shelf underside.
3. Size: 36 inches (915 mm) long by 8 inches (205 mm) deep.
4. Material and Finish: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel, No. 4 finish (satin).

O. Mirror T-15:

1. Basis-of-Design Product: Bobrick, B165 24 x 30.
2. Description: ½" x ½" x ½" channel framed with ¼" glass mirror with galvanized back.
3. Size: 24 inches wide by 30 inches high.
4. Material and Finish: Type 430 stainless steel with bright polish finish.

2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire protection cabinets for the following:

a. Portable fire extinguishers.

B. Related Sections:
1. Division 10 Section "Fire Extinguishers."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Size: 6 by 6 inches (150 by 150 mm) square.

D. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

E. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Stainless-Steel Sheet: ASTM A 666, Type 304.

C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Basis-of-Design Product: The design for each metal locker specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.3 FIRE PROTECTION CABINET FE-1

A. Cabinet Type: Suitable for fire extinguisher.

B. Basis-of-Design Product: J.L. Industries, Inc., Cosmopolitan or a comparable product of one of the following:
   a. Larsen's Manufacturing Company.
   b. Moon-America.
   c. Potter Roemer LLC.
   d. Watrous Division, American Specialties, Inc.

C. Cabinet Construction: Nonrated and 1-hour fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.

D. Cabinet Material: Steel sheet.

1. Shelf: Same metal and finish as cabinet.

E. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.

F. Cabinet Trim Material: Stainless-steel sheet.

G. Door Material: Stainless-steel sheet.

H. Door Style: Fully glazed panel with frame.

I. Door Glazing: Tempered float glass (clear).

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide continuous hinge, of same material and finish as trim permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Decals.
3) Lettering Color: Red.
4) Orientation: Vertical.

L. Finishes:
1. Stainless Steel: No. 4.

2.4 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

C. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, fire extinguishers and mounting brackets for fire extinguishers.

B. Related Sections:

1. Division 10 Section "Fire Extinguisher Cabinets."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.

C. Remaining paragraphs are defined in Division 01 Section "Submittal Procedures" as "Informational Submittals."Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Fire End & Croker Corporation.
e. J. L. Industries, Inc.; a division of Activar Construction Products Group.
f. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
g. Larsen's Manufacturing Company.
h. Moon-American.
i. Potter Roemer LLC.

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS (FE-2)

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
g. Larsen's Manufacturing Company.
h. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105116

WOOD LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Wood lockers with plastic-laminate-faced wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood lockers.

B. LEED Submittals:

   1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood lockers comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating costs for each certified wood product.
   2. Product Data for Credit EQ 4.4: For each composite wood product used, documentation indicating that product contains no urea formaldehyde.

C. Shop Drawings: For wood lockers. Include plans, elevations, sections, details, and attachments to other work.

   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for items installed in wood lockers.
   4. Show wood locker fillers, trim, base and accessories.
   5. Show wood locker numbering sequence.

D. Samples for Initial Selection: For the following:
   1. High-pressure decorative laminates.
   2. Thermoset decorative overlay panels.

E. Maintenance Data: For adjusting, repairing, and replacing wood locker doors and latching mechanisms to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Regulatory Requirements: Where wood lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

C. Forest Certification: Fabricate wood lockers from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood lockers until painting and similar operations that could damage wood lockers have been completed in installation areas. If wood lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are same as that in final installation location and comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install wood lockers until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature between 60 and 90 deg F (16 and 32 deg C) and humidity conditions between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of concealed framing, blocking, and reinforcements that support wood lockers by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate sizes and locations of concealed wood support bases.

1. Requirements are specified in Division 06 Section "Miscellaneous Rough Carpentry."

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that wood lockers can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of wood lockers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of locks or hardware.
c. Deterioration of wood, wood finishes, and other materials beyond normal use.

2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. The New England Wood Locker Co., Inc.
2. World Famous Lockers, a Division of Wisconsin Bench.
3. Ideal Products, Inc. – 2000 Series.

2.2 MATERIALS

A. Solid Wood: Clear hardwood lumber, selected for compatible grain and color.

B. Particleboard: ANSI A208.1, Grade M-2, urea formaldehyde-free.

C. Thermoset Decorative Overlay: Surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1 for application over particleboard or medium-density fiberboard.

D. High-Pressure Decorative Laminate: NEMA LD 1, vertical grade.

E. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

F. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as indicated on Drawings.
2. Provide toothed-steel or lead-expansion sleeves for drilled-in-place anchors.

G. Wood Support Base: 2-by-4-inch nominal-size (38-by-89-mm actual-size) lumber.

2.3 WOOD LOCKER HARDWARE

A. General: Provide manufacturer's standard wood locker hardware complying with the requirements in this Section.

B. Frameless Hinges (European Type): Fully concealed, self-closing, nickel-plated steel, with not less than 125 degrees of opening.
   1. Provide three hinges for doors more than 42 inches (1070 mm) high.

C. Exposed Hardware Finishes: Satin chrome unless otherwise indicated.

2.4 DOOR LOCKS

A. General: Fabricate wood lockers to receive locking devices. Provide one locking device for each wood locker door unless otherwise indicated.

B. Cylinder Locks: Built-in, flush cam locks with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and two master keys.

2.5 PLASTIC-LAMINATE-FACED WOOD LOCKERS

A. Construction Style: Flush overlay.

B. Locker Body: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay.

   1. Side Panels: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
   2. Back Panel: Manufacturer's standard 1/2 or 3/8 inch (13 or 9.5 mm) thick.
   3. Top Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
   4. Bottom Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
   5. Exposed Panel Edges: High-pressure decorative laminate, Grade VGS, to match panels.

C. Plastic-Laminate-Faced Wood Doors: High-pressure decorative laminate, Grade VGS, over both sides of particleboard core.

   1. Thickness: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
   2. Panel Edges: 1-mm-thick PVC or High-pressure decorative laminate, Grade VGS, to match panels.

D. End Panels: Match style, material, construction, and finish of plastic-laminate-faced wood doors.

E. Shelves: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay; fixed.

   1. Thickness: 3/4 inch (19 mm.)
   2. Exposed Edges: Thermoset decorative overlay to match panels.

F. Corners and Filler Panels: 3/4-inch- (19-mm-) thick panels. Match style, material, construction, and finish of plastic-laminate-faced wood doors.

G. Plastic-Laminate Colors, Patterns, and Finishes:
1. As selected by Architect from plastic-laminate manufacturer's full range of solid colors, wood grains and patterns.

2.6 LOCKER ACCESSORIES

A. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; chrome finished. Attach hooks with at least two fasteners.
1. Provide two single-prong wall hooks for each compartment of wood lockers.

B. Coat Rods: 1-inch- (25-mm-) diameter steel; nickel plated.
1. Provide coat rod for each compartment of single-tier wood lockers.

C. Number Plates: 1-1/2-inch- (38-mm-) diameter, etched, embossed, or stamped, stainless-steel plates with black numbers and letters at least 1/2 inch (13 mm) high. Identify wood lockers in sequence indicated on Drawings.

D. Continuous Finish Base: Plastic-laminate-faced, 3/4-inch- (19-mm-) thick panel that matches door faces; fabricated in lengths as long as practical to enclose base and base ends of wood lockers.

2.7 FABRICATION

A. Fabricate each wood locker with shelves, an individual door and frame, an individual top, a bottom, and a back, and with common intermediate uprights separating compartments.

1. Fabricate wood lockers to dimensions, profiles, and details indicated.

B. Fabricate components square, rigid, without warp, and with finished faces flat and free of scratches and chips. Accurately machine components for attachments in factory. Make joints tight and true.

1. Fabricate wood lockers using manufacturer's standard construction with joints made with dowels, dados, or rabbets. Dado side panels to receive shelving except where indicated to be adjustable.

C. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

D. Venting: Fabricate wood lockers with space between doors and locker assembly of not less than 1/4 inch (6 mm).

E. Number Plates: Inlay number plates flush in each wood locker door, near top, centered.

F. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

G. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

H. Attach PVC edging to panels by thermally fusing edging to panels after panel fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting wood locker installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Condition wood lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing wood lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Install wood support base with 1/2-inch- (13-mm-) thick plywood top.

B. Install wood lockers level, plumb, and true; use concealed shims.

C. Connect groups of wood lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit wood lockers accurately together to form flush, tight, hairline joints.

D. Install wood lockers without distortion so doors fit openings properly and are accurately aligned. Adjust hardware to center doors in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Installation Tolerance: No more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line. Shim as required with concealed shims.
2. Fasten wood lockers through back, near top and bottom, at ends with No. 8 flush-head wood screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or furring spaced not more than 16 inches (400 mm) o.c.
3. Fasten wood lockers through wood locker base, at ends, and not more than 36 inches (910 mm) o.c. with No. 8 flush-head wood screws sized for 1-inch (25-mm) penetration into wood base.

E. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.

F. Install number plates after wood lockers are in place.

1. Attach number plate on each wood locker door, near top, centered, with at least two screws with finish matching number plate.

3.4 ADJUSTING, CLEANING, AND PROTECTING

A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect wood lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

C. Touch up marred finishes, or replace wood lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by wood locker manufacturer.

END OF SECTION 105116

SECTION 108213

EXTERIOR GRILLES AND SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum equipment screens.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for supports for equipment screens.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Equipment screens shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. Design earthquake spectral response acceleration, short period (Sds) for Project is 0.251.
2. Component Importance Factor is 1.5.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For equipment screens and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
1. Show mullion profiles and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain equipment screens from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

B. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Include supports, anchorages, and accessories required for complete assembly.

D. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with fully recessed mullions at corners.

2.3 FIXED, EXTRUDED-ALUMINUM EQUIPMENT SCREENS

A. Horizontal Equipment Screen:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialites Inc. Vert-a-Cade 301 Screen or comparable product by one of the following:

a. Architectural Louvers, Inc.
b. Leed Himmel Industries.

2. Louver Depth: 4 inches (100 mm), spaced approximately 6-3/4" on center.
3. Frame and Blade Nominal Thickness: Not less than 0.081 inch (2.03 mm).

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.5 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine structural supports, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate and place equipment screens level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

E. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces of equipment screens that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore equipment screens damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 108213

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine structural supports, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate and place equipment screens level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

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C. Restore equipment screens damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 108213

1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor on request.

B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other items located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.

C. Lead Glazing: Unless otherwise indicated, provide lead equivalence not less than that indicated for assembly in which glazing is installed.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittal:

1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood veneer on doors complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

a. Include statement indicating costs for certified wood veneer doors.

C. Shop Drawings: Show layout of radiation-protected areas. Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.

1. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.

D. Other Action Submittals:

1. Schedule: Provide a schedule of observation windows, doors and frames prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A.

B. Source Limitations: Obtain each type of radiation protection product from single source from single manufacturer unless otherwise indicated.

C. Forest Certification: Provide wood veneers for doors produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

D. Glazing: Comply with requirements in Division 08 Section "Glazing."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Lead-Lined Gypsum Panels: Neatly stack panels flat to prevent deformation.

B. Lead-Lined Steel Frames: Comply with requirements in Division 08 Section "Hollow Metal Doors and Frames" for delivery, storage, and handling.

C. Lead-Lined Wood Doors: Comply with requirements in Division 08 Section "Flush Wood Doors" for delivery, storage, and handling.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install radiation protection until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 WARRANTY

A. Comply with requirements in Division 08 Section "Flush Wood Doors."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lead Glazing Plastic: Transparent acrylic sheet impregnated with an organolead compound and containing 30 percent lead by weight.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Fluke Biomedical; Radiation Management Services.

B. Lead-Lined Gypsum Board: 5/8-inch- (16-mm-) thick gypsum board complying with Division 09 Section "Gypsum Board" of width and length required for support spacing and to

prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.

1. Provide lead sheet lining the full width and length of board.
2. Provide 3-inch- (75-mm-) wide lead strips for wrapping metal stud flanges.
3. Provide 2-inch- (50-mm-) wide lead strips for backing joints.
4. Provide 5/8-inch (16-mm) lead disks for covering screw heads.

C. Accessories and Fasteners: Provide manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.

D. Asphalt Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Asphalt Felt: ASTM D 226.

2.2 LEAD-LINED STEEL HOLLOW-METAL DOOR FRAMES

A. General: Steel door frames complying with ANSI/NAAMM-HMMA 861, except 0.0667 inch (1.7 mm) thick, and lined with lead sheet of thickness not less than that required for doors and walls where frames are used.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Deronde Products.
   b. Karpen Steel Custom Doors & Frames.
   c. Aaccurate Radiation Shielding, Inc.
   d. A & L Shielding Inc.
   e. El Dorado Metals, Inc.
   f. Fluke Biomedical; Radiation Management Services.
   g. Mayco Industries; a Metalico company.
   h. NELCO, Inc.
   i. New Shield.
   j. Radiation Protection Products, Inc.
   k. Ray-Bar Engineering Corp.

2. Provide additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
3. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
4. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

2.3 LEAD-LINED WOOD DOORS

A. General: Flush solid-core wood doors with lead lining, thickness not less than that required for partition in which door is installed.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Algoma Hardwoods, Inc.
b. Lambton Doors.
c. Marshfield DoorSystems, Inc.
d. V-T Industries Inc.
e. Aaccurate Radiation Shielding, Inc.
f. A & L Shielding Inc.
g. Atomic International.
h. El Dorado Metals, Inc.
i. Fluke Biomedical; Radiation Management Services.
j. Mayco Industries; a Metalico company.
k. NELCO, Inc.
l. New Shield.
m. Radiation Protection Products, Inc.
n. Ray-Bar Engineering Corp.

2. Door Construction: Veneer face, five ply, bonded particleboard or structural composite lumber core.
3. Lead Lining: One or more continuous sheets of lead extending from top to bottom and edge to edge, constructed either in the core or between the core and faces, at manufacturer's option.
4. Lead Lining: One continuous sheet of lead extending from top to bottom and edge to edge, constructed in the core. Assemble lead lining and core with poured lead fasteners or steel bolts. Space fasteners not more than 1-1/2 inches (38 mm) from door edge and about 8 inches (200 mm) o.c. Countersink bolt heads and cover with lead.
5. Comply with Division 08 Section "Flush Wood Doors" for grade, faces, veneer matching, fabrication, finishing, and other requirements unless otherwise indicated.
6. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining.
7. Factory fit doors to suit frame openings indicated with 1/16-inch (1.5-mm) clearance at heads and jambs and minimum clearance at bottom. Factory machine doors for hardware not surface applied.

2.4 LEAD-LINED OBSERVATION-WINDOW FRAMES

A. General: Fabricate from 0.043-inch- (1.1-mm-) thick, formed-steel sheet or 0.064-inch- (1.6-mm-) thick aluminum extrusions with mitered corners, welded or bolted with concealed fasteners.

1. Line with lead sheet formed to match frame contour, continuous in each jamb and across head and sill, lapping the stops, and fabricated wide enough to maintain an effective lap with lead of adjoining assemblies.
2. Construct so lead lining overlaps glazing material perimeter by at least 3/8 inch (9.5 mm) and provide removable stops.
3. Form sill with an opening for sound transmission. Offset sound passage to make opening lightproof and to maintain required lead equivalence at all points and in all directions.

2.5 DOOR AND DOOR FRAME FABRICATION

A. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF LEAD SHEETS IN CONCRETE FLOOR SLABS

A. Apply a coat of asphalt mastic or paint to concrete surfaces before installing lead sheet.

B. Before installing floor lead sheet, place lead strips not less than 7 inches (175 mm) wide under the base of vertical wall protection. Extend lead strips approximately 3 inches (75 mm) into the shielded room area.

C. Lead Sheet, 1/8 Inch (3 mm) Thick or Less: Install in a single layer with a 2-inch (50-mm) minimum lap at joints.

D. Lead Sheet More Than 1/8 Inch (3 mm) Thick: Install in two or more layers with a 2-inch (50-mm) minimum lap at joints, or in a single layer with joints butted and covered with a 4-inch-(100-mm-) wide lead strip of same thickness.

E. Extend lead sheet at least 12 inches (300 mm) beyond radiation protection in walls of room.

F. In floor slabs above shielded rooms where lead sheet is indicated, extend lead sheet at least 12 inches (300 mm) beyond radiation protection in walls of room below.

G. At door openings, extend lead sheet at least 12 inches (300 mm) beyond radiation protection in walls and at least 12 inches (300 mm) beyond door opening on both sides[**except where lead-lined thresholds are provided**].

H. After installation, apply **[a coat]** [**two coats**] of asphalt coating on top surface of lead sheet and protect from damage until concrete topping is placed.

3.3 INSTALLATION OF LEAD-LINED GYPSUM BOARD

A. Install with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints. Install using construction adhesive and supplementary fasteners.

B. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer. Install lead strips covering face of framing and wrap around flange to cover points of screws.

1. Where possible, install lead-lined gypsum board before installing gypsum board on other side of partition, and do not fold lead strips back over inside of flange until after lead-lined gypsum board is applied.
2. Apply lead disks recessed flush with surface of board over heads of screws securing trim.

C. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer. Apply lead disks over screw heads and recess flush with surface of board.

1. Install lead strips, 1-1/2 inches (38 mm) wide minimum and same thickness as lead lining, to face of supports and blocking where joints occur. Secure lead strips with construction adhesive. Provide shims at intermediate supports.
2. Apply lead disks recessed flush with surface of board over heads of screws securing trim.

D. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least 1 inch (25 mm). Arrange board around openings so neither horizontal nor vertical joints occur at corners of openings.

E. Install control and expansion joints where indicated, with appropriate trim accessories. Install lead strip on face of framing, extending across joint, and lap with lead lining of gypsum board.

3.4 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

A. Install lead-lined steel door frames according to Division 08 Section "Hollow Metal Doors and Frames."

1. Apply a coat of asphalt mastic or paint to lead lining in door frames where lead will come in contact with masonry or grout.

B. Install lead-lined wood doors according to Division 08 Section "Flush Wood Doors."

C. Frames: Comply with HMMA 840 unless otherwise indicated. Except for frames located in existing walls or partitions, place frames before constructing walls. Set frames accurately in position, plumb, and brace securely until permanent anchors are set.

1. Provide three anchors per jamb, located adjacent to hinge on hinge jamb and at corresponding heights on strike jamb.
2. In metal stud construction, use wall anchors attached to studs with screws.

D. Lap lead lining of frames over lining in walls at least 1 inch (25 mm).

E. Lead Lining of Frames: Line inside of frames with lead of thickness not less than that required in doors and walls where frames are used. Form lead to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Lap lining over lining in walls at least 1 inch (25 mm).

F. Install doors in frames level and plumb, aligned with frames and with uniform clearance at each edge.

G. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. See Division 08 Section "Door Hardware" for other installation requirements.

H. Touch up damaged finishes with compatible coating after sanding smooth.

I. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.

3.5 INSTALLATION OF LEAD-LINED OBSERVATION WINDOWS

A. Install observation windows according to manufacturer's written installation instructions.

1. Apply a coat of asphalt mastic or paint to lead lining in frames where lead will come in contact with masonry or grout.

B. Install windows level, plumb, square, true to line, and anchored securely in place to structural support.

C. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least 1 inch (25 mm).

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with manufacturer's written instructions.

3.6 INSTALLATION OF PENETRATING ITEMS

A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.

B. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.

C. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.

D. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch (25 mm). Wrap conduit with lead sheet for a distance of not less than 10 inches (250 mm) from box.

E. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to three times the largest opening dimension. Lap lead sheet with adjacent lead lining at least 1 inch (25 mm).

F. Piping: Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 inches (250 mm) from point of penetration.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections after radiology equipment has been installed and placed in operating condition.

B. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements.

END OF SECTION 134900

SECTION 142400

HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes hydraulic passenger elevators.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.

2. Division 05 Section "Metal Fabrications" for the following:

   a. Attachment plates and angle brackets for supporting guide-rail brackets.
   b. Divider beams.
   c. Hoist beams.
   d. Structural-steel shapes for subsills.
   e. Pit ladders.
   f. Cants in hoistways made from steel sheet.

3. Division 09 Section "Resilient Tile Flooring" for finish flooring in elevator cars.
4. Division 09 painting Sections for field painting of hoistway entrance doors and frames.
5. Division 16 Sections for electrical service for elevators to and including shunt trip circuit breaker at machine room door.
6. Division 16 Section "Communications Technology Infrastructure" for telephone service for elevators.
7. Division 16 Section "Fire Alarm Systems" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.
8. Division 2 Section "Earthwork" for excavating well hole to accommodate cylinder assembly.
9. Division 2 Section "Earthwork" for disposition of excavated material from cylinder well hole.

1.3 DEFINITIONS

A. Definitions in ASME A17.1 apply to work of this Section.

B. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

C. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:

1. Car enclosures and hoistway entrances.
2. Operation, control, and signal systems.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control station. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Initial Selection: For finishes involving color selection.

D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

E. Qualification Data: For Installer.

F. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

G. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain elevators through one source from a single manufacturer.

1. Provide major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.

C. The elevator installation shall be a design that can be maintainable by any licensed elevator maintenance company employing journeymen mechanics, without the need to purchase or lease additional diagnostic devices, special tools, or instructions from the original equipment manufacturer.

D. Regulatory Requirements: Comply with ASME A17.1 and elevator design requirements for earthquake loads in ASCE 7-02
1. Design earthquake spectral response acceleration, short period (Sds) for Project is .251.
2. Project's seismic design category is C.
3. Elevator importance factor is 1.5.
4. Seismic Use Group: III (Emergency Facility).

E. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

F. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging.

B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

1.7 COORDINATION

A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.

B. Furnish well casing and coordinate delivery with related excavation work.

B. Group Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators and elevator groups where indicated:

1. Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to a preselected floor, opens its doors, and shuts down. If car is below the preselected floor, it is lowered to the next lower floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

1. Card-Reader Operation: System uses card readers at car control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Provide stripe-swipe card reader integral with each car control station.

a. Security access system equipment will be provided by Owner. Coordinate with Owner's vendor.

2.4 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.5 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

E. Stainless-Steel Bars: ASTM A 276, Type 304.

F. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

2.6 CAR ENCLOSURES

A. General: Provide enameled-steel car enclosures to receive removable wall panels, with car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
2. Provide finished car including materials and finishes specified below.

B. Materials and Finishes: Provide manufacturer's standards, but not less than the following:

1. Subfloor: Underlayment grade, exterior plywood, 5/8-inch (16-mm) nominal thickness.
2. Floor Finish: Specified in Division 09 Section "Resilient Tile Flooring."
3. Enameled-Steel Wall Panels: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
4. Fabricate car with recesses and cutouts for signal equipment.
5. Fabricate car door frame integrally with front wall of car.
6. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
7. Sight Guards: Provide sight guards on car doors.
8. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.
9. Metal Ceiling: Flush panels, with four low-voltage downlights in each panel. Align ceiling panel joints with joints between wall panels.
10. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.7 HOISTWAY ENTRANCES

A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.

B. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:
1. Stainless-Steel Frames: Formed from stainless-steel sheet. Provide stainless-steel frames at all entrances.
2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
3. Sight Guards: Provide sight guards on doors matching door edges.
4. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.
5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.8 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers or LEDs.

B. Car Control Stations: Provide manufacturer's standard recessed car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

C. Swing-Return Car Control Stations: Provide car control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.

1. Mark buttons and switches with standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car control station, either integral with car control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

D. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.

1. Include travel direction arrows if not provided in car control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than one station for each four elevators in a group.

G. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.
1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
2. Equip units with buttons for calling elevator and for indicating desired direction of travel.

H. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:

1. Manufacturer's standard wall-mounted units, for mounting beside frames.

I. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on each car.

J. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.

K. Fire Command Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

L. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

2.9 ELEVATORS

A. Elevator Description:
1. Elevator Numbers: One and Two.
2. Type: Under-the-car single cylinder.
3. Rated Load: 2500 lb (1135 kg).
4. Rated Speed: 100 fpm (0.51 m/s).
5. Operation System: Selective collective automatic operation.
6. Auxiliary Operations:
   a. Battery-powered lowering.
7. Security Features: Card-reader operation.
8. Car Enclosures:
   a. Inside Width: 80 inches (2032 mm) from side wall to side wall.
   b. Inside Depth: 51 inches (1295 mm) from back wall to front wall (return panels).
   c. Inside Height: 96 inches (2337 mm) to underside of ceiling.
   d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish. finish with integral car door frames.
   e. Car Fixtures: Satin stainless steel, No. 4 finish.
   f. Side and Rear Wall Panels: Enameled steel with wood paneling by others.
   g. Door Faces (Interior): Satin stainless steel, No. 4 finish.
   h. Door Sills: Nickel silver, polished.
   i. Ceiling: Polished stainless steel, No. 8 finish.
   j. Handrails: 1-1/2 inches (38 mm) round satin stainless steel, No. 4 finish, at sides and rear of car.
   k. Floor recessed and prepared to receive rubber tile (specified in Division 09 Section "Resilient Tile Flooring."
   l. Floor Thickness, Including Setting Materials: 1/8"+/- above plywood subfloor.
9. Hoistway Entrances:
   a. Width: 42 inches (1067 mm).

b. Height: 84 inches (2134 mm).
c. Type: Single-speed side sliding.
d. Fire-Protection Rating: 2 hour.
e. Frames: Satin stainless steel, No. 4 finish.
f. Doors: Satin stainless steel, No. 4 finish.
g. Sills at All Floors: Nickel silver, polished.

10. Hall Fixtures at All Floors: Satin stainless steel, No. 4 finish.
11. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
b. Provide blanket hooks in all cars complete set(s) of full-height protective blankets.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Excavation for Cylinder: Drill well hole in each elevator pit to accommodate installation of cylinder; comply with applicable requirements in Division 2 Section "Earthwork."

B. Provide waterproof well casing to retain walls of well hole.

C. Install cylinder in protective casing within well hole. Before installing protective casing, remove water and debris from well hole and provide permanent waterproof seal at bottom of well casing.

1. Fill void space between protective casing and cylinder with corrosion protective filler.
2. Align cylinders and fill space around protective casing with fine sand.

D. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between protective casing and pit floor with 4 inches (100 mm) of nonshrink, nonmetallic grout.

E. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

F. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

G. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

H. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cemented fittings.

I. Install piping above the floor, where possible. Where not possible, cover underground piping with permanent protective wrapping before backfilling.

J. Lubricate operating parts of systems as recommended by manufacturers.

K. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

L. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and direction of travel.

M. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

N. Locate hall signal equipment for elevators as follows, unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s). Refer to Division 01 Section "Demonstration and Training."

B. Check operation of each elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

C. Check operation of each elevator with Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION 142400