SPECIFICATIONS

PROJECT:

0 HANCOCK STREET
PORTLAND, MAINE

DEVELOPER:

0 HANCOCK STREET, LLC
PO BOX 910
WESTBROOK, ME 04098

ARCHITECT:

ARCHETYPE, P. A.
48 UNION WHARF
PORTLAND, MAINE 04101

November 15, 2017
Construction Set

INDEX TO SPECIFICATIONS

Section:

0 Hancock Street – Portland, ME

END OF SECTION

SECTION 01 70 00.01

SITE PERMIT REQUIREMENTS

PART 1 - GENERAL

A. Construction of this project must meet the terms and conditions of a City of Portland Site Plan Permit. The Owner has applied for this permit. This permit is provided to the contractor in Attachment A. The aforementioned permit shall be the extent of Owner supplied permits. Any other permits required to conduct the work shall be obtained by the Contractor.

B. Some of the permits may require inspection or the work by the Owner or Engineer. The contractor shall review these requirements and provide the Owner a minimum of 48 hours prior to the need for a specified inspection. The Owner will respond and arrange for a time for the inspections to occur. It is the responsibility of the Contractor to have these inspections performed during the course of the work.

C. Copies of the Permit Applications and correspondence during review of the permits may be inspected during normal working hours at the office of:

Stantec Consulting Services Inc.
482 Payne Road, Scarborough Court
Scarborough, Maine
celina.daniell@stantec.com

D. Any Contractor who desires to view the Permit Applications and Associated Correspondence must contact Stantec 48 hours prior to inspecting the information.

E. Certain conditions of the permits will be the responsibility of the Contractor. The Contractor is responsible for familiarizing himself with all specific and standard conditions of the permits issued for the project, and for undertaking all work in strict conformance with these.

F. A copy of the permit and the approved plans shall be available at the Project Site at all times.

G. A copy of all erosion inspection logs, reports and meeting minutes shall be available at the Project Site at all times.

PART 2 - PERMITS

A. The City of Portland Site Plan Permit.

END OF SECTION

ATTACHMENT A

CITY OF PORTLAND SITE PLAN PERMIT

CITY OF PORTLAND, MAINE
PLANNING BOARD

October 6, 2017

0 Hancock Street, LLC
Jonathan Cohen
PO Box 910
Portland, ME 04098-0910

Stantec
Stephen Bushey
482 Payne Road
Scarborough, ME 04074

Project Name:	0 Hancock Street (Wex)	Project ID:	2017-180
Address:	0 Hancock Street	CBL:	019 A0014
Applicant:	0 Hancock Street, LLC, Jonathan Cohen		
Planner:	Caitlin Cameron		

Dear Mr. Cohen:

On October 4, 2017, the Planning Board considered the Level III Site Plan application for 0 Hancock Street. The Planning Board reviewed the proposal for conformance with the standards of the Site Plan Ordinance. The Planning Board voted unanimously 7-0 to approve the application with the following waiver(s) and condition(s) as presented below:

WAIVERS
The Planning Board voted (7-0) on each waiver request and granted the following waivers of the Technical Standards:

1. Technical Manual Section 1.7.2.7 *Location and spacing of driveways* to allow the reduction in the driveway separation to 20 feet on Hancock Street, as shown on the plan and supported by the Traffic Engineering reviewer.

2. Technical Manual Section 5, Subsection II *Applicability* to allow a waiver of the 50% treatment for redevelopment areas, since the proposal includes a roof drain filter system, rooftop vegetation, reduction in impervious area, and hardscaping with less pollutant load, as supported by the Traffic Engineering reviewer.

3. Technical Manual Section 1.8.3 *Sidewalk Design for Accessibility* and the accompanying street cross-sections to allow for a standard curb with two intervening granite steps, as presented at the public hearing (Plan L-2.0).

SITE PLAN REVIEW

The Planning Board voted (7-0) that the plan is in conformance with the site plan standards of the Land Use Code, subject to the following conditions of approval:

1. Prior to Certificate of Occupancy, the applicant shall receive approval for the Traffic Movement Permit. Concurrent to the Traffic Movement Permit review, the applicant shall submit for review and approval by the Planning Authority, additional information to meet the transportation monitoring and analysis requirements of the Site Plan Ordinance. Fees to mitigate impacts may be assessed as part of that review.

2. Prior to Certificate of Occupancy, the applicant shall complete the transfer of ownership process with the Maine Department of Environmental Protection for the Site Location of Development Permit applicable to the property.

3. The developer/contractor/subcontractor must comply with conditions of the stormwater management plan and sediment and erosion control plan based on City standards and state guidelines. The owner/operator of the approved stormwater management system, and all assigns, shall comply with the conditions of Chapter 32 Stormwater including Article III, Post Construction Management, which specifies the annual inspections and reporting requirements. A maintenance agreement for the stormwater drainage system, including the roof system, as attached, or in substantially the same form, shall be submitted for review by Corporation Counsel. Once approved, the document shall be signed and recorded at the Cumberland County Registry of Deeds prior to the issuance of a building permit. Please submit final copies to bot the Department of Public Works and the Department of Planning and Urban Development.

4. Prior to Building Permit and before any site preparation or construction activities occur, the Construction Management Plan shall be approved by City staff.

5. Prior to Building Permit, the final building design shall be revised and submitted to staff for final approval by the Planning Authority in accordance with staff and planning board comment.

6. Prior to Building Permit, the final sidewalk design including grading, material detail, cross slope, street light placement, ADA ramps, apron, and street tree design shall be revised and submitted to staff for final approval by the Department of Public Works, and the Planning Authority in accordance with staff and planning board comment per site plan approval.

7. Prior to Building Permit, the final layout of the utilities and sewer connections shall be revised per staff comment and submitted to Department of Public Works for final approval.

8. Prior to Building Permit, the applicant shall provide drafts of all necessary easements for review and approval by Corporation Counsel, the Department of Public Works, and the Planning Authority, with evidence of executed easements to be submitted prior to the issuance of a building permit, including but not limited to:

    a. Sidewalk easement from 0 Hancock, LLC. to the City of Portland.
    b. License from the City of Portland to 0 Hancock, LLC for canopies extending into the public right-of-way.
    c. License from the City of Portland to 0 Hancock, LLC for foundation footings on Thames Street.

9. Prior to Certificate of Occupancy, the applicant shall provide updated lease agreements verifying the sufficient capacity of the Ocean Gateway Garage to meet the needs of this project. If, upon review, staff or the applicant determines the required off-street parking cannot be met in the Ocean Gateway Garage, the applicant shall propose an alternative parking location(s) or strategies meeting the City's Land Use Code of Ordinances.

10. The Planning Board approved a waiver of the sidewalk design for Thames Street from the City of Portland's Technical Manual Standards; thus prior to Certificate of Occupancy, the applicant shall enter into an agreement to maintain and repair the Thames Street sidewalk to be reviewed and approved by Corporation Counsel and the Planning Authority. This agreement with the City shall be recorded in the deed associated with the property.

11. The Planning Board approved a waiver of the sidewalk design for Thames Street from the City of Portland's Technical Manual Standards; thus outdoor dining will not be allowed in the public right-of-way on the Thames Street frontage.

The approval is based on the submitted plans and the findings related to site plan review standards as contained in the Planning Report for application #2017-180 which is attached.

STANDARD CONDITIONS OF APPROVAL

Please Note: The following standard conditions of approval and requirements apply to all approved site plans:

1. **Develop Site According to Plan** The site shall be developed and maintained as depicted on the site plan and in 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 Planning Authority pursuant to the terms of Chapter 14, Land Use, of the Portland City Code.

2. **Separate Building Permits Are Required** This approval does not constitute approval of building plans, which must be reviewed and approved by the City of Portland's Permitting and Inspections Department.

3. **Site Plan Expiration** The site plan approval will be deemed to have expired unless work has commenced within one (1) year of the approval or within a time period up to three (3) years from the approval date as agreed upon in writing by the City and the applicant. Requests to extend approvals must be received before the one (1) year expiration date.

4. **Performance Guarantee and Inspection Fees** A performance guarantee covering the site improvements, 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 and Urban Development Department and Public Works Department prior to the release of a building permit, street opening permit or certificate of occupancy for site plans. If you need to make any modifications to the approved plans, you must submit a revised site plan application for staff review and approval.

5. **Defect Guarantee** A defect guarantee, consisting of 10% of the performance guarantee, must be posted before the performance guarantee will be released.

6. **Preconstruction Meeting** Prior to the release of a building permit or site construction, a pre-construction meeting shall be held at the project site. This meeting will be held with the contractor, Development Review Coordinator, Public Works representative and owner to review the construction schedule and critical aspects of the site work. At that time, the Development Review Coordinator will confirm that the contractor is working from the approved site plan. 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.

7. **Department of Public Works Permits** If work or obstructions will occur within the public right-of-way, such as utilities, curb, sidewalk , driveway construction, site deliveries and equipment siting, a Street Opening and/or Occupancy Permit (s) is required for your site. Please contact the Department of Public Works Permit Clerk at 874-8300, ext. 8828. (Only excavators licensed by the City of Portland are eligible.)

8. **As-Built Final Plans** Final sets of as-built plans shall be submitted digitally to the Planning and Urban Development Department, on a CD or DVD, in AutoCAD format (*,dwg), release AutoCAD 2005 or greater.

The Development Review Coordinator must be notified five (5) working days prior to the date required for final site inspection. The Development Review Coordinator can be reached at the Planning and Urban Development Department at 874-8632. 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 Caitlin Cameron at (207) 874-8901.

Sincerely,

Sean T. Dundon

Sean Dundon, Vice Chair
Portland Planning Board

Attachments:
1. Staff Memos
2. Planning Board Report + Addenda
3. Portland City Code: Chapter 32
5. Performance Guarantee Packet

Electronic Distribution:
cc: Jeff Levine, AICP, Director of Planning and Urban Development
Stuart G. O'Brien, City Planning Director, Planning and Urban Development
Barbara Barhydt, Development Review Services Manager, Planning and Urban Development
Caitlin Cameron, Urban Designer, Planning and Urban Development
Philip DiPierro, DRC, Planning and Urban Development
Mike Russell, Director of Permitting and Inspections
Ann Machado, Zoning Administrator, Permitting and Inspections
Jonathan Rioux, Deputy Director, Permitting and Inspections
Jeanie Bourke, Plan Reviewer/CEO, Permitting and Inspections

Chris Branch, Director of Public Works
Katherine Earley, Engineering Manager, Public Works
Keith Gray, Senior Engineer, Public Works
Doug Roncarati, Stormwater Coordinator, Public Works
Jane Ward, Engineering, Public Works
Rhonda Zazzara, Construction Engineering Coordinator, Public Works
Jeff Tarling, City Arborist, Public Works
Jeremiah Bartlett, Transportation Systems Engineer, Public Works
William Scott, Chief Surveyor, Public Works
Keith Gautreau, Fire
Mike Thompson, Fire
Danielle West-Chuhta, Corporation Counsel
Jennifer Thompson, Corporation Counsel
Victoria Volent, Housing Program Manager, Housing and Community Development
Thomas Errico, P.E., TY Lin Associates
Lauren Swett, P.E., Woodard and Curran
Christopher Huff, Assessor

Planning and Urban Development Department
Planning Division

Subject: B-6 Eastern Waterfront Design Review – 0 Hancock Street

Written by: Caitlin Cameron, Urban Designer

Date of Review: Friday, September 29, 2017

Design Review Criteria:
The policies and standards listed below are applied to the design review of a B6 Site Plan application.

Eastern Waterfront Master Plan - *Design Guidelines for the Eastern Waterfront*

City of Portland Design Manual – *(g) EWPZ Eastern Waterfront Port Zone and B6 Eastern Waterfront Mixed Use Zone*

Findings of the Design Review:
Preliminary staff review was conducted during the week of September 4, 2017 and included Caitlin Cameron, Urban Designer, Christine Grimando, Senior Planner, and Deb Andrews, Historic Preservation Program Manager. Generally, the staff find the project to meet the design guidelines and support the direction of the project with some revision. Comments in red denote topics of concern or questions for the board to consider.

Eastern Waterfront Master Plan - *Design Guidelines for the Eastern Waterfront*

Introduction: *Development will serve to integrate the working waterfront, commercial business areas, and the Munjoy Hill neighborhood. For integration to be successful, thoughtful, high quality design for all aspects of construction is imperative. With care and attention paid to details and quality, the design of streets, buildings, open space, parking, and changes to the water's edge will contribute to the value of public and private property and the quality of life for Portland residents. . . . that the Eastern Waterfront become a benefit to City residents. The Master Plan, along with these Guidelines, promotes development that will be an asset, not a liability, to the surrounding neighborhoods and community at large.*

A. **Streets**
   1. **Public Streets:** The project maintains the Mountfort Street extension as proposed in the Eastern Waterfront Master Plan.
   2. **Appropriate Street Design:** Not applicable. The design for the new Mountfort Street extension is not part of this application.
   3. **Sidewalks**: Staff continue to work with the applicant on the sidewalk design. Appropriate to the urban context, the applicant revised the drawing to remove the planters and widen the sidewalk. The street tree and street lighting design will be consistent with other developments on Thames Street to provide a consistent streetscape.

4. **View Corridors:** The proposal maintains the protected view corridors through the site according to the B6 Building Height Overlay & Building Envelopes Map.
5. **Railroad Right of Way:** Not applicable
6. **Underground Utilities:** Utilities are being provided underground from Fore/Hancock street.
7. **Marine Passenger Terminal Circulation**: Not applicable
8. **Bicycle Safety:** The bicycle facilities were revised to meet staff comment.

B. **Buildings and Architecture**

Purpose: Met – Project is mixed-use, high quality contemporary design.

Design guidelines for buildings in the Eastern Waterfront Redevelopment Area encourage architecture that enhances the development of a mixed-use . . . New construction should respect the historic character of Portland's waterfront, while representing the best elements of contemporary design.

1. **Contextual Design:** *New buildings should be designed in response to their context and should be compatible with surrounding neighborhoods.*
   The site should be considered to have a unique context when it comes to the architectural approach. Staff recognizes that this site has little historic context to relate to. Where there is visual connection on Hancock Street to the India Street neighborhood context, the building employs a height, façade treatment, and massing that are sensitive to and relate to that more traditional context. On Thames Street and facing the water, the Ocean Gateway terminal, waterfront, and future Amethyst Lot park are contemporary designs that create the most immediate context for the 0 Hancock Street project and the contemporary design reflects that – the project proposes a new vision for contemporary development on the waterfront.

   There is one general area of criticism which has to do with how the building relates to its urban setting – The applicant revised the building design to have better connection with the streetscape at the pedestrian level.

   The signs shown in the application are not approved as part of this application and do not necessarily meet the sign ordinance.

2. **Building Composition:**
   a. **Placement:** The building is placed to comply with the B6 overlay envelope on Hancock Street. The building facing Thames Street is close to the property line to help create a consistent street wall with the surrounding blocks currently under development. The primary office entrance is oriented to the street and retail entrances are shown facing Thames Street and the private plaza.

   b. **Height:** The project complies with the B6 45' height overlay. On Hancock Street the project is four stories and steps down to three stories on Thames. This is as tall or shorter than most recent development in this area. The important thing of note is that it is a multi-story building consistent with zoning and urban design goals.

   c. **Massing:** The building has massing variation with a taller mass at Hancock Street, a curved massing with special roof treatment at the primary corner, and a low and

long mass along Thames Street. The massing is appropriate according to each street relationship and provides visually interesting building forms.

d. **Proportion:** Buildings in the Eastern Waterfront vary in their height, length, and proportion but are often low and long – similar to the longitudinal proportions of the historic industrial complex and working waterfront building typologies. Facing the mixed-use India Street neighborhood, the building has a more vertical proportion. The proportion on Thames is horizontal.

e. **Articulation:** The project uses a combination articulation elements such as material changes, canopies, and plane changes. Interest is also provided by the roof design and massing changes. The long length of Thames Street façade is broken down to a human scale with the fenestration pattern, material placement, and the ground level design. The applicant revised the façade in response to staff and Planning Board comment regarding the articulation of the facades – these changes include revisions to the horizontal spandrel panels, articulation created at the vertical elements through 3" to 6" reveals, a further deepening of the retail entrance facades to provide a sense of enclosure and emphasis on the more active retail frontage. Staff supports the current design but calls attention to the changes at the corner for board consideration.

f. **Materials:** The proposal conveys a contemporary approach similar to other contemporary buildings nearby such as the Ocean Gateway terminal. Where the project faces the India Street neighborhood, the material placement is more traditional. Where the project faces the waterfront, curtainwall is used.

3. **Pedestrian Environment:** Staff support providing wider sidewalks to give enough space for pedestrian amenities such as street trees and lighting. Both facades are proposed to provide active entrances with the office entrance on Hancock Street and retail entrances on Thames. Thames Street has a long façade but accommodates the pedestrian environment through the use of storefront and high transparency, retail uses and entrances, canopies, and plane changes. Staff requests that the design of the canopies be further revised in scale, proportion, and materiality in relationship to the overall building scale and to better provide a grounded, human-scale pedestrian realm.

4. **Primary Entrances and Service Entrances:** The primary entrance is on Hancock Street which is considered by these guidelines to be a primary street. Building entrances on Thames Street for retail have been generally located. Service entrances are internal to the site with an access path interior to the block.

5. **Parking Structures:** Not applicable

6. **Infill and Small Scale Development:** Not applicable

7. **Historic Structures:** Not applicable

8. **Civic Structures:** Not applicable

9. **Marine Development:** Not applicable

C. **Open Space and the Public Realm**

1. **Public Open Space and Plazas:** Not applicable

2. **Private Open Space and Plazas**: A plaza space at the east end of the development is proposed to occupy the space of the view corridor. Staff supports the revisions to the plaza design to accommodate ADA access from the sidewalk. In addition, an internal path cuts through the site to provide service access and possible mid-block cut through between Hancock and a future Mountfort extension. The project also proposes rooftop plazas for the office workers.
3. **Historic Sites:** Not applicable
4. **Public Art:** The proposal does not currently include public art or similar focal points.
5. **View Protection**: The proposal maintains the protected view corridors through the site according to the B6 Building Height Overlay & Building Envelopes Map.

D. **Surface Parking and Vehicle Queuing:** Not applicable - the project predominantly uses off-site structured parking meeting the Shared Use and Partnerships guideline and does not include vehicle queuing.

COMMITMENT & INTEGRITY
DRIVE RESULTS

41 Hutchins Drive
Portland, Maine 04102
www.woodardcurran.com

T 800.426.4262
T 207.774.2112
F 207.774.6635

MEMORANDUM

TO: Caitlin Cameron, Planner
FROM: Lauren Swett, PE
DATE: September 28, 2017
RE: Level III Site Plan Response to Comments, WEX Hancock & Thames Street.

Woodard & Curran has reviewed the Level III Site Plan Application for the proposed development located at 0 Hancock Street in Portland, Maine. The project involves the construction of 102,027 square foot, 4-story building at the intersection of Hancock and Thames Street.

Documents Reviewed by Woodard & Curran

- Level III Response to Comments and attachments, dated September 26, 2017, prepared by Stantec Consulting Services Inc., on behalf of 0 Hancock Street LLC.
- Engineering Plans, dated September 26, 2017, prepared by Stantec Consulting Services Inc., on behalf of 0 Hancock Street LLC.

Comments *Comments repeated from prior memos included in italics*

1) *The Applicant has noted that the project does not require any additional Federal or State level environmental site permits. The lot was originally part of the Ocean Gateway Site Location of Development, and there may be additional permits associated with Ocean Gateway that encompass this site. We anticipate that the City or the Applicant will need to work with the original permitting agencies to determine what needs to be done to remove the site from the original permits in association with the sale of the property. We also anticipate that the Notice of Intent to Comply with the Maine Construction General Permit will be required for the project.* Applicant has noted that they are working on the submission to the MaineDEP, and it likely will not be approved prior to the Planning Board Public Hearing. It is agreed that this may be a condition of approval.
2) *In accordance with Section 5 of the City of Portland Technical Manual, a Level III development project is required to submit a stormwater management plan pursuant to the regulations of MaineDEP Chapter 500 Stormwater Management Rules, including conformance with the Basic, General, and Flooding Standards. We offer the following comments:*
   a) *Basic Standard: Plans, notes, and details have been provided to address erosion and sediment control requirements, inspection and maintenance requirements, and good housekeeping practices in accordance with Appendix A, B, & C of MaineDEP Chapter 500.*
   b) General Standard: The Applicant is not increasing impervious surface, but will be creating 11,446 square feet of redeveloped non-roof impervious surface. They have requested a waiver from the City of Portland Requirement of providing treatment for 50% of this redevelopment area. Instead of treatment of the redevelopment area, they will be providing a roof drain filter system. They will also be providing some rooftop vegetation. The project will also be increasing pervious surface on the site, and the redeveloped impervious surface is primarily hardscaping that will have a lower pollutant load than the existing gravel parking lot. For all of these reasons, a waiver of the standard would be acceptable.
   c) *Flooding Standard: No additional impervious surface is being added as a result of the project. The site discharges to the Fore River, and the area was accounted for as part of the original outfall design. The project is not anticipated to increase flow to the site.*
3) *In Accordance with The City of Portland Technical Manual sanitary sewer laterals shall be connected to main sanitary sewer lines for sanitary building laterals under 8 inches in diameter. The connection is currently proposed directly to the existing manhole in Thames Street. Acceptability of this type of connection should be confirmed with the Department of Public Works.* Public works has noted that with the pipe sizes in question, the acceptable means of connecting a 6" service into a 12" sewer main would be to cut out a section of the sewer and install a wye in the main using Fernco connectors. Finalization of the details of this connection should be made a condition of approval.

Portland Maine | Yes. Google's good here.

Caitlin Cameron <ccameron@portlandmaine.gov>

PEZ 2017-180: WEX Public ROW Staff Comments - Bruce Hyman

Bruce Hyman <bhyman@portlandmaine.gov> Fri, Sep 29, 2017 at 12:21 PM
To: Caitlin Cameron <ccameron@portlandmaine.gov>
Cc: Keith Gray <kgray@portlandmaine.gov>, Barbara Barhydt <bab@portlandmaine.gov>, Tom Errico <thomas.errico@tylin.com>

Good afternoon Caitlin,

These comments address outstanding topics based on the applicant's most recent submittals (uploaded 9/26/17) that may not covered by other reviewing staff:

- the placement of the lighting along the applicant's frontage is to be adjusted as necessary to provide adequate lighting of the crosswalks along the Thames Street frontage at Hancock Street and at the Mountfort ROW/Ocean Gateway Terminal driveway
- the driveway on Hancock Street is to carry brick across the applicant's driveway per the new sidewalk material policy, have a maximum cross-slope of 2% for the pedestrian access route and the sidewalk on each side of the driveway is to ramp down (not introduce a flare as currently shown) - the detail for the driveway is to reflect these items
- the detectable warning panel within the existing curb ramp at the corner of Fore-Hancock Streets (SE corner) is to be replaced (cast iron, per new curb ramp detail) to create a direct and fully ADA-accessible route from the WEX main entrance on Hancock Street to the Ocean Gateway Garage
- the brick sidewalk detail is to note a maximum cross-slope of 2%.

Bruce
--
Bruce Hyman
Transportation Program Manager
Transportation Division

Department of Planning & Urban Development
389 Congress Street
Portland, Maine 04101
(207) 874-8717 phone

bhyman@portlandmaine.gov
http://www.portlandmaine.gov/1363/Transportation-Division
Yes! Transportation's Good Here ....

Portland Maine Yes. Google's good here.

Caitlin Cameron <ccameron@portlandmaine.gov>

0 Hancock Street - Review Comments

Keith Gray <kgray@portlandmaine.gov> Fri, Sep 29, 2017 at 12:59 PM
To: Caitlin Cameron <ccameron@portlandmaine.gov>
Cc: Bruce Hyman <bhyman@portlandmaine.gov>, "Swett, Lauren" <lswett@woodardcurran.com>, John Peverada <jbp@portlandmaine.gov>

Hello Caitlin,

Below are a few items that were discussed with Mr. Bushey from Stantec but have not been integrated within the current submission.

- There is a meeting this afternoon with Cianbro to discuss the CMPlan components. Some notable items include; requirement of a 5-foot sidewalk along Hancock Street, parking occupancy is not allowed until parking spaces are restored along AC Hotels frontage on Thames Street and no more than two parking spaces are to be occupied at a time.

- The Grading Plan shows a stabilized construction entrance on Mountfort Street. DPW does support the construction entrance location given that a temporary construction easement is obtained and there is no loss of parking spaces.

- The proposed stormdrain shall be routed on the applicant's property and not within Mountfort Street ROW. The existing catch basin within Mountfort Street will need to be reconnected.

Please contact me with any questions.

Thank you,

Keith

--
Keith D. Gray, PE
Senior Engineer
Dept. of Public Works
City of Portland Maine

207.874.8834
kgray@portlandmaine.gov

City of Portland Maine
Dept. of Public Works
Engineering Division

Memo

To: Caitlin Cameron - Planner

From: Keith Gray, PE – Senior Engineer, DPW

Date: September 25, 2017

Re: 0 Hancock Street (2017-180) – Level III Site Plan Application

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The following comments/concerns are in regards to the Level III Site Plan Application prepared by Stantec, on behalf of the applicant, 0 Hancock, LLC, with last plan revision submitted on September 15th, 2017. Please feel free to contact me with questions.

C-4.0 – Grading, Drainage and Erosion Control Plan:

- The applicant is proposing a grade break (vertical curb) within the Thames Street sidewalk to accommodate ADA building access.
  - DPW does not support a split grade sidewalk within the ROW
    - We suggest lowering the finish floor elevation by ramping down the sidewalk, within the applicant's property, at the Hancock Street entrance. The lowered finish floor elevation allows for a continuous sidewalk along Thames Street. See enclosed figure (For illustration purposes only, grades and design to be completed by Stantec).

C-5.0 – Utility Plan:

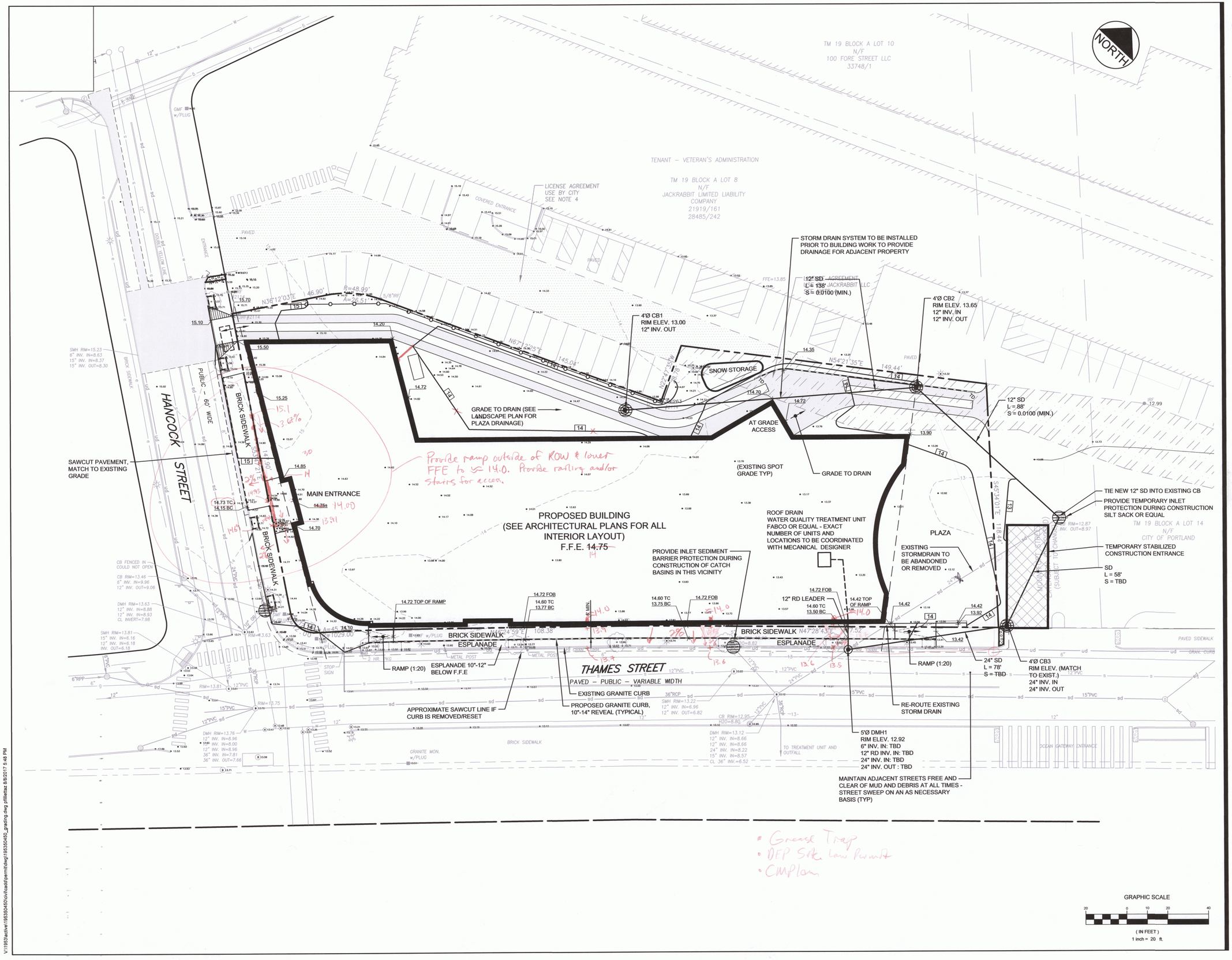
- Verify that no crossing conflicts exist between the proposed sewer and the existing 12" stormdrain. Rigid insulation should be provided between crossings. Test pit may be required to determine depth of gas main at sewer service.

Construction Management Plan:

- The applicant has submitted a Construction Management Plan (CMPlan) prepared by Stantec and Cainbro.
  - The provided CMPlan indicates that the sidewalk along Hancock and Thames Street and the parking spaces along Thames Street frontage will be occupied for an extended period of time (roughly a year).

- DPW does not support occupancy of the sidewalk and/or parking spaces for an extended period of time. The applicant shall revise the CMPlan to specify the duration required for the sidewalk occupancy. Construction sequences shall be scheduled to minimize the duration of any street occupancy.
- DPW does not support extended occupancy of (Islander) parking spaces along Thames Street. We suggest the following options:
    - The occupancy of two parking spaces at a time for the duration required to complete the current construction activity.
    - The occupancy of all spaces requested provided that the applicant provides for the equivalent parking spaces within a close vicinity.

- Update contact person for construction activities for Cianbro.
- A five foot sidewalk (existing or temporary) shall be maintained along Hancock Street



- Grease Trap
- DEP Site Law Permit
- CMP Plan

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Stantec
482 Payne Road Scarborough Court
Scarborough, Maine 04074-8929
Tel. 207.883.3355
www.stantec.com

Consultants

Notes

No.	Revision	By	Appd.	YY.MM.DD
1.	PB/AL SITE PLAN REVIEW	SRB	DBS	17.08.08

File Name: 195350450_grading	DWN.	DBS	SRB	17.07.12
P.E. STEPHEN R. BUSHEY	DWN.	CHKD.	DSGN.	DATE

Permit-Seal

STATE OF MAINE
STEPHEN R. BUSHEY
No. 7429
LICENSED
PROFESSIONAL ENGINEER
8/10/17

Client/Project
0 HANCOCK LLC

THAMES STREET SITE
PORTLAND, MAINE

Title
GRADING, DRAINAGE AND EROSION CONTROL PLAN

Project No.
195350450

Scale
1" = 20'

Sheet
C-4.0

MEMORANDUM

To: FILE

From: Caitlin Cameron

Subject: Application ID: 2017-180

Date: 9/29/2017

Comments Submitted by: John Brennan/Fire on 8/30/2017

Construction management plan must be approved by the Fire Department.

Comments Submitted by: John Brennan/Fire on 8/30/2017

Premises Identification
The main entrance of the building must be the address for the property. This should be consistent with 911, tax assessor, Inspections Division and future mailing address.
Street addresses shall be marked on the structure and shall be as approved by the City E-911 Addressing Officer.
If the building entry faces a different street, both the street name and number should be large enough to read from the street.
Address numbers must be a minimum of 6 inches high.
The number should be in Arabic numerals rather than spelled out (for example, “130” instead of “One Hundred and Thirty’).
Color: Addresses should be in a color that contrasts with the background.
Whenever possible, should be illuminated.
Provide additional address signs at entrances to the property when the building address is not legible from the public street.
Buildings set back in groups that share common entrances can make quickly locating a specific building and the shortest route difficult. On such sites, additional signs with directional arrows and/or diagrams of the buildings and access layout should be posted.

Comments Submitted by: John Brennan/Fire on 8/30/2017

Fire Department is requesting a Capacity To Serve letter from the Portland Water District.

Comments Submitted by: John Brennan/Fire on 8/30/2017

Emergency access to the proposed site is excellent. Emergency vehicles have access to three sides of the building.

Portland Maine | Yes. Google's good here.

Caitlin Cameron <ccameron@portlandmaine.gov>

0 Hancock Street/WEX Building - Traffic Comments

Tom Errico <thomas.errico@tylin.com> Fri, Sep 29, 2017 at 10:05 AM
To: "ccameron@portlandmaine.gov" <ccameron@portlandmaine.gov>
Cc: "kgray@portlandmaine.gov" <kgray@portlandmaine.gov>, Katherine Earley <kas@portlandmaine.gov>, Jeremiah Bartlett <JBartlett@portlandmaine.gov>, "Jeff Tarling (JST@portlandmaine.gov)" <JST@portlandmaine.gov>, "Swett, Lauren" <lswett@woodardcurran.com>

Hi Caitlin – I have reviewed the application materials and offer the following traffic comments.

- The project requires a Traffic Movement Permit. A Traffic Movement Permit Application has been submitted and a Scoping Meeting was held on Monday September 25, 2017. It is my understanding that the Traffic Movement Permit approval will follow a separate approval schedule. The following should be noted as it relates to expectations for the outcome of the traffic impact study:

    - Given current roadway construction activities and traffic circulation impacts, a condition of approval is likely as it relates to conducting traffic counts and analysis at the Fore Street/India Street, Fore Street/Hancock Street, Middle Street/India Street, and Middle Street/Hancock Street intersections. The applicant may be responsible for the implementation of mitigation improvements, if deficiencies are identified.

    - The applicant will be working with City staff in finalizing trip generation and assignment of project trips to the study area. The applicant may be required to provide a monetary contribution to Franklin Street area improvements using methodologies developed for the 58 Fore Street project.

    - The applicant has identified the Franklin Street/Middle Street intersection as the only study area location that is classified as a High Crash Location per MaineDOT methods. No action is being requested of the applicant as it relates to mitigating this location (the monetary contribution/fund would be used to implement future safety improvements).

- The applicant has conducted a parking demand analysis for the project. Parking demand for the project is primarily based on parking demand surveys conducted at the WEX facility in South Portland. Based upon surveys conducted in August and September of this year, the WEX office use would be expected to generate 0.71 parking spaces per employee. Assuming 450 employees, WEX would be expected to require a need for 320 parking spaces. For the other building uses (assumed restaurant, gift shop and Financial Loan Agency), 19 parking spaces are estimated. Given the location of the project in downtown Portland, adjustment to account for multi-modal factors (walk/bike/transit) and implementation of a robust TDM plan, seem reasonable. The proposed reduction is 55 vehicles. Based upon the analysis, it is my professional opinion that the project would be expected to require a parking demand of 284 parking spaces.

- The driveway on Hancock Street does not meet City driveway separation standards. Given low traffic volumes expected to use the driveway, I support a waiver from City requirements.

If you have any questions, please contact me.

Best regards,

Thomas A. Errico, PE
Senior Associate
Traffic Engineering Director
TY LIN INTERNATIONAL
12 Northbrook Drive
Falmouth, ME 04105
+1.207.781.4721 main
+1.207.347.4354 direct
+1.207.400.0719 mobile
+1.207.781.4753 fax
thomas.errico@tylin.com
Visit us online at www.tylin.com
Twitter | Facebook | LinkedIn | Google+

"One Vision, One Company"

0 HANCOCK PARKING - GARAGE CAPACITY ANALYSIS					
Address	**Leased Parking Space (City records)**	**Leased Parking Space (Applicant records)**	**Required Parking Spaces (per zoning)**	**Building Type**	**Notes from Applicant**
Leases as part of approved Site Plan applications					
16 MIDDLE STREET	140	140	0	MIXED-USE RETAIL/OFFICE	Daytime only
185 FORE STREET	96	44	0	MIXED-USE RESIDENTIAL/RETAIL	Daytime only
50 INDIA STREET (cPORT CREDIT UNION)	20	10	3	MIXED-USE RESIDENTIAL/COMMERCIAL	Missing from applicant's calculations
113 NEWBURY STREET (BAY HOUSE)	20	13	20	MIXED-USE RESIDENTIAL/COMMERCIAL	Daytime only
145 FORE STREET (RESIDENCE INN)	140	140	50	COMMERCIAL	Lease restricts parking to 4pm-9am
167 FORE STREET (OFFICE ADDITION)	24	14	24	COMMERCIAL	Daytime only; No lease, Site plan approval requirement
158 FORE STREET (AC HOTEL)	400	100	45	MIXED-USE RESIDENTIAL/COMMERCIAL	Lease restricts parking to 4pm-9am
20 THAMES STREET (COVERED BY AC HOTEL LEASE)	0	50	37	MIXED-USE RESIDENTIAL/RETAIL	Daytime only
170 FORE STREET* (COVERED BY AC HOTEL LEASE)	0	157	110	MIXED-USE RESIDENTIAL/RETAIL	Daytime only
5 INDIA STREET* (COVERED BY AC HOTEL LEASE)	0	29	22	MIXED-USE RETAIL/OFFICE	Daytime only
300 FORE STREET (CIEE)	145	145	123	COMMERCIAL	Daytime only: 56.4% are used/day
1 INDIA STREET* (Gorham Savings Bank)	0	24	24	COMMERCIAL	Daytime only
0 HANCOCK (WEX)	284	284	258	MIXED-USE RETAIL/OFFICE	TDM Plan
TOTAL SITE PLAN LEASED SPACE	1269	1150	716		
TOTAL GARAGE CAPACITY	720	720	720		
DIFFERENCE**	-549	-430	4		

*Project does not have an active Site Plan application, numbers may change

** Applicant claims lease agreements state that parking garage owner is financially obligated to cover parking off-site if no space available

Portland Maine Yes. Google's good here.

Caitlin Cameron <ccameron@portlandmaine.gov>

Re: WEX Corp Development

Helen Donaldson <hcd@portlandmaine.gov> Thu, Sep 14, 2017 at 3:56 PM
To: "Lynn A. Rollins" <lynnr@miloneandmacbroom.com>, Caitlin Cameron <ccameron@portlandmaine.gov>

Lynn,

I am forwarding your email to Caitlin Cameron, who is the planner leading the review on this project. She is best positioned to answer your questions.

Best,
Nell

On Thu, Sep 14, 2017 at 2:46 PM, Lynn A. Rollins <lynnr@miloneandmacbroom.com> wrote:

> As a worker in the Portland area, I am very concerned that I have not read about a traffic study being conducted. It would seem to me that there needs to be some serious resources put into some traffic infrastructure before the WEX building moves forward. Working in Portland is already a somewhat difficult commute, what steps are being taken to resolve future growth?
>
> Lynn
>
> **Lynn Rollins**
>
> Administrative Assistant
>
> MILONE & MACBROOM
>
> 121 Middle Street, Suite 201, Portland, Maine 04101
>
> 207-541-9544 / 207-541-9548 (Fax)
>
> www.miloneandmacbroom.com
>
>

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Nell Donaldson
City of Portland Planning Division
874-8723
hcd@portlandmaine.gov

Google Groups

WEX Public Hearing

Daniel DesPres <ddespres@sbcglobal.net> Sep 25, 2017 1:30 PM

Posted in group: **Planning Board**

Just a comment on the parking issue. The WEX proposal should include a dedicated parking deck for their employees. The Ocean Gateway Parking Garage is currently stretched, particularly during the Summer months, and traffic in and out of this facility onto Fore and Middle Streets is already problematic.

Dan DesPres
Resident - 185 Fore St.

SECTION 01 70 00.02

CIVIL ENGINEERING REQUESTS FOR INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for handling and processing "Requests for Information" (RFI).

2. "Request for Information" form is attached at the end of this Section.

3. Request/limit of use for AutoCAD files.

4. “Electronic Document Transfer Agreement” form is attached at the end of this Section.

1.2 DEFINITION

A. Requests for Information: A formal process used during the construction phase to facilitate communication between the contractor, the Owner’s representative, the Architect’s Clerk of the Works, and the Civil Engineer regarding requests for additional information and clarification of the intent of the Contract Documents (Drawings and Specifications).

B. Do not use "Request for Information" form during bidding. Direct questions during bidding phase as indicated in the bid documents.

1.3 PROCEDURE

A. Conditions Requiring Clarification and the Contract Documents:

1. Contractor shall submit a "Request for Information" to the Owner and request review by the Civil Engineer.

2. Submit "Request for Information" from the Contractor's office or field office only. "Requests for Information" submitted directly from subcontractors or suppliers will not be accepted.

3. Generate "Requests for Information" by one source per project and number accordingly.

4. Submit one "Request for Information" per form.

B. Engineer will review RFI from the Contractor with reasonable promptness and the Contractor will be notified in writing of decisions made.

1. The Engineering Consultant's written response to the RFI shall not be considered as a Change Order or Change Directive, nor does it authorize changes in the Contract Sum or Contract Time.

C. Contractor shall maintain a log of "Requests for Information" sent to, and responses from Engineer "Requests for Information" log shall be sent, by Fax, every Friday to the Engineer.

D. All "Requests for Information" regarding scheduling, costing, and Owner provided equipment coordination shall be directed to the Architect.

1.4 REQUEST FOR INFORMATION FORM

A. Submit "Requests for Information" on the attached "Request for Information" form, or format accordingly on letterhead. Engineer will not respond to requests for information unless this form or format is utilized.

B. Where submittal form or format does not provide space needed for complete information, additional sheets may be attached.

1.5 REQUEST FOR ELECTRONIC MEDIA

A. Contractors may request AutoCAD disks for use in determining earthwork quantities. Contractors may obtain these disks by submitting the enclosed “Electronic Document Transfer Agreement” form to the Architect. This form restricts the use of this data.

B. The computer aided design file represents the work product of Stantec Consulting Services Inc. Certain files and information are considered proprietary and are not to be released to any third party.

C. Contractors acknowledge that CAD files may include embedded information, have varying degrees of layer management, and are subject to limitations in the software systems.

END OF SECTION

REQUEST FOR INFORMATION FROM THE ENGINEER

RFI NO. _____

DATE: _____ PROJECT: _____
(City, State)

TO: _____

FROM: _____ DRAWING NO. _____
(General Contractor)

_____ DETAIL NO. _____
(Project Superintendent)

_____ SPECS SECTION NO. _____
(Job Site Fax Number)

RFI Type:

( ) Demolition
( ) Site Preparation
( ) Earthwork
( ) Rock
( ) Erosion Control
( ) Storm Sewer
( ) Utilities
( ) Paving
( ) Landscape/ Irrigation
( ) Site Lighting
( ) Slope Stabilization Retaining Walls
( ) Traffic Related
( ) Other

Information Requested: _____

Requested By: _____

Reply: _____

_____ _____
Response By: Date:

File Distribution:

ELECTRONIC DOCUMENT TRANSFER AGREEMENT

Project:	Date:
Client:	Project No.
Location:	Page 1 of 1

Company Requesting Files:

Person Requesting Files:

Description of Files:

Reason for Requesting Files:

1. The requested electronic file(s) (the "Files") remain the property of Stantec.
2. No warranties or guarantees are made that the Files represent or reflect the complete scope of work and/or as-built condition.
3. Stantec assumes no responsibility for data files supplied in electronic format. Such data is being provided as a courtesy only.
4. Company receiving the Files and users thereof accept full responsibility for verifying the accuracy and completeness of the Files and shall indemnify and hold Stantec, its officers, employees, consultants and agents harmless from any claims or damages arising from the use of the Files.
5. The use of Files to alter or revise the scope of work is not permitted unless authorized by change orders.
6. In the event that drawing Files transferred electronically contain electronic copies of permits or professional seals, the Files shall be immediately returned to Stantec and all copies thereof destroyed.
7. No use shall be made of the Files for any purpose other than that for which they were originally intended without the express written consent of Stantec.
8. No retransmission of the Files in any form to any third party is permitted unless authorized in writing by Stantec.

Having read and understood the above, and in consideration of Stantec providing e-copies, the undersigned agrees to be bound by the terms hereof.

Print Name and Title

Signature of Company's Authorized Representative — Date

Signature of Stantec Project Manager Authorizing Release — Date

The above requested files will only be released upon receipt by Stantec of an original of this agreement signed by a duly authorized representative of the company requesting the files. Stantec reserves the right to deny any request for copies of electronic files.

Revised: 2013.09.04

SECTION 01 71 23.13

LAYOUT OF WORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Owen Haskell, Inc. has established a project benchmark and elevation as shown and identified on the project plans. For the purposes of this specification, this shall be the limit of Owner provided survey control to the contractor. The datum is NGVD 1929.

B. The Contractor shall employ a licensed land surveyor in the State of Maine to lay out the work from the established reference points, benchmarks, and the coordinate system indicated on the drawings, and shall be responsible for all measurements in connection with the layout. AutoCAD 2014 files will be furnished to the Contractor upon written request upon signing a limit of use form. 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 Engineer.

The Contractor is responsible for confirming elevation by cross checking the two benchmarks.

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 clearing shall be delineated for review and approval of the Owner prior to clearing.

D. Establish and plainly mark centerlines 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 athletic field, access drive, 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 parking, driveway, and walkways.
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 alignment of all access drives.
6. Record conditions of the stormwater management system.

G. Record Data:

1. The Contractor shall record the following information for buried utilities:
   - The location of all appurtenances and controls including control or shutoff valves, angle points or bends, manholes, conduits, handholes, 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. The final record drawings shall be delivered to the Owner. Two copies are required.

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 Engineer.

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

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, site improvements, and for disposition of hazardous waste.
2. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
3. Section 026000 “Excavated Material Management” for special requirements attendant with potential contaminated soils and groundwater at the site.
4. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.
5. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for Notice to Proceed.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. LEED Submittal (N.I.C.): LEED letter template for Credit MR 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

H. Qualification Data: For waste management coordinator.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications (N.I.C.): LEED-Accredited Professional, certified by USGBC. A waste management coordinator may also serve as LEED coordinator.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for sale and donation are not permitted on Project site.

C. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area onsite designated by Owner.
5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving (N.I.C.): Grind asphalt in accordance with Section 024221 Reclaimed Stabilized Base.

B. Concrete (N.I.C.): Remove reinforcement and other metals from concrete and sort with other metals in accordance with Section 024200 Aggregate Material from Recycling.

1. Pulverize concrete to maximum Section 024200 Aggregate Material from Recycling.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum Section 024200 Aggregate Material from Recycling.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

J. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them in accordance with the Environmental Work Plan prepared by Ransom Consulting (Refer to Section 026000 Excavated Material Management).

3.7 SAMPLE FORMS

A. Owner will review and provide sample templates at the preconstruction conference.

END OF SECTION

SECTION 02 32 00

GEOTECHNICAL INVESTIGATIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

1.2 DESCRIPTION OF WORK

A. Contractor shall review the Geotechnical Report prepared for the project by Summit Geoengineering Services appended to this section of Project 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 and borings. Locations of the test pits and borings are shown on the contract drawings. Logs of the explorations are also appended to these specifications.

B. 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.

C. 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 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. A copy of the geotechnical engineering services report and Addenum are appended to the project manual and shall be considered part of the Contract Documents.

END OF SECTION

GEOTECHNICAL REPORT & ADDENDUM
PREPARED BY
SUMMIT GEOENGINEERING SERVICES

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Geotechnical Report - Addendum

Proposed Wex Building

Corner of Hancock & Thames Street, Portland, Maine

Client
Archetype, PA
Union Wharf
Portland, Maine 04101

SUMMIT
GEOENGINEERING SERVICES

Project #: 17181
Date: 9/5/17

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173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
www.summitgeoeng.com

September 5, 2017
Summit #17181

Attn: Bill Hopkins
Archetype, PA
Union Wharf
Portland, Maine 04101

Reference: Geotechnical Report Addendum – Proposed Wex Building
Corner of Hancock & Thames Street, Portland, Maine

Dear Bill;

A geotechnical report for the above referenced project was prepared by Summit Geoengineering Services, Inc. (SGS) dated July 20, 2017. Subsequent to the completion of our original geotechnical report, the structural loads for the building were revised by Veitas & Veitas (V&V). The load revisions were provided to SGS on August 8, 2017. In general, the loads for all columns increased. The maximum point load (dead + live load) increased from a value of 422 kips to a value of 720 kips. We understand that uplift loads are uncertain at this time.

This addendum also includes the results of test pits completed at the site on August 23, 2017. The purpose of these test pits was to determine the quality of the existing fill and to evaluate its potential for reuse during construction.

Based on the updated compressive loads, our previously recommended “floating stone column” ground improvement method will result in excessive foundations settlements due to applied stress to the underlying clay layer.

We recommend that the proposed building foundation be supported on end-bearing elements consisting of either driven piles or rigid inclusion ground improvement. An evaluation and recommendations are provided herein for both foundation types.

It should be noted that Section 1.0 (Project and Site Description), Section 2.0 (Subsurface Exploration and Laboratory Testing), Section 3.0 (Subsurface Conditions), Section 5.3 (Frost Protection), Section 5.4 (Seismic Design), Section 5.5 (Groundwater Control), Section 5.6 (Slab-on-Grade), Section 6.0 (Pavement Recommendations), and Section 7.0 (Earthwork Considerations) from the original geotechnical report are still valid and applicable.

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1.0 Geotechnical Evaluation and Recommendations

Based on the revised column loads provided to us by V&V, we anticipate that shallow spread footings supported by the existing fill or footings supported on ground improvement (stone columns) terminating in the fill will result in maximum total settlement exceeding 3 to 4 inches. We understand that this exceeds the tolerable settlement for the proposed structure.

To limit settlements of the proposed foundation to within a tolerable magnitude, we recommend that the proposed foundation be supported using end bearing piles or end bearing rigid inclusion elements. The slab for the new building can be constructed on-grade and does not need to be supported with piles or rigid inclusions.

1.1 Rigid Inclusion Ground Improvement:

Rigid inclusions (RI) typically consist of concrete or grouted stone elements extending to a dense stratum or refusal to support foundation loads. The foundation loads are transferred to the stiff RI elements using a Load Transfer Platform (LTP) constructed between the top of the RI elements and the bottom of footings. LTPs may consist of engineered fill (sand and/or gravel) with possible layers of geogrid within the fill to ensure complete load transfer to the RI elements.

One limitation of the RI ground improvement technique is the maximum available installation length of the elements. Based on discussions with a specialty contractor who design and installs RI, we understand that the maximum length of RI elements is 60 to 65 feet due to equipment limitations. Refusal was encountered in our explorations between 59.0 to 65.5 feet. Refusal was encountered at the adjacent hotel site, directly west across Hancock Street, at a depth of 72 feet. Since the elements must be founded on dense soil or refusal, there is a possibility that the required installation length will exceed 65 feet.

Uplift capacity for the proposed foundation should also be considered when selecting a foundation support type. Upon discussion with the RI specialty contractor, we understand that RI elements are not capable of supporting large uplift loads without a structural connection to the footing.

Additionally, we understand that any existing fill at the site that is exported will require special treatment and disposal. Therefore, to reduce construction costs, it is advantageous to limit the volume of exported material. The associated disposal cost of the soil displaced by the LTP and any over-excavation required to deepen the footing to add uplift capacity should be considered when evaluating the RI ground improvement option.

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If RI ground improvement is selected to support the proposed construction, we recommend that the RI elements and the LTP be designed and stamped by a qualified Maine Licensed Professional Engineer. The contractor submittal shall include detailed design computations and construction installation drawings. The submittal shall also include provisions for completion of the work if refusal depths exceed the equipment reach. SGS should be retained to review the contractor submittal on behalf of our client. The bearing capacity of the RI system should meet or exceed the 5,000 psf allowable bearing pressure provided in the original geotechnical report. Total settlement should not exceed 1.0" and differential settlement between two adjacent columns should not exceed 0.5".

Any rubble/debris encountered in the upper fill layer that restricts RI installation will need to be removed or the hole will need to be pre-augered. Based on our explorations and the historic maps of the site, we anticipate that old foundation elements and rubble will be encountered in various locations.

Soil parameters used in the design of the RI and LTP systems are at the discretion of the designer. We have provided some recommended geotechnical soil properties for the existing fill and the glacial marine (clay) in Section 2.0.

1.2 End Bearing Piles:

End bearing piles for this site would consist of H-Piles or steel pipe piles driven to refusal. We anticipate that the settlement of footings supported with end bearing piles will be negligible.

We recommend that piles consist of Grade 50 steel and that all piles be vibrated or driven to a dense stratum, either glacial till or bedrock, which is anticipated to range from 50 feet to 70 feet below the current ground surface.

To provide pile design recommendations, we have preliminarily assumed that the piles will have a minimum diameter of 10". SGS should be notified in order to provide updated recommendations if smaller piles are selected for design. We recommend that the pile design be performed and stamped by a qualified Maine Licensed Professional Engineer and the design be made available to Summit Geoengineering Services, Inc. for review.

We recommend that piles be designed and installed in accordance with the International Building Code 2015 (IBC 2015), Section 1810. The designed piles should be verified with a WEAP analysis to ensure that driving stresses do not exceed the allowable capacity of the piles. To ensure that the pile does not become damaged during driving through the upper fill layer, we recommend that a steel driving shoe (or steel conical tip, if a pipe pile is used), be welded to the

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end of the piles. Any rubble/debris encountered in the upper fill layer that restricts pile driving will need to be removed to prevent damage to the pile. Based on our explorations and the historic maps of the site, we anticipate that old foundation elements and rubble will be encountered in various locations.

The piles can be designed using the soil properties in Section 2.0. All non-load bearing elements such as grade beams can be proportioned using an allowable bearing pressure of 2,000 psf.

1.2.1 Lateral Support

We recommend that the allowable lateral capacity of the installed piles be taken as a maximum of 4 kips per pile in the direction of the major principle axis. If a higher lateral capacity is desired, the pile designer shall submit a lateral capacity computation for review by SGS. All soil within a 3 foot width beyond the edge of the pile in all directions should be proofrolled with a minimum of 4 passes in each of two perpendicular directions with a 5-ton (operating weight) vibratory roller. Any unsuitable soils exposed at the ground surface around the pile should be removed and replaced with SF or ¾" Crushed Stone. If fill is required to raise the grade around the pile, it should consist of SF placed in 12" lifts and compacted to 95% of the dry density in accordance with ASTM D1557. Lateral capacity of piles which are spaced closer than 8 pile diameters center-to-center in the direction of loading should be reduced using the following table:

Table 1: Lateral Capacity Reduction

LATERAL CAPACITY REDUCTION	
Pile Spacing (in direction of loading)	**Capacity Reduction**
8D	1.00
6D	0.70
4D	0.40
3D	0.25

1.2.2 Corrosion Protection

We recommend that corrosion resistance measures be taken to protect the long-term integrity of the piles. In the order of preference, these measures include:

- If pipe piles are used, filling the piles with concrete
- Increasing the size of the steel pile to account for area loss over time

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- Coating the pipe pile with a corrosion inhibitor

To increase the corrosion protection, more than one of the above mentioned methods can be used. The corrosion rate of an uncoated steel pile is estimated to be in the order of 0.001 in/year.

1.2.3 Uplift Resistance

We recommend that the ultimate uplift capacity of the H-piles or pipe piles be taken as the dead weight of the pile, pile cap, soil above the pile cap, friction of the mobilized soil, and soil friction resistance along the length of the pile. We recommend that factor of safety of 1.0 be used for the dead weight calculations, and a factor of safety of 2.5 be used for the mobilized soil and soil friction resistance along the pile. The ultimate soil friction resistance along the pile can be calculated using the coefficients provided in Table 2.

1.2.4 Pile Splices

We anticipate that pile splices will be required for some of the installed piles. The design of all pile splices should be in accordance with IBC 2015 Section 1810.3.6.

1.2.5 Downdrag

Assuming that the proposed fill height (including slab) is 2.5 feet or less, we anticipate that consolidation of the clay will be negligible and downdrag force along the length of the pile embedded in the clay can be ignored in the pile design.

1.2.6 Pile Testing and Field Monitoring

All piles should be installed to an ultimate capacity equal to the allowable axial capacity multiplied by a factor of safety of 2.5. To ensure that this capacity is developed, and to avoid over-stressing of the installed piles, we recommend dynamic pile testing (PDA) be performed on select piles in accordance with ASTM D4945. We further recommend that a specialty consultant be used to perform these tests.

In addition to the PDA testing, we also recommend that a detailed pile-driving log for each pile be performed and reviewed to evaluate pile installation and consistency. The contractor or a qualified technician can record the pile-driving logs. If the contractor is selected to record the pile driving logs, we recommend that SGS review the logs and verify that the piles are being installed within the design recommendations.

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We recommend that the skin friction values generated by the compressive load test (ASTM D4945) be evaluated to verify the field uplift capacity.

Field testing for lateral capacity is not required.

2.0 Soil Parameter Recommendations:

The following table presents soil parameters to be used in the structural design of the rigid inclusions or piles:

Table 2: Geotechnical Design Parameters

GEOTECHNICAL PARAMETERS					
PARAMETER	**[1]EXISTING FILL**	**GLACIAL MARINE**	**[2]STRUCTURAL FILL**	**[2]FOUNDATION BACKFILL**	**CRUSHED STONE**
Total Unit Weight (γ_t)	120 pcf	125 pcf	135 pcf	130 pcf	115
Submerged Unit Weight (γ_B)	58 pcf	63 pcf	73 pcf	68 pcf	53 pcf
Effective Friction Angle (ϕ')	32°	10°	34°	32°	40°
Cohesion (c)	0 psf	600 psf	0 psf	0 psf	0 psf
Interface Friction Angle (δ), C.I.P. Conc.	25°	0°	28°	26°	30°
Interface Friction Angle (δ), Steel	20°	0°	20°	20°	22°
Adhesion (c_a)	0 psf	500 psf	0 psf	0 psf	0 psf

[1]***Note:*** *Existing Fill refers to granular soil clear of trash, debris, and rubble.*
[2]***Note:*** *Soil Parameters for Structural Fill and Foundation Backfill assume that the fill is placed in 12" maximum lifts and compacted to 95% of the dry density in accordance with ASTM D1557.*

Lateral capacity can also be developed by the soil resistance against the pile caps, grade beams, footings, and walls. If lateral deflection of the foundation element is greater than 0.005 feet per foot of depth, the passive resistance of the soil will be mobilized. If lateral deflections are less than 0.005 feet per foot of depth, at-rest soil conditions will be present. Depending on the anticipated deflection, we recommend that either passive (K_p) or at-rest (K_o) coefficient be used to calculate the soil resistance against grade beams, pile caps, footings, and walls. These coefficients can be computed using the effective friction angles in Table 2.

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3.0 Earthwork Considerations – Reuse of Existing Soil

3.1 Subsurface Explorations

Summit Geoengineering Services (SGS) observed the subsurface conditions at the site with the excavation of 2 test pits on August 23, 2017, advanced to depths of 4.5 to 5 feet with no refusal. Test pits were excavated by Shaw Bros. using a Takeuchi TB285 Tracked Mini Excavator under direct supervision of SGS. The test pits were located on the day of the explorations by taping from existing site features. The locations of the test pits are shown on the exploration location plan in Appendix A. The test pit logs are included in Appendix B.

Existing rubble was encountered in TP-1 starting at a depth of 3.5 feet. The rubble consisted of granite pieces, which are likely remnants of an old foundation. Also intermixed in the fill was brick, glass, metal (railroad spikes), and small wood pieces. Only trace rubble (glass and metal) was encountered in TP-2.

Laboratory testing, consisting of Grain Size Analyses (*ASTM D422*), were performed on samples of the existing fill collected from each of the test pits. A summary of the results are presented below. Detailed results can be found in Appendix C.

Table 3: Laboratory Test Results

GRAIN SIZE ANALYSIS RESULTS – FILL						
Test Pit	**Sample**	**Depth (ft.)**	**Composition**			**USCS**
			Gravel	Sand	Silt	
TP-1	S-1	3.5’	59%	38%	3%	GP
TP-2	S-1	1.0’	56%	41%	3%	GP
TP-2	S-2	4.0’	25%	69%	6%	SP-SM

USCS = Unified Soil Classification System, GP = Poorly Graded Gravel, SP-SM = Poorly Graded Sand with Silt

Based on the laboratory testing results, we anticipate that the clean portion (no rubble or debris) of the existing fill can be reused as Foundation Backfill (FB) or Structural Fill (SF). We recommend that when this soil is reused, all man-made materials and organics are removed from the soil stockpile. We further recommend that periodic grains size analyses be performed throughout the earthwork period to confirm that the reused fill is consistent with the gradation requirements of FB and SF.

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4.0 Closure

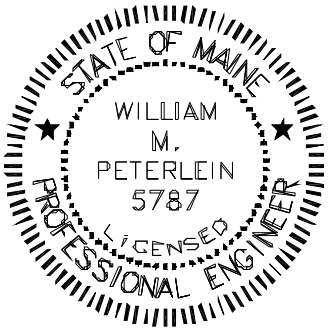
Our recommendations are based on professional judgment and generally accepted principles of geotechnical engineering and project information provided by others. Some changes in subsurface conditions from those presented in this report may occur. Should these conditions or the proposed development differ from those described in this report, SGS should be notified so that we can re-evaluate our recommendations. SGS should be provided an opportunity to review the Stone Column submittal package.

It is recommended that this report be made available in its entirety to contractors for informational purposes and be incorporated in the construction Contract Documents. We recommend that SGS be retained to review final construction documents relevant to the recommendations in this report.

We appreciate the opportunity to serve you during this phase of your project. If there are any questions or additional information is required, please do not hesitate to call.

Sincerely yours,

Mathew Hardison, EI
Geotechnical Engineer



William M. Peterlein, PE
President & Principal Engineer

145 Lisbon Street (PO Box 7216) Lewiston, Maine 04243 | (207) 576-3313
173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
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APPENDIX A

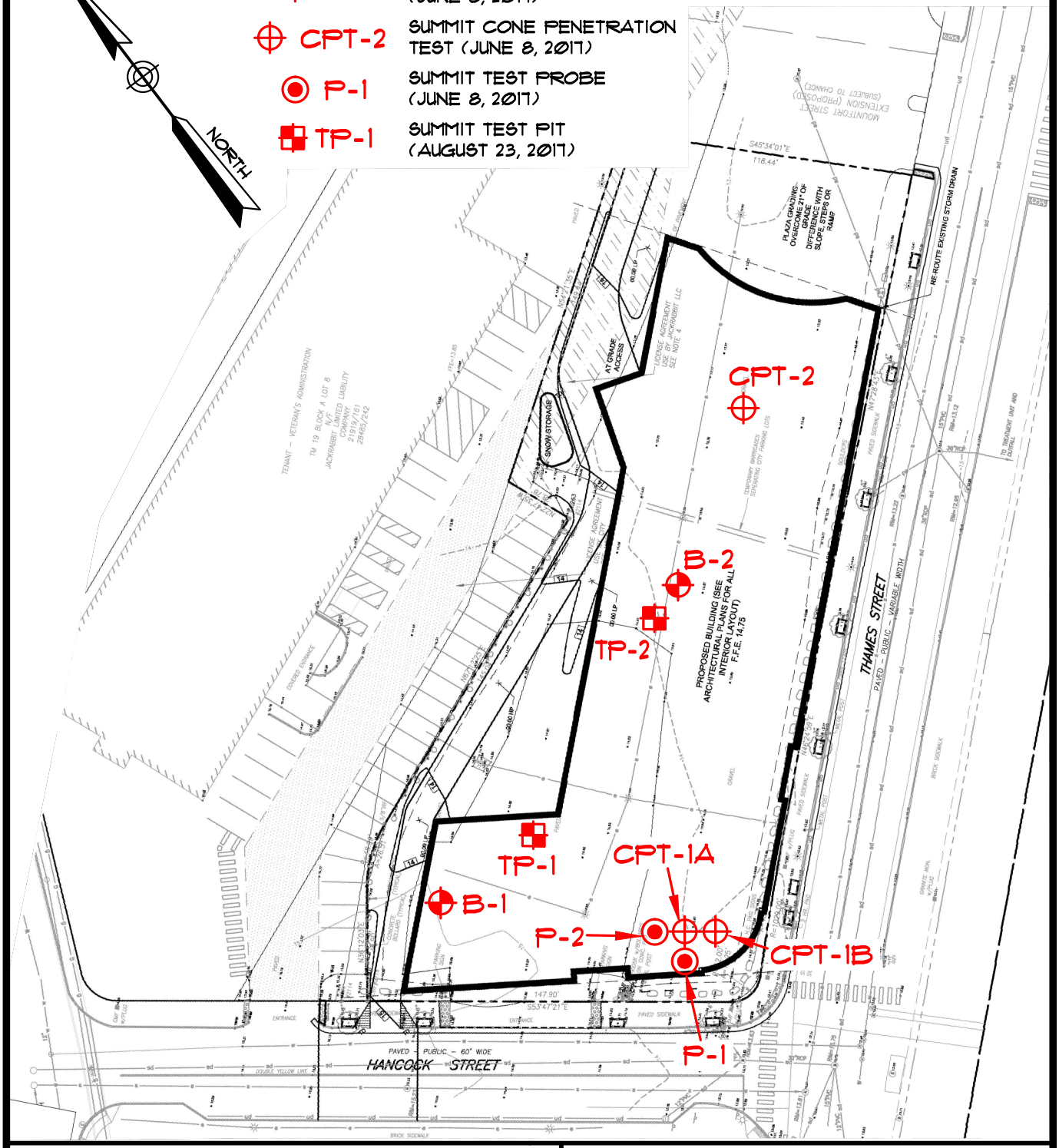
EXPLORATION LOCATION PLAN

LEGEND

B-1	SUMMIT TEST BORING (JUNE 8, 2017)
CPT-2	SUMMIT CONE PENETRATION TEST (JUNE 8, 2017)
P-1	SUMMIT TEST PROBE (JUNE 8, 2017)
TP-1	SUMMIT TEST PIT (AUGUST 23, 2017)

PLAN REFERENCE

AERIAL IMAGE (2012) OBTAINED FROM MAINE OFFICE OF G.I.S.



EXPLORATION LOCATION PLAN
WEX BUILDING

HANCOCK & THAMES STREETS - PORTLAND, ME

PREPARED FOR

ARCHETYPE, PA

DATE: 9-1-2017	DRAWN BY: KRF	CHECKED BY: WMP
JOB: 17181	SCALE: 1" = 60'	FILE: 17181 BOR

145 LISBON ST. - SUITE 601
LEWISTON, ME 04240
Tel.: (207) 576-3313

173 PLEASANT STREET
ROCKLAND, ME 04841
Tel.: (207) 318-7761

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APPENDIX B

TEST PIT LOGS

SUMMIT GEOENGINEERING SERVICES	TEST PIT LOG	Test Pit # TP-1
	Project: Proposed Wex Building Corner of Hancock and Thames Portland, ME	Project #: 17181 Groundwater: None Encountered
Contractor: Shaw Brothers	Ground Surface Elevation: 14.5 ft. +/-	
Equipment: Takeuchi TB285 Mini Excavator	Reference: "Grading and Drainage Plan" prepared by Stantec 7/12/17	
Summit Staff: M. Hardison, E.I.	Date: 8/23/2017	Weather: Sunny, 65°

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
	3.5" Pavement, poor condition	PAVEMENT
1	Light Brown fine to coarse SAND, little to some Gravel, trace to little Silt, humid, SP-SM	FILL
2	Dark Brown Sandy GRAVEL, trace Silt, humid, GP	FILL with RUBBLE
3		Large Granite Block at 3.5' depth, probable remnant of old foundation
4	Similar to above, intermixed brick, wood, glass, metal (railroad spikes), and granite pieces	**Grain Size = 59% Gravel, 38% Sand, 3% Silt**
5	End of Test Pit at 4.5', no refusal	
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

SUMMIT GEOENGINEERING SERVICES	**TEST PIT LOG**	Test Pit # **TP-2**
	Project: Proposed Wex Building Corner of Hancock and Thames Portland, ME	Project #: 17181 Groundwater: None Encountered
Contractor: Shaw Brothers	Ground Surface Elevation: 13.8 ft. +/-	
Equipment: Takeuchi TB285 Mini Excavator	Reference: "Grading and Drainage Plan" prepared by Stantec 7/12/17	
Summit Staff: M. Hardison, E.I.	Date: 8/23/2017	Weather: Sunny, 65°

Depth (ft)	DESCRIPTION	
	ENGINEERING	**GEOLOGIC/GENERAL**
1	Light Brown fine to coarse Sandy GRAVEL, trace Silt, humid, SP or SP-SM	FILL
2		**Grain Size = 56% Gravel, 41% Sand, 3% Silt**
3		
4	Similar to above, Gravelly SAND content, little Silt, moist, trace glass and metal pieces	**Grain Size = 25% Gravel, 69% Sand, 6% Silt**
5		
6	End of Test Pit at 5.0', no refusal	
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

APPENDIX C

LABORATORY TEST RESULTS

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GEOENGINEERING SERVICES

GRAIN SIZE ANALYSIS - ASTM D6913

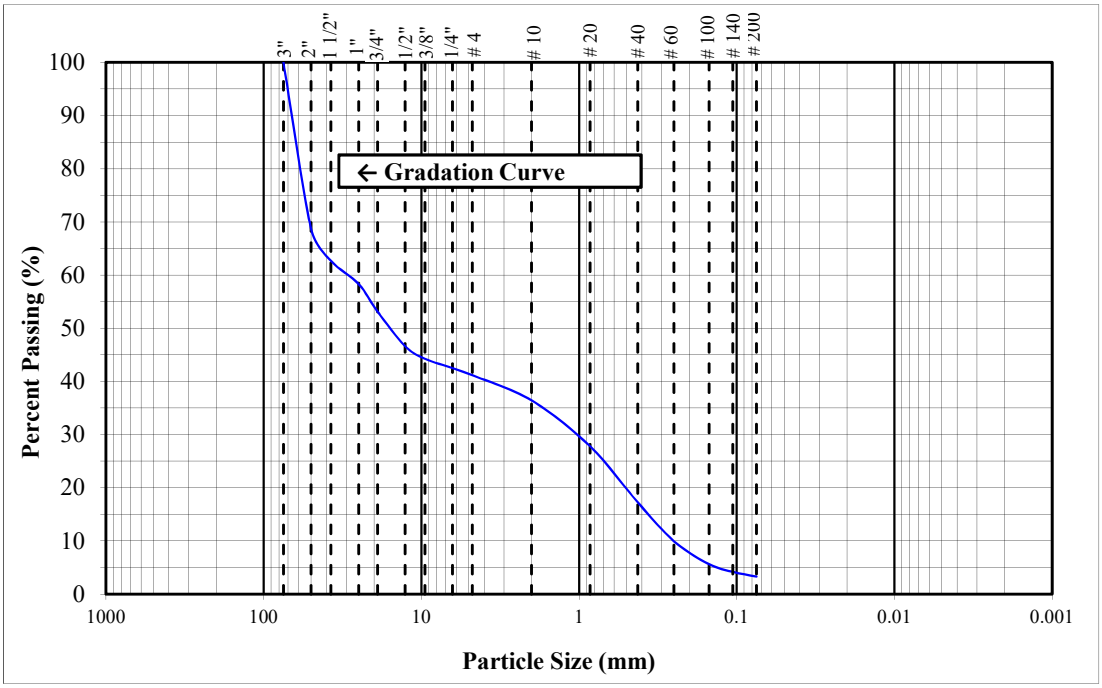
PROJECT NAME:	Proposed Wex Building	PROJECT #:	17181
PROJECT LOCATION:	Hancock & Thames St., Portland, ME	EXPLORATION #:	TP-1
CLIENT:	Archetype, P.A.	SAMPLE #:	S-1
TECHNICIAN:	Erika Stewart, P.E.	SAMPLE DEPTH:	3.5 ft
SOIL DESCRIPTION:	Sandy GRAVEL, trace Silt, GP	TEST DATE:	8/28/2017

TEST PROCEDURE

Sample Source: Test Pit	**Sieve Stack:** Composite	**Specimen Procedure:** Moist
Test Method: Method A	**Separating Sieve(s):** 3/8 Inch	**Dispersion Type:** Tap Water

DATA

STANDARD SIEVE DESIGNATION (mm)	ALTERNATIVE SIEVE DESIGNATION (in)	PERCENT PASSING (%)
75	(3 in)	100
50	(2 in)	69
37.5	(1-1/2 in)	63
25.0	(1 in)	58
19.0	(3/4 in)	53
12.7	(1/2 in)	47
9.5	(3/8 in)	44
6.35	(1/4 in)	42
4.75	(No. 4)	41
2.00	(No. 10)	36
0.850	(No. 20)	28
0.425	(No. 40)	17
0.250	(No. 60)	10
0.150	(No. 100)	6
0.106	(No. 140)	4
0.075	(No. 200)	3



REMARKS: Moisture Content = 5.5%. Sample contained gravel sized pieces of brick and tar conglomerates. Little to trace asphalt/tar pieces were observed in the wash water and finer sieve set. The sample contained one large gravel sized piece granite rock. The sample is undersized based the maximum partle size.

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GRAIN SIZE ANALYSIS - ASTM D6913

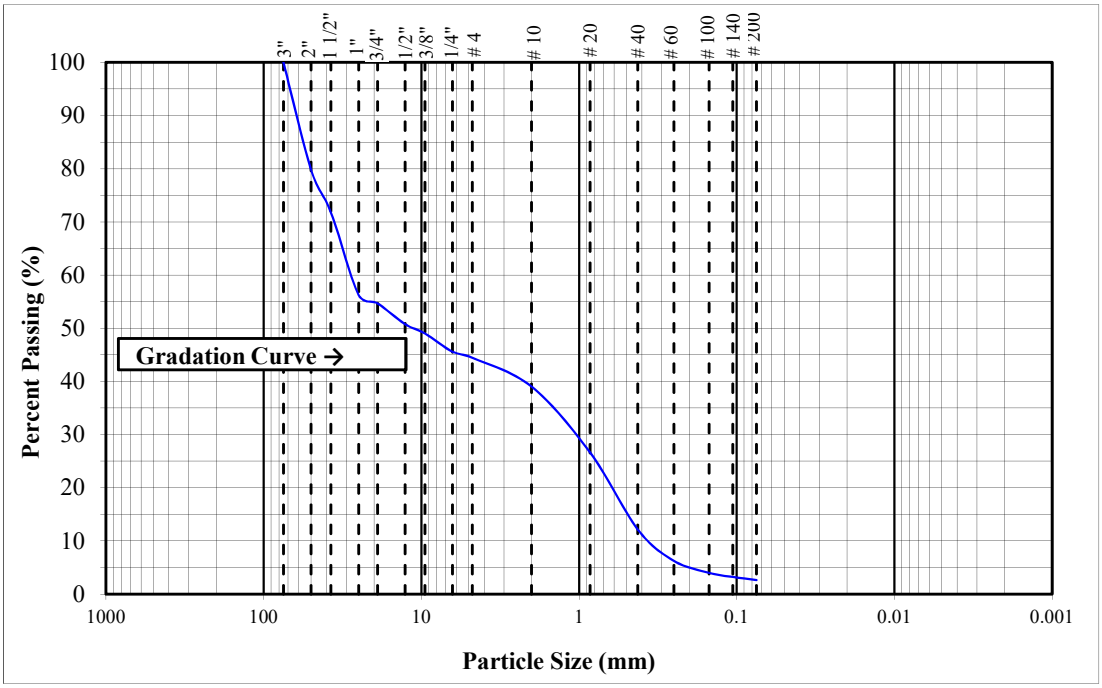
PROJECT NAME:	Proposed Wex Building	PROJECT #:	17181
PROJECT LOCATION:	Hancock & Thames St., Portland, ME	EXPLORATION #:	TP-2
CLIENT:	Archetype, P.A.	SAMPLE #:	S-1
TECHNICIAN:	Erika Stewart, P.E.	SAMPLE DEPTH:	1 ft
SOIL DESCRIPTION:	Sandy GRAVEL, trace Silt, GP	TEST DATE:	8/28/2017

TEST PROCEDURE

Sample Source: Test Pit	**Sieve Stack:** Composite	**Specimen Procedure:** Moist
Test Method: Method A	**Separating Sieve(s):** 3/8 Inch	**Dispersion Type:** Tap Water

DATA

STANDARD SIEVE DESIGNATION (mm)	ALTERNATIVE SIEVE DESIGNATION (in)	PERCENT PASSING (%)
75	(3 in)	100
50	(2 in)	80
37.5	(1-1/2 in)	72
25.0	(1 in)	56
19.0	(3/4 in)	55
12.7	(1/2 in)	51
9.5	(3/8 in)	49
6.35	(1/4 in)	46
4.75	(No. 4)	44
2.00	(No. 10)	39
0.850	(No. 20)	27
0.425	(No. 40)	12
0.250	(No. 60)	6
0.150	(No. 100)	4
0.106	(No. 140)	3
0.075	(No. 200)	3



REMARKS: Moisture Content = 2.3%. The gravel sized particles are rounded. The sample is undersized based the maximum partle size.

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GRAIN SIZE ANALYSIS - ASTM D6913

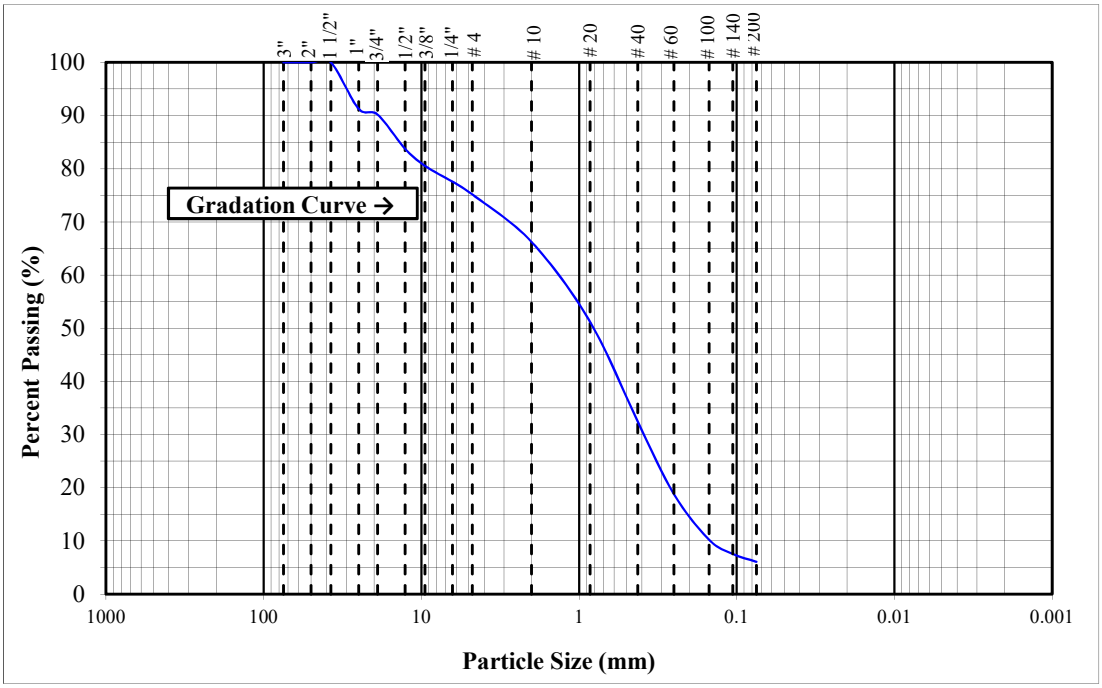
PROJECT NAME:	Proposed Wex Building	PROJECT #:	17181
PROJECT LOCATION:	Hancock & Thames St., Portland, ME	EXPLORATION #:	TP-2
CLIENT:	Archetype, P.A.	SAMPLE #:	S-2
TECHNICIAN:	Erika Stewart, P.E.	SAMPLE DEPTH:	4 ft
SOIL DESCRIPTION:	SAND, some Gravel, little Silt, SP-SM	TEST DATE:	8/28/2017

TEST PROCEDURE

Sample Source: Test Pit	**Sieve Stack:** Composite	**Specimen Procedure:** Moist
Test Method: Method A	**Separating Sieve(s):** 3/8 Inch	**Dispersion Type:** Tap Water

DATA

STANDARD SIEVE DESIGNATION (mm)	ALTERNATIVE SIEVE DESIGNATION (in)	PERCENT PASSING (%)
75	(3 in)	100
50	(2 in)	100
37.5	(1-1/2 in)	100
25.0	(1 in)	91
19.0	(3/4 in)	90
12.7	(1/2 in)	84
9.5	(3/8 in)	81
6.35	(1/4 in)	78
4.75	(No. 4)	75
2.00	(No. 10)	66
0.850	(No. 20)	51
0.425	(No. 40)	32
0.250	(No. 60)	19
0.150	(No. 100)	10
0.106	(No. 140)	8
0.075	(No. 200)	6



REMARKS: Moisture Content = 6.3%. The sample contains trace wood pieces.

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Geotechnical Report

Proposed Wex Building

Corner of Hancock & Thames Street, Portland, Maine

Client
Archetype, PA
Union Wharf
Portland, Maine 04101

SUMMIT
GEOENGINEERING SERVICES

Project #: 17181
Date: 7/20/17

145 Lisbon Street (PO Box 7216) Lewiston, Maine 04243 | (207) 576-3313
173 Pleasant Street Rockland, Maine 04841 | (207) 318-7761
www.summitgeoeng.com

July 20, 2017
Summit #17181

Attn: Bill Hopkins
Archetype, PA
Union Wharf
Portland, Maine 04101

Reference: Geotechnical Engineering Services – Proposed Wex Building
Corner of Hancock & Thames Street, Portland, Maine

Dear Bill;

Summit Geoengineering Services, Inc. (SGS) has completed a geotechnical investigation for the proposed construction at the site referenced above. Our scope of services included the drilling of 2 test borings and 2 cone penetration tests (CPT), laboratory testing of collected samples, and preparing this geotechnical report summarizing our findings and providing geotechnical recommendations.

Our scope of services for this project did not include an environmental site assessment or further investigation for the presence or absence of hazardous or toxic material on, below, or around the site. Any statements in this report, or on the soil boring logs, regarding odors or unusual and suspicious conditions observed are for informational purposes and are not intended to constitute an environmental assessment.

1.0 Project and Site Description

We understand that the project consists of the construction of a new building at the corner of Hancock and Thames Street in Portland, Maine. We further understand that the building will be a three story structure with an approximate footprint of 30,000 square feet. There will be a fourth story constructed on the portion of the building adjacent to Hancock Street totaling approximately 10,000 square feet of the 30,000 total. There will be a roof deck on the 3-story portion of the building.

The site of the proposed development is located at the corner of Hancock Street and Thames Street in Portland, Maine. The site is northeast of the AC Hotel currently being constructed and southwest of the Hamilton Marine building. The site is currently used as a parking lot. Existing grades are relatively flat throughout the proposed development area, ranging from

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approximately elevation 14 feet to 15 feet, based on the City of Portland GIS contours. At the time of preparing this report, a proposed grading plan was not available.

Anticipated structural loads were provided to us by Veitas & Veitas Engineers, Inc. (V&V) for the proposed building. Based on these loads and a preliminary foundation plan prepared by V&V, we understand that isolated column loads are anticipated to range from 125 kips to 405 kips. Dead load accounts for approximately 50% to 60% of the total load. At the time of preparing this report, uplift and lateral loads were not available to SGS.

2.0 Subsurface Exploration and Laboratory Testing

2.1 Subsurface Explorations

Summit Geoengineering Services (SGS) observed the subsurface conditions with the drilling of 2 borings (B-1 and B-2) and 2 cone penetration tests (CPT-1 and CPT-2) on June 8, 2017 using a rubber track mounted Power Probe 9500 VTR. Both borings and CPT-2 were advanced to refusal (probable bedrock), ranging in depth from 59.0 feet to 65.5 feet. CPT-1 was advanced to a depth of 5.5 feet, where refusal was encountered on rubble/debris. CPT-1 was offset and multiple probes were advanced in this location, all of which encountered refusal on rubble/debris at depths ranging from 4.0 feet to 7.5 feet.

Borings were advanced using 3-inch direct push steel casing. Soils were visually classified (*ASTM D2488*) using SPT split spoon sampling (*ASTM D1586*) and thin wall tube sampling (*ASTM D1587*). Field vane shear tests (*ASTM D2573*) were attempted in Boring B-2, but the vane was unable to be advanced due to likely sand seams.

Two cone penetration tests (ASTM D5778) were performed using a 5-ton digital cone anchored using a dual driven anchor system. Parameters obtained include cone resistance (q_c), sleeve friction (f_s), and piezocone pore pressure (u). Shear wave velocity (ASTM D7400) was performed in CPT-2. CPT-1 encountered refusal on rubble/debris at a depth of 5.5 feet.

The boring and CPT explorations were approximately located by SGS by taping and pacing from existing site features. The exploration locations are shown on the Exploration Location Plan in Appendix A. Logs of the explorations are provided in Appendix B.

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2.2 Laboratory Testing

Laboratory testing was performed on specimens of clay obtained from a thin wall tube sample (UT-1) of the marine clay from Boring B-2 at a depth of 25 to 27.5 feet below ground surface. Testing consisted of Atterberg Limits (*ASTM D4318*), one-dimensional consolidation test (*ASTM D2435)*, and moisture contents (*ASTM D2216*). The results from the testing of tube UT-1 is summarized below:

Glacial Marine Clay (Boring B-2, UT-1: 25-27.5 ft)
Liquid Limit: 29, Plasticity Index: 8
Moisture Content: 27.9% to 36.1%
Laboratory Torvane (S_u): 360 psf

Results of these tests and the consolidation curve can be found in Appendix C.

3.0 Subsurface Conditions

3.1 Soil

The following subsurface layers and thicknesses were encountered in our geotechnical investigation, starting from the ground surface:

- ***Pavement,*** 10 inches (B-1 only)
- ***Fill,*** 18.2 feet to 20.0 feet
- ***Glacial Marine (Sand),*** 5.0 feet to 7.0 feet
- ***Glacial Marine (Clay),*** 31 feet to 39 feet
- ***Glacial Till,*** 1.0 to 3.0 feet, (absent in B-1)
- ***Bedrock (refusal depth),*** 59.6 feet depth to 65.5 feet depth

The ***Pavement*** was only encountered in Boring B-1 and is 10 inches thick and in poor condition. The ground surface at the site is either gravel or pavement.

The ***Fill*** was encountered in all of the explorations, starting either beneath the pavement or at the ground surface and ranges in thickness from 18.2 to 20.0 feet. The fill recovered from Borings B-1 and B-2 is fine to coarse sand with little to some gravel and trace to little silt with occasional asphalt pieces near the surface of B-1. The fill observed in the southern corner of the site includes frequent brick pieces and buried rubble. The explorations in this corner of the site could not penetrate through the rubble fill.

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Standard Penetration Number (SPT-N) of the fill ranges from 1 to 19 with an average of 12 blows per foot (bpf). We anticipate that the SPT-N value of 1 was due to groundwater pressure loosening the fill soil once the casing plug was removed at that dept. In general, the fill is loose to compact, dry to wet (increasing moisture with depth) and classifies as SP or SP-SM in accordance with the Unified Soil Classification System. Based on our review of historic Sanborn maps made available to us, it appears that the site previously included a trainyard, passenger station, lumber yard, and a store. It is possible that the foundation of the passenger station was encountered in the southern corner of the site which caused the shallow refusal.

The ***Glacial Marine (Sand)*** deposit begins at a depth ranging from 19 feet to 20 feet below ground surface and extends to depths ranging from 24 to 26 feet. The glacial marine sand is described as gray silty fine sand or silt with trace clay and sand. It is loose/soft, wet, and contains trace shell fragments and wood pieces at the B-2 location. SPT-N ranges from 4 to 7 and averages 5 blows per foot (bpf). Pocket Penetrometer measurements (an estimate of unconfined compressive strength) range from 1,000 psf to 5,500 psf. The glacial marine sand visually classifies as SM or ML in general accordance with USCS.

The ***Glacial Marine (Clay)*** deposit begins at a depth ranging from 24 feet to 26 feet below ground surface and extends to depths ranging from 56 to 65.5 feet, terminating on glacial till or bedrock. This soil is described as wet, very soft gray silty clay. Occasional sand and silt seams are present throught the deposit, and increase in frequency within the lower 5 to 10 feet of the deposit. Moisture contents ranged from 27.9% to 36.1% and averages 31.9%. Atterberg Limit testing resulted in a Liquid Limit of 29 and a Plasticity Index of 8. The glacial marine (clay) deposit classifies as CL in accordance with the USCS.

Interpretation of the consolidation test on sample UT-1 from Boring B-2 and the CPT results indicates that the clay is nearly normally consolidated. We anticipate that applied stresses exceeding 300 to 400 psf will exceed the preconsolidation pressure of the clay. This was calculated with an approximate OCR value of 1.2 at this depth.

The ***Glacial Till*** was encountered in B-2 and CPT-2 starting at depths ranging from 56 to 58 feet and extends to bedrock. Samples of the glacial till were not collected, however Soil Behavior Type (SBT) classification using the tip resistance and sleeve friction meausrements in the CPT tests indicate the glacial till consists of a medium dense clean to silty sand.

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3.2 Groundwater

On the day of the explorations, groundwater was encountered at depths ranging from 8.4 feet to 10.0 feet below ground surface. In general, groundwater appears to fluctuate within the fill layer. Table 1 presents the depth and approximate elevation of the groundwater measured on the days of the explorations.

Table 1: Groundwater Depths and Approx. Elevations

GROUNDWATER DEPTHS and ELEVATIONS		
Exploration	**Depth (ft.)**	**Approximate Elevation (ft.)**
B-1	10.0’	5.0’ +/-
B-2	8.4’	6.1’ +/-
CPT-1	NE	NE
CPT-2	8.0’	6.0’ +/-

Note: 1) All elevations are approximate and were interpolated from the City of Portland GIS
2) NE = none encountered

3.3 Bedrock

Bedrock was encountered at the depths and approximate elevations shown in Table 2. According to the Maine Geological Survey, bedrock at the site is of the Precambrian Z Spring Point Formation consisting of green schist and amphibolites facies ranging from and mafic to felsic volcanic rock.

Table 2: Bedrock Depths and Approx. Elevations

BEDROCK DEPTHS and ELEVATIONS		
Exploration	**Depth (ft.)**	**Approximate Elevation (ft.)**
B-1	65.5’	-50.5’ +/-
B-2	59.0’	-44.5’ +/-
CPT-2	59.6’	-45.6’ +/-

Note: 1) All elevations are approximate and were interpolated from the City of Portland GIS

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4.0 Geotechnical Evaluation

We have identified the following geotechnical considerations in regard to the construction of the proposed foundation:

- Potential for excessive total and differential settlements of footings constructed on loose, existing fill.
- Potential for excessive total and differential settlements of footings which apply load to the underlying clay deposit.
- Presence of rubble and debris within the existing fill.

Based on discussions with the design team, we understand that the desired settlement limitations for the proposed structure are 1.0" of total settlement and 0.5" of differential settlement between two adjacent columns. Given these settlement magnitude limitations and the structural loads from V&V, the feasibility of various foundation types were evaluated for construction of the new building. This included shallow foundations, intermediate foundations/ground improvement, and deep foundations. We did not investigate the option of preloading the site due to the time restraint of the project schedule and the existing use of the lot as a parking area.

Our analysis assumes that fill placed within the building footprint does not exceed 2 to 3 feet. SGS should be notified if the proposed FFE is any more than 3 feet above existing grade.

4.1 Shallow Foundations

4.1.1 Frost Wall and Continuous Strip Footings with Isolated Column Footings.

A settlement analysis of the existing fill was performed using assumed allowable bearing pressures and column loads to compute the footing dimensions. The results of this analysis suggest that long-term settlement due to footing loads will be on the order of 1.3" to 1.9". Based on discussions with the design team, we understand that this magnitude of settlement is unacceptable for the new building construction.

4.1.2 Structural Mat

Assuming a design bearing pressure of 800 psf to 1,000 psf for the structural mat, settlement magnitudes were estimated to be on the order of 1.5" to 3.0" for the total settlement of the existing fill and clay soil. We believe that this settlement magnitude is unacceptable for the new building construction. We also understand that the cost of a structural mat is likely greater than alternative options.

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4.2 Intermediate Foundations/Ground Improvement:

4.2.1 Stone Columns

The use of Stone Columns (SC) is a form of ground improvement which involves the installation of crushed stone columns into the existing fill to stiffen the soil matrix beneath foundation elements and reduce settlement magnitudes. SC elements can also increase the allowable bearing capacity of existing soils. SCs are installed using replacement or displacement methods and involve the installation of controlled, compacted lifts of stone to force the stone laterally into the surrounding soils. Building foundations constructed on SC improved soils can typically be built as conventional foundations without any load transfer platforms, grade beams, or other load transfer mechanisms.

We anticipate that SC will be a feasible option for the proposed foundation. Based on our preliminary computations, settlements can be limited to 1.0" within the fill soil using engineering properties of soil improved with SCs. SC should be constructed as "floating columns" above the clay deposit and should be designed to limit or prevent foundation loads from reaching the clay deposit.

4.2.2 Grouted Stone Columns or Rigid Inclusions

Grouted Stone Columns (GSC) or Rigid Inclusion Piles (RIP) is a ground improvement technique which involves the installation of rigid pier elements extending to hard bearing strata. In this method, the rigid elements are designed to support the entire building load (bypass the existing fill and clay) and generally require a load transfer platform to transfer the load from the foundation to the rigid elements. We anticipate that GSC or RIP elements would need to extend to the glacial till/bedrock layer at a depth of approximately 55 to 65 feet below existing grade. Additionally, we anticipate a load transfer platform would also be required for the installation of this type of ground improvement. While this is an option for the proposed building, we anticipate it will be more expensive than stone columns.

4.3 Deep Foundations:

4.3.1 Timber Piles

Typically, timber piles are only feasible for sites where the refusal depth or pile termination depth is less than 50 feet. We anticipate that timber piles are not feasible at this site.

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4.3.2 Steel H-Piles or Pipe Piles

Utilizing steel H-piles or pipe piles for construction of the new foundation will eliminate the settlement of the fill and clay by transferring the foundation loads directly to bedrock. However, we anticipate that the cost of steel piles driven to refusal will exceed that of intermediate foundation/ground improvement.

5.0 Geotechnical Recommendations

5.1 Ground Improvement

Given the evaluations stated above we recommend that ground improvement, consisting of stone columns, be used to improve the site soils and provide adequate bearing for the proposed building foundation footings. We recommend that stone columns be designed to terminate in the upper fill or glacial marine (sand) deposit above the clay. Stone columns should be designed to limit all foundation loads to the underlying clay deposit in order to minimize foundation settlements.

As discussed in Section 5.2 below, the stone column system should be designed to meet the following criteria:

- Maximum Allowable Bearing Pressure: 5,000 psf
- Maximum Total Long-Term Settlement: 1.0 inches
- Maximum Differential Long-Term Settlement: 0.5 inches between adjacent columns

Based on preliminary stone column calculations, we estimate that an area replacement ratio of 25% or higher may be required to obtain the allowable bearing pressure of 5,000 psf. The working pad from which the stone columns are installed should be the elevation of the bottom of the 12” slab subgrade (1.0 feet below bottom of slab). Imported fill within the project area should be minimal. All fill placed within the proposed building footprint should consist of Structural Fill (SF, see Section 5.6). Fill outside of the building footprint can consist of SF or Gravel Borrow (GB). The portion of GB passing the 3” sieve size should meet the following gradation requirements:

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Table 3: Gravel Borrow Gradation

GRAVEL BORROW (GB)	
Sieve Size	**Percent finer**
¼ inch	0 to 70
No. 200	0 to 10.0

Reference: MDOT Specification 703.19, Gravel Borrow

The maximum GB particle size should be limited to 6 inches. GB should be placed in 6 to 12 inch lifts and should be compacted to a minimum of 95 percent of its maximum dry density, determined in accordance with ASTM D1557.

Assuming that the subgrade preparation recommendations contained herein are followed, the proposed slab can be constructed as a slab-on-grade on the existing proofrolled fill without the need for stone columns.

Pre-augering for stone column installation may be necessary in some parts of the proposed footprint, particularly in the southern corner where rubble/debris was encountered in the explorations. The stone column design should be performed and stamped by a qualified Maine Licensed Professional Engineer. Soil property assumptions are the responsibility of the stone column designer. Summit Geoengineering Services (SGS) should be provided an opportunity to review the Stone Column design submittal package.

If an alternative foundation type besides stone columns is selected for this site, SGS should be notified so that we can evaluate the alternatives.

5.2 Foundation Bearing Pressure

Assuming that the recommendations below are followed, we recommend an allowable bearing pressure of 5,000 psf be used to proportion the footings for the new building constructed on the improved existing fill. The stone column system should be designed to limit the total footing settlement to 1.0” and differential settlement between adjacent footings to 0.5”.

- Prior to footing excavations, the entire building footprint should be proofrolled with a minimum of 12 passes (6 north/south and 6 east/west) with a 10 ton minimum operating weight vibratory roller.
- All footings exposed to freezing temperatures are constructed at the recommended frost protection depth of 4.0 feet below exterior finish grade. Interior footings

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should be constructed at a minimum depth of 2.0 feet below finish floor elevation (FFE).

- If soft or unsuitable fill is encountered during proofrolling, it should be removed and replaced with ¾" crushed stone or compacted Structural Fill. If a significant amount of soft/unsuitable soils are encountered, SGS should be notified.
- All placed fill within the building footprint consists of Structural Fill (SF, see Section 5.6 for gradation and compaction requirement) or ¾" crushed stone.

Any subgrade improvements required beneath footings (proofrolling, over-excavation and replacement, etc.) should be provided by the Stone Column designer and reviewed by Summit Geoengineering Services.

5.3 Frost Protection

The design air freezing index for the Portland area is approximately 1,200 degree F days (10 year, 90% probability). Based on this, a total of 4.0 feet of frost protection should be provided for the exterior footings and interior footings exposed to freezing temperatures. Interior footings constructed in continuously heated areas can be constructed at a depth of 2.0 feet below interior grade.

We recommend that the exterior of all foundation elements exposed to freezing temperatures be backfilled with Foundation Backfill (FB). The portion of FB passing the 3" sieve size should meet the following gradation requirements:

Table 4: Foundation Backfill - Soil Gradation

FOUNDATION BACKFILL	
Sieve Size	**Percent Finer**
3 inch	100
¼ inch	25 to 100
No. 40	0 to 50
No. 200	0 to 6*

Reference: MDOT Specification 703.06, Type E (2014)
*Reduced from 7% to 6% from Type E Standard

Maximum particle size should be limited to 6 inches. Foundation backfill should be placed in 6 to 12 inch lifts and compacted to 95% of its optimum dry density determined in accordance with ASTM D1557. The compaction requirement can be reduced to 90% beneath landscaped areas.

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5.4 Seismic Design

Based on the summary of field results we recommend Site Class D be used in accordance with the 2006 or 2009 International Building Code. The following seismic site coefficients should be used:

Table 5: Seismic Design Parameters

SUBGRADE SITE SEISMIC DESIGN COEFFICIENTS – 2006/2009 IBC	
Seismic Coefficient	**Site Class D**
Short period spectral response (S_S)	0.311
1 second spectral response (S_1)	0.077
Maximum short period spectral response (S_{MS})	0.485
Maximum 1 second spectral response (S_{M1})	0.184
Design short period spectral response (S_{DS})	0.324
Design 1 second spectral response (S_{D1})	0.123

Subgrade conditions are not considered susceptible to liquefaction during seismic events.

5.5 Groundwater Control

Based on observed groundwater levels, groundwater is anticipated below exterior foundation depths. However, seasonal perched water may be present during wet periods or from runoff and snowmelt. Based on this we recommend perimeter underdrains be installed along the exterior foundation walls. In addition, we recommend exterior grades slope away from the building footprint to reduce runoff water from infiltrating the foundation backfill soils.

Perimeter underdrains should consist of 4 inch rigid perforated PVC placed adjacent to the exterior footings and surrounded by a minimum of 6 inches of crushed stone wrapped in filter fabric to prevent clogging from the migration of the fine soil particles in the foundation backfill soils. The underdrain pipe should be outlet to a location where it will be free flowing. If the grades do not allow a gravity outlet, a sump and pump would be required.

5.6 Slab-on-Grade

Existing fill or imported fill will be exposed in the slab excavation. We recommend that the slab for the building be constructed on a minimum of 12" of Structural Fill (SF) or ¾" Crushed Stone. As discussed in Section 5.2, the entire building footprint should be proofrolled with a minimum of 12 passes (6 north/south and 6 east/west) with a 10 ton minimum operating weight vibratory roller prior to excavating for the footings once the ground improvement elements are

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installed. Any soft, wet, or otherwise unsuitable soils exposed in the slab excavation or identified during proofrolling should be removed and replaced with compacted SF or ¾" Crushed Stone.

The portion of SF passing the 3" sieve shall meet the following gradation requirements:

Table 6: Structural Fill Gradation

STRUCTURAL FILL (SF)	
Sieve Size	**Percent finer**
3 inch	100
½ inch	35 to 80
¼ inch	25 to 65
No. 40	0 to 30
No. 200	0 to 7

Reference: MDOT Specification 703.06, Type D

The maximum particle size should be limited to 6 inches. Structural Fill should be placed in 6 to 12 inch lifts and should be compacted to a minimum of 95 percent of its maximum dry density, determined in accordance with ASTM D1557.

For the conditions described above, the slab can be designed using a coefficient of subgrade reaction of 150 pci.

6.0 Pavement Recommendations

The mean annual freezing index for the Portland area is estimated at 900 degree days. Based on the subgrade and mean annual freezing index, the anticipated mean annual frost penetration depth is 36 inches.

We recommend a minimum total section thickness of 18 inches for paved areas. We further recommend that the pavement section consist of the following materials:

Table 7: Pavement Section Thicknesses

MATERIAL	THICKNESS (in)	SPECIFICATION
Asphalt Surface Course	1	MDOT 703.09 Type 9.5 mm or Type 12.5 mm
Asphalt Binder Course	2	MDOT 703.09 Type 19 mm
Base Soil	3	MDOT 703.06 Type A
Subbase Soil	12	MDOT 703.06 Type D

For portions of the pavement subjected to light traffic loads of cars and light trucks we recommend MDOT Type 9.5mm surface course. The following specifications are for MDOT base and subbase gravel:

Table 8: Pavement Base and Subbase Gradations

SIEVE SIZE	Percent Passing a 3-inch Sieve	
	MDOT Type A (Base)	MDOT Type D (Subbase)
3 Inch	100	100
2 Inch	100	--
½ Inch	45 – 70	35 – 80
¼ Inch	30 – 55	25 – 65
No. 40	0 – 20	0 – 30
No. 200	0 – 6	0 – 7

Reference: MDOT Specification 703.06, Aggregate for Base and Subbase (2014)

7.0 Earthwork Considerations

The existing fill is classified as OSHA Type C soil. Based on this, general occupied excavations less than a depth of 20 feet are limited to a maximum side slope of 1.5 horizontal to 1 vertical in the existing fill and native sand soil. Excavations within the clay are not anticipated.

Rubble and debris was encountered in the southern corner of the proposed site, at the corner of Hancock and Thames Street. The extent of this rubble/debris is unknown, but it appears to consist of brick and possible concrete foundation elements. The site contractor and stone column installer should coordinate and be prepared to either pre-auger through this rubble/debris or have it removed prior to installing the columns. Any voids created upon removal of the rubble/debris should be backfill with Structural Fill compacted to a minimum of 95% of ASTM D1557.

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If a displacement-type of stone columns is used for ground improvement, some vibrations are anticipated during construction. The contractor should take the necessary precautions for monitoring vibrations and/or adjacent structures, if necessary based on the anticipated vibrations.

Surface water should be redirected from excavation areas. Where softened, we recommend the subgrade at the base of slab excavation be over-excavated and replaced with a minimum of 12 inches of Crushed Stone or compacted Structural Fill. Crushed Stone should be should be tamped to lock the stone structure together. Crushed Stone should meet the following gradation specification:

Table 9: Crushed Stone Gradation

CRUSHED STONE ¾ INCH	
Sieve Size	**Percent finer**
1 inch	100
¾ inch	90 to 100
½ inch	20 to 55
⅜ inch	0 to 15
No. 4	0 to 5

Reference: MDOT Specification 703.13, Crushed Stone ¾-Inch (2014)

In general, we do not anticipate groundwater within footing excavations. If localized perched groundwater is encountered, dewatering may consist of shallow sumps at the base of the excavation. Diversion and control of surface water should be performed to prevent water flow from rain or snowmelt from entering the excavations.

We recommend that a qualified geotechnical consultant be retained to monitor and test soil materials used during construction and confirm that soil conditions and construction methods are consistent with this report.

8.0 Closure

Our recommendations are based on professional judgment and generally accepted principles of geotechnical engineering and project information provided by others. Some changes in subsurface conditions from those presented in this report may occur. Should these conditions or the proposed development differ from those described in this report, SGS should be notified

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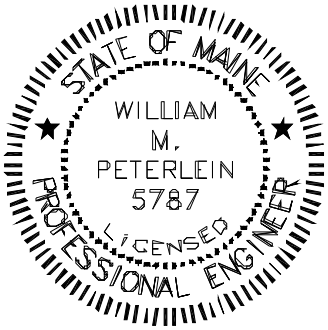
so that we can re-evaluate our recommendations. SGS should be provided an opportunity to review the Stone Column submittal package.

It is recommended that this report be made available in its entirety to contractors for informational purposes and be incorporated in the construction Contract Documents. We recommend that SGS be retained to review final construction documents relevant to the recommendations in this report.

We appreciate the opportunity to serve you during this phase of your project. If there are any questions or additional information is required, please do not hesitate to call.

Sincerely yours,

Mathew Hardison, EI
Geotechnical Engineer



William M. Peterlein, PE
President & Principal Engineer

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APPENDIX A

EXPLORATION LOCATION PLAN

LEGEND

- B-1 — SUMMIT TEST BORING (JUNE 8, 2017)
- CPT-2 — SUMMIT CONE PENETRATION TEST (JUNE 8, 2017)
- P-1 — SUMMIT TEST PROBE (JUNE 8, 2017)

PLAN REFERENCE

AERIAL IMAGE (2012) OBTAINED FROM MAINE OFFICE OF G.I.S.

EXPLORATION LOCATION PLAN
WEX BUILDING

HANCOCK & THAMES STREETS - PORTLAND, ME

PREPARED FOR

ARCHETYPE, PA

DATE: 7-5-2017	DRAWN BY: KRF	CHECKED BY: WMP
JOB: 17181	SCALE: 1" = 60'	FILE: 17181 BOR

145 LISBON ST. - SUITE 601
LEWISTON, ME 04240
Tel.: (207) 576-3313

173 PLEASANT STREET
ROCKLAND, ME 04841
Tel.: (207) 318-7761

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APPENDIX B

EXPLORATION LOGS

EXPLORATION COVER SHEET

The exploration logs are prepared by the geotechnical engineer from both field and laboratory data. Soil descriptions are based upon the Unified Soil Classification System (USCS) per ASTM D2487 and/or ASTM D2488 as applicable. Supplemental descriptive terms for estimated particle percentage, color, density, moisture condition, and bedrock may also be included to further describe conditions.

Drilling and Sampling Symbols:

SS = Split Spoon Sample
UT = Thin Wall Shelby Tube
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RW = Rotary Wash
SV = Shear Vane
PP = Pocket Penetrometer
RC = Rock Core Sample
FV = Field Vane Shear Test
PS = Concrete Punch Sample
Hyd = Hydraulic Advancement of Drilling Rods
Push = Direct Push of Drilling Rods
WOH = Weight of Hammer
WOR = Weight of Rod
PI = Plasticity Index
LL = Liquid Limit
W = Natural Water Content
USCS = Unified Soil Classification System
Su = Undrained Shear Strength
Su(r) = Remolded Shear Strength

Water Level Measurements:

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations. Groundwater monitoring wells may be required to record accurate depths and fluctuation.

Gradation Description and Terminology:

Boulders:	Over 12 inches	Trace:	Less than 5%
Cobbles:	12 inches to 3 inches	Little:	5% to 15%
Gravel:	3 inches to No.4 sieve	Some:	15% to 30%
Sand:	No.4 to No. 200 sieve	Silty, Sandy, etc.:	Greater than 30%
Silt:	No. 200 sieve to 0.005 mm		
Clay:	less than 0.005 mm		

Density of Granular Soils and Consistency of Cohesive Soils:

CONSISTENCY OF COHESIVE SOILS		DENSITY OF GRANULAR SOILS	
SPT N-value blows/ft	**Consistency**	**SPT N-value blows/ft**	**Relative Density**
0 to 2	Very Soft	0 to 4	Very Loose
2 to 4	Soft	5 to 10	Loose
5 to 8	Firm	11 to 30	Compact
9 to 15	Stiff	31 to 50	Dense
16 to 30	Very Stiff	>50	Very Dense
>30	Hard		

SOIL BORING LOG

SUMMIT GEOENGINEERING SERVICES

Project:	Proposed Wex Building	Boring #:	B-1
Location:	Corner of Hancock and Thames St.	Project #:	17181
City, State:	Portland, Maine	Sheet:	1 of 2
		Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	15.0 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	City of Portland GIS
Summit Staff:	M. Hardison, E.I.; T. Jones, E.I.	Date started: 6/8/2017	Date Completed: 6/8/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/8/2017	10.0 ft.	5.0 ft. +/-	Observed on soil samples

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
					14.2'	10" Pavement		PAVEMENT
1								
	S-1	24/12	1 to 3	5		Brown/Black SAND, little Gravel, little Asphalt, compact,		
2				7		humid, SP		FILL
				6				
3				5				
4								
5								
	S-2	24/18	5 to 7	2		Brown fine-medium SAND, little Gravel, trace Silt,		
6				5		compact, SP		
				*10		*Bottom 1' high blow counts likely due to driving through		
7				*19		cobble		
8								
9								
10								
	S-3	24/1	10 to 12	WH		Brown Gravelly SAND, trace Silt, very loose,	▽ Groundwater	
11				1		moist, SP		
				WH				
12				1				
13								
14								
15								
						Could not sample at 15', running sands		
16								
17								
18								
19					-4.0'			
20								
	S-4	24/20	20 to 22	7		Top 1.5' gray Silty fine SAND, loose, wet, SM		GLACIAL MARINE
21				4				(SAND)
				3				
22				5		Bottom 0.5' gray Silty CLAY, stiff, CL	PP = 5,500 psf to 5,000 psf	

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: **B-1**

Project:	Proposed Wex Building	Project #:	17181
Location:	Corner of Hancock and Thames St.	Sheet:	2 of 2
City, State:	Portland, Maine	Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	15.0 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	City of Portland GIS
Summit Staff:	M. Hardison, E.I.; T. Jones, E.I.	Date started: 6/8/2017	Date Completed: 6/8/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/8/2017	10.0 ft.	5.0 ft. +/-	Observed on soil samples

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
23								GLACIAL MARINE (SAND)
24								
25								
	S-5	2 2/5	25 to 27	3		Top 1' Silty SAND, trace Clay, SM, similar to above	PP = 1,500 psf to 2,000 psf	
26				4	-11.0			
				2		Bottom 1' gray CLAY, little Silt, CL, similar to above		GLACIAL MARINE (CLAY)
27				3				
				PROBE		Probed to refusal		
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
63								
64								
65								
					-50.5	REFUSAL at 65.5', probable bedrock		
66								PROBABLE BEDROCK
67								

Granular Soils		Cohesive Soils	
Blows/ft.	Density	Blows/ft.	Consistency
0-4	V. Loose	<2	V. soft
5-10	Loose	2-4	Soft
11-30	Compact	5-8	Firm
31-50	Dense	9-15	Stiff
>50	V. Dense	16-30	V. Stiff
		>30	Hard

% Composition ASTM D2487
< 5% Trace
5-15% Little
15-30% Some
> 30% With

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: **B-2**

Project:	Proposed Wex Building	Project #:	17181
Location:	Corner of Hancock and Thames St.	Sheet:	1 of 2
City, State:	Portland, Maine	Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	14.5 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	City of Portland GIS
Summit Staff:	M. Hardison, E.I.; T. Jones, E.I.	Date started: 6/8/2017	Date Completed: 6/8/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/8/2017	8.4'	6.1 ft. +/-	10' Casing in hole

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
	S-1	24/20	0 to 2	7		Black Gravelly medium to coarse SAND, little Silt,		
1				5		compact, humid, SP-SM		
				7				FILL
2				6				
3								
4								
5								
	S-2	24/18	5 to 7	8		Brown Gravelly fine to coarse SAND, trace Silt, compact,		
6				9		humid, SP		
				10				
7				9				
8								
							▽	
9							Groundwater	
10								
	S-3	24/6	10 to 12	6		Brown Gravelly medium to coarse SAND, trace Silt		
11				6		compact, saturated, SP		
				6				
12				5				
13								
14								
15								
	S-3	24/6	15 to 17	3		Same as above		
16				5				
				7				
17				5				
18								
19					-4.5			
						Drilling becomes softer at 19' depth		
20								
	S-4	24/	20 to 22	3		Grayish Blue SILT, trace Sand and Clay, trace shell	PP = 1,500 psf	GLACIAL MARINE
21				2		fragments and wood (natural) pieces, soft, ML	to 1,000 psf	(SAND)
				2				
22				3				

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL BORING LOG

Boring #: **B-2**

Project:	Proposed Wex Building	Project #:	17181
Location:	Corner of Hancock and Thames St.	Sheet:	2 of 2
City, State:	Portland, Maine	Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	14.5 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	City of Portland GIS
Summit Staff:	M. Hardison, E.I.; T. Jones, E.I.	Date started: 6/8/2017	Date Completed: 6/8/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference
6/8/2017	8.4'	6.1 ft. +/-	10' Casing in hole

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
23								GLACIAL MARINE (SAND)
24					-9.5			
25								
	UT-1	30"	25'-27.5'	Push		Undisturbed Shelby Tube Collected	MC = 30.2%	GLACIAL MARINE
26						Gray Silty CLAY, occasional fine Sand seams, soft, wet,	LL = 29	(CLAY)
27						CL	PI = 8	
28				PROBE				
29								
30						Attempted field vane, encountered sand/silt seams, encountered Sand or Silt seam at 30' depth, unable to advance field vane		
31						Speartip probe advanced with vibratory method		
32								
33								
34						Various dense layers (probable seams) encountered throughout probe depth		
50								
51								
52								
53								
54								
55								
56								
57								
58								
59						Becomes denser at 58'		GLACIAL TILL
						REFUSAL at 59', probable bedrock		PROBABLE BEDROCK

Granular Soils		Cohesive Soils	
Blows/ft.	Density	Blows/ft.	Consistency
0-4	V. Loose	<2	V. soft
5-10	Loose	2-4	Soft
11-30	Compact	5-8	Firm
31-50	Dense	9-15	Stiff
>50	V. Dense	16-30	V. Stiff
		>30	Hard

% Composition ASTM D2487
< 5% Trace
5-15% Little
15-30% Some
> 30% With

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL PROBE LOG

Boring #: **P-1**

Project:	Proposed Wex Building	Project #:	17181
Location:	Corner of Hancock and Thames St.	Sheet:	1 of 1
City, State:	Portland, Maine	Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	15.0 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	City of Portland GIS
Summit Staff:	M. Hardison, E.I.; T. Jones, E.I.	Date started: 6/8/2017	Date Completed: 6/8/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE				
1						Speartip probe advanced from ground surface. Refusal on likely rubble (brick framgents recovered from speartip)		
2								
3								
4								
5								
6								
7								
8						End of probe at 7.5', likely rubble		RUBBLE
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

Granular Soils		Cohesive Soils	
Blows/ft.	Density	Blows/ft.	Consistency
0-4	V. Loose	<2	V. soft
5-10	Loose	2-4	Soft
11-30	Compact	5-8	Firm
31-50	Dense	9-15	Stiff
>50	V. Dense	16-30	V. Stiff
		>30	Hard

% Composition ASTM D2487
< 5% Trace
5-15% Little
15-30% Some
> 30% With

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength

Bedrock Joints
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

SOIL PROBE LOG

Boring #: **P-2**

Project:	Proposed Wex Building	Project #:	17181
Location:	Corner of Hancock and Thames St.	Sheet:	1 of 1
City, State:	Portland, Maine	Chkd by:	

Drilling Co:	Summit Geoengineering Services	Boring Elevation:	15.0 ft. +/-
Driller:	C. Coolidge, P.E.	Reference:	City of Portland GIS
Summit Staff:	M. Hardison, E.I.; T. Jones, E.I.	Date started: 6/8/2017	Date Completed: 6/8/2017

DRILLING METHOD		SAMPLER	
Vehicle:	Tracked	Length:	24" SS
Model:	AMS Power Probe	Diameter:	2"OD/1.5"ID
Method:	3" Casing	Hammer:	140 lb
Hammer Style:	Auto	Method:	ASTM D1586

ESTIMATED GROUND WATER DEPTH

Date	Depth	Elevation	Reference

Depth (ft.)	No.	Pen/Rec (in)	Depth (ft)	blows/6"	Elev. (ft.)	SAMPLE DESCRIPTION	Geological/ Test Data	Geological Stratum
				PROBE				
1						Speartip probe advanced from ground surface. Refusal on likely rubble (brick framgents recovered from speartip)		
2								
3								
4								
5				▼				
						End of probe at 5.0', likely rubble		RUBBLE
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

Granular Soils		Cohesive Soils		% Composition
Blows/ft.	Density	Blows/ft.	Consistency	ASTM D2487
0-4	V. Loose	<2	V. soft	
5-10	Loose	2-4	Soft	< 5% Trace
11-30	Compact	5-8	Firm	5-15% Little
31-50	Dense	9-15	Stiff	15-30% Some
>50	V. Dense	16-30	V. Stiff	> 30% With
		>30	Hard	

NOTES: PP = Pocket Penetrometer, MC = Moisture Content
LL = Liquid Limit, PI = Plastic Index, FV = Field Vane Test
Bedrock Joints Su = Undrained Shear Strength, Su(r) = Remolded Shear Strength
Shallow = 0 to 35 degrees
Dipping = 35 to 55 degrees
Steep = 55 to 90 degrees

Boulders = diameter > 12 inches, Cobbles = diameter < 12 inches and > 3 inches
Gravel = < 3 inch and > No 4, Sand = < No 4 and >No 200, Silt/Clay = < No 200

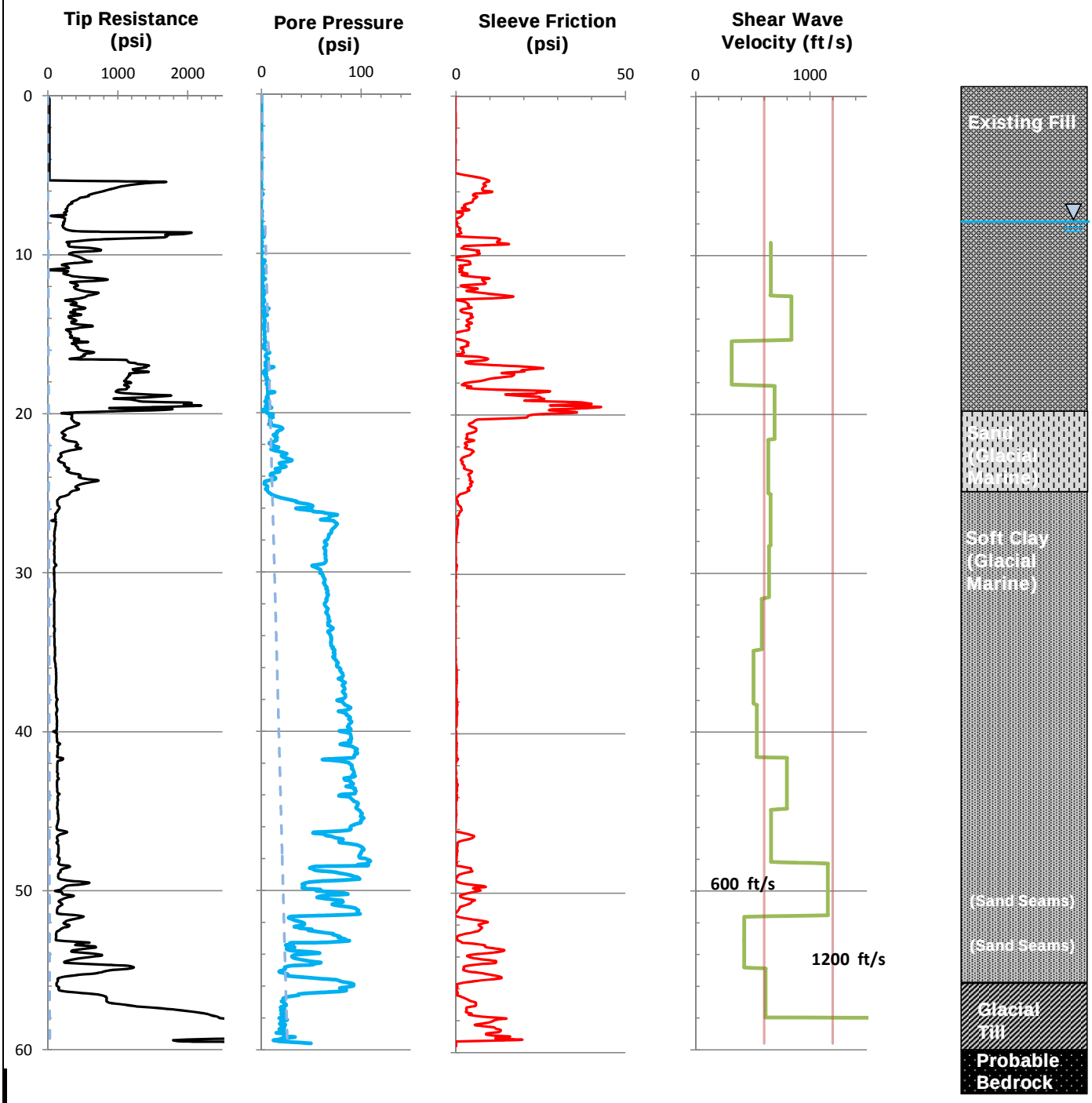
Soil Moisture Condition
Dry: S = 0%
Humid: S = 1 to 25%
Damp: S = 26 to 50%
Moist: S = 51 to 75%
Wet: S = 76 to 99%
Saturated: S = 100%

SUMMIT GEOENGINEERING SERVICES

PIEZOCONE PENETRATION LOG

Test Number:	CPT-2		
Sheet:	1 of 1		
Project:	Proposed Wex Building	Project Number:	17181
Location:	Corner of Hancock and Thames	Method:	ASTM D5778
City, State	Portland, Maine	Weather:	30° Sunny

Cone ID:	Vertek #4544.101	Test Elevation:	14.0 ft. +/-
Cone Type:	VTK 5 Ton Digital Cone	Reference:	City of Portland GIS
Piezocone:	Silicone Single Filter	Date started: 6/9/2017	Date Completed: 6/9/2017
Push Rig:	AMS Power Probe 9500 VTR	ESTIMATED GROUND WATER DEPTH	
Anchor Style:	Dual Driven Anchors	Date: 6/9/2017	Depth: 8.0 ft.
Performed By:	Craig Coolidge, P.E.		Elevation: 6.0 ft. +/-
			Reference: Interpreted from pore pressure



NOTES:

Soil Profile based on interpretation of CPT measurements and nearby borings

Shear Wave Velocity test (V_s) performed at 3.3 feet (1-meter) increments

Abrupt push refusal encountered at depth of 59.6

APPENDIX C

LABORATORY TESTING RESULTS

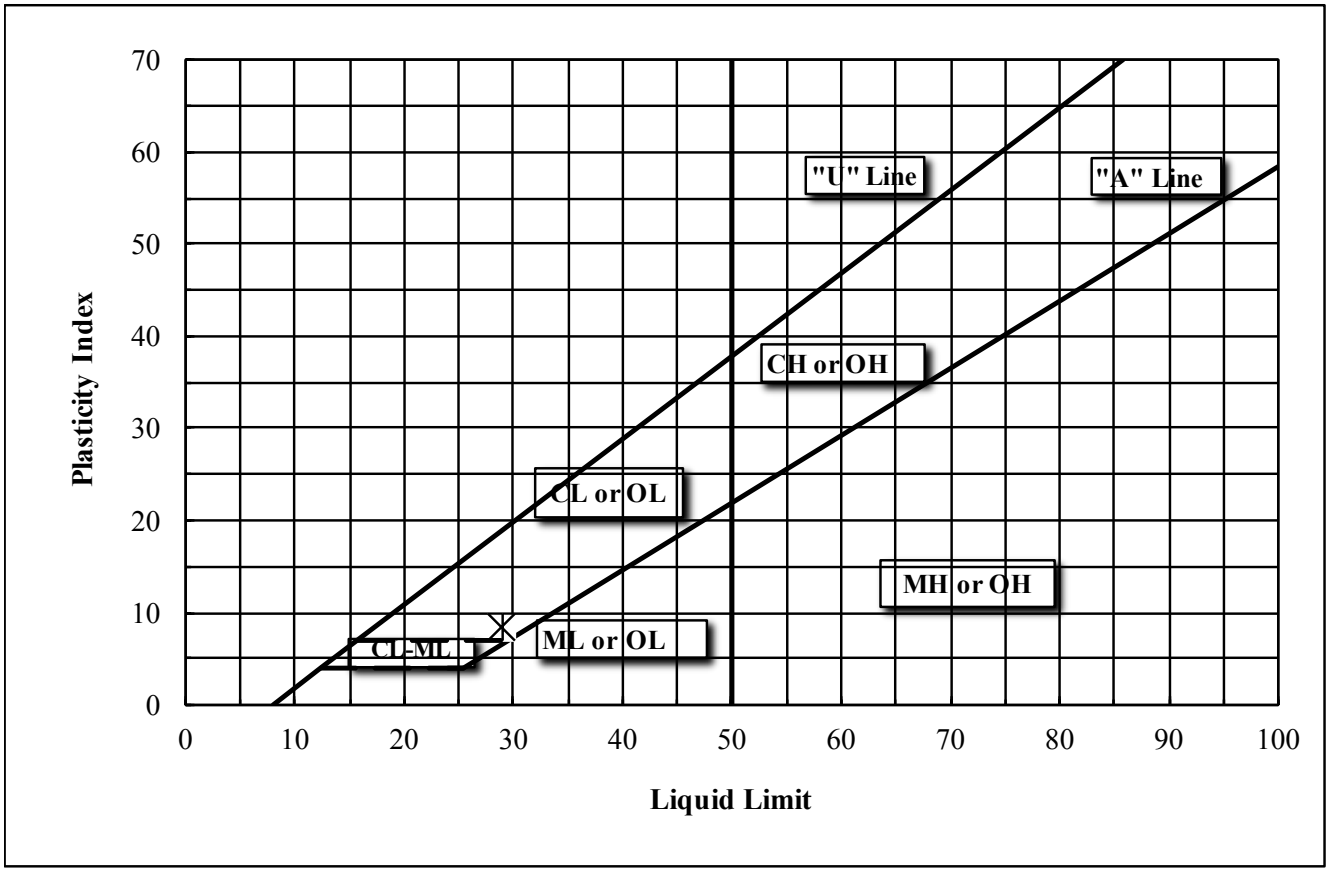
ATTERBERG LIMIT TEST - ASTM D4318

Method "A" (Multi-point)

PROJECT NAME:	Proposed Building	PROJECT NUMBER:	17181
CLIENT:	Archetype, PA	SAMPLE NUMBER:	UT-1
SOURCE:	Boring B-2	DEPTH:	25' to 27.5'
TEST DATE:	6/13/17	TECHNICIAN:	Preston Spicer

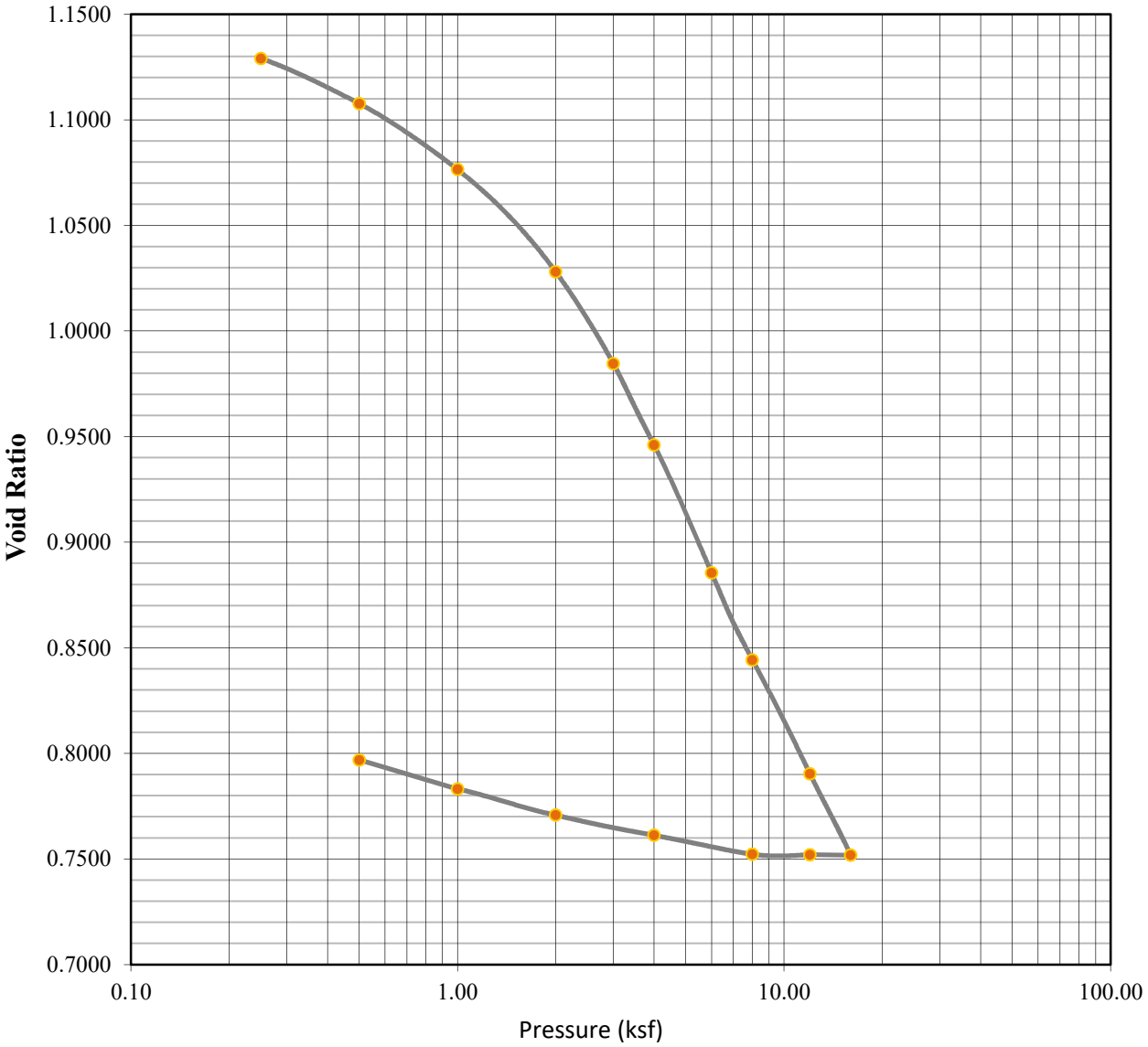
DATA

Source	Depth	LL	PL	PI	Classification
B-2	25' to 27.5'	29	21	8	Gray CLAY, occasional fine Sand seams, CL



Notes: Moisture Content = 30.2%

Consolidation Test
Test Results



	Before	After				
Moisture (%):	37.97	27.80	**Liquid Limits:**	29	**Test Date:**	7/11/17
Dry Density (pcf):	80.61	96.68	**Plastic Limits:**	21	**Performed By:**	PS
Saturation (%):	91.55	97.21	**Plasticity Index (%):**	8	**Reviewed By:**	ELS
Void Ratio:	1.1489	0.7966	**Specific Gravity:**	2.780	Assumed	

Soil Description:	Gray CLAY, occasional fine Sand seams, soft, wet, C		
Project Number:	17181	**Depth:**	25' to 27.5'
Sample Number:	UT-1	**Boring Number:**	B-2
Project:	Proposed Building		
Client:	Archetype, PA		
Location:	Hancock and Thames St., Portland, ME		

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145 Lisbon Street (PO Box 7216), Lewiston, Maine 04243, (207) 576-3313
173 Pleasant Street, Rockland, Maine 04841, (207) 318-7761

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THIN WALLED TUBE SAMPLING - ASTM D1587

PROJECT NAME: Proposed Building
PROJECT LOCATION: Hancock and Thames Streets, Portland, ME
COLLECTION DATE: 6/8/17
TEST DATE: 6/13/17

PROJECT #: 17181
CLIENT: Archetype, PA
SAMPLE #: UT-1
TECHNICIAN: Preston Spicer

Test Boring Information

Boring Number: B-2
Drilling Method: Direct push
Drilling Tooling: 3-inch casing
Sampling Method: Direct push

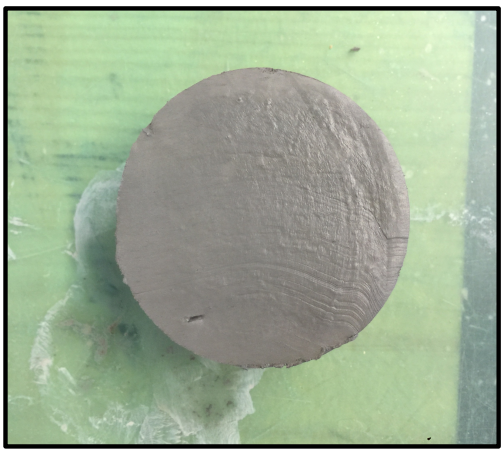
Sample Information

Tube Length: 30"
Recovery: 28"
Tube Diameter: 2.5"
Depth: 25' to 27.5'

Trial / Specimen Number	Moisture Content	Unit Weight	Torvane
1	36.1%	118 pcf	300 psf
2	27.9%	110 pcf	400 psf
3	31.6%	121 pcf	360 psf
Average	31.9%	116 pcf	360 psf

Visual Description (ASTM D2488):

Gray CLAY, occasional fine Sand seams, soft, wet, CL



Photograph of cross sectional sample view.

Photograph of longitudinal sample view.

REMARKS:

SECTION 03 30 00

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
2. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Each mix design will also indicate where concrete will be used.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Setting Drawings shall be complete in showing and identifying by mark or otherwise all the bars to be incorporated into the work. Reinforcement of concrete walls shall be shown on wall elevations and reinforcement of beams shall be shown on beam elevations with sections as required. Elevations of walls and beams shall be at least 1/4 inch scale.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work 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 firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

C. Supplier Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 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.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not ex-

ceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

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.

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 the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A82

C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete 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 or CRSI Class 2 stainless-steel bar supports.

2. For chairs supporting reinforcement above soil, provide sand plates to properly support bars.

B. Slab On Grade Construction Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM 150, Type I/II.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
   1. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3-mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3 mm).

C. Lightweight Aggregate: ASTM C 330.

   1. Nominal Maximum Aggregate Size: 3/4 inch (19 mm).

D. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

B. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

2.7 VAPOR RETARDERS

A. Vapor Retarder
   1. Vapor Retarder membrane must have the following qualities

a.	Water Vapor Transmission Rate	ASTM E 96	0.04 Perms or lower
b.	Water Vapor Retarder	ASTM E 1745	Meets or Exceeds Class C
c.	Thickness of Retarder (plastic)	ACI 302.1R-96	Not less than 10 mils

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.8 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.9 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.10 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

B. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): Refer to plans.
2. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 4-inch (50- to 100-mm) slump.

C. Slab-on-Grade: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): Refer to plans.
2. Maximum Slump: 4 inches (100 mm) before adding additives.

D. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength (28 Days): Refer to Plans
2. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).

E. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Combined Fly Ash and Pozzolan: 25 percent.

G. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.

H. Air Content: Where required, add air-entraining admixture 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: 6 percent for 3/4-inch- (19-mm-) nominal maximum aggregate size.

I. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 2 percent.

J. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture 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 water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information. Provide amount of water withheld from Design Mix on batch ticket.

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.

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 concrete 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 B, 1/4 inch (6 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Chamfer edges of permanently exposed concrete, as indicated on the drawings.

F. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. 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 bolts, accurately located, to elevations required. All anchor bolts shall be dryset (set prior to placement – wetsetting is unacceptable).

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 provided concrete is hard enough to not be damaged by form-removal operations and provided 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. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

B. Granular Fill: Place vapor retarder over 8” of granular fill compacted with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

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.

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 fabric 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. Use sand chair supports at slabs on grade.

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. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38mm) into concrete.
3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

4. Use neat cement slurry at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

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. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Slab On Grade Construction Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated. Refer to drawings for details.

1. Construction joints shall be saw cut and filled with joint filler.

3.7 WATERSTOPS

A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or 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 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 mix.

C. Deposit concrete continuously or in 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 specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators 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 mix 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, free of humps or hollows, before excess moisture or 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.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
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 mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to 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. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. 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 defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

B. Rubbed Finish: Apply the following to smooth-formed finished concrete, as indicated on plans:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

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 recommendations in ACI 302.1R 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 indicated, to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first trowel finish 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 indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15 for slabs-on grade.
b. Specified overall values of flatness, F(F) 25; for elevated slabs on steel beams and metal deck (for slabs on metal deck the top of concrete shall be set by the stick method to set the minimum thickness from the top of steel beams and using a 10 foot long min. screed (a max ¼" gap under a 10 foot straight edge is equivalent to F(F)25)).

D. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

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 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 of manufacturer furnishing machines and equipment.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE PROTECTION 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 with recommendations in ACI 305R for hot-weather protection during curing.

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. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, 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 or adhesive applied floor finishes.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

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.

3.13 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 six 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 epoxy joint filler full depth in saw-cut joints and at least 1.5 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 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 (1.2-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 by removal and replacement.
5. Repair defective areas and low 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 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 mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Correct low areas scheduled to remain exposed by removal and replacement.

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.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: 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 mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, 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 mix.
5. Concrete Temperature: ASTM C 1064; 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.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
7. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

    a. Cast and field cure one set of four standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.

    a. Test two field-cured specimens at 7 days and two at 28 days.

b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. 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.

D. Strength of each concrete mix 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).

E. Test results shall be reported in writing to Architect, the SER, 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 mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

F. 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.

G. 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 or by other methods as directed by Architect.

END OF SECTION 03 30 00

SECTION 05 12 00

STRUCTURAL STEEL

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 structural steel.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Quality Control" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Metal Fabrications" for miscellaneous steel framing.
3. Division 9 Section "Painting" for surface preparation and priming requirements. ***(Select)***

1.3 PERFORMANCE REQUIREMENTS

A. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings detailing fabrication of structural steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Indicate type, size and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

D. Qualification data for firms and persons specified in the "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.

E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Shear stud connectors.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:

a. Category: Category I, conventional steel structures.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
2. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
3. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
4. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
5. AISC's "Seismic Provisions for Structural Steel Buildings."
6. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
7. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
8. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the 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

projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." The GC, steel fabricator, steel erector, SER, architect and testing lab shall attend the meeting.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes, Plates, and Bars: As follows:

1. Rolled W Shapes & Channels: ASTM A572 Grade 50.
2. Plates, Bars and Angles: ASTM A36

B. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade C.

C. Hot-Formed Structural Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 500, Grade C.

E. Anchor Rods (Bolts), Bolts, Nuts, and Washers: As follows:

1. Anchor Rods (Bolts): ASTM A 307, ASTM A 449 refer to plans.
2. Washers: ASTM A 36 (ASTM A 36M).

F. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.

G. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

H. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

I. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. None.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant 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, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

C. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

D. Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

E. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.5 SHOP CONNECTIONS

A. Shop install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

2.6 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

2.7 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, 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. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
4. Ultrasonic Inspection: ASTM E 164.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until 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.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

    a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

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. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Finish sections thermally cut during erection equal to a sheared appearance.

I. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, 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. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
4. Ultrasonic Inspection: ASTM E 164.

END OF SECTION 05 12 00

SECTION 05 31 00

STEEL DECK

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. Roof deck.
2. Composite floor deck.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill.
2. Division 5 Section "Structural Steel" for shop- and field-welded shear connectors.
3. Division 9 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction. Shop drawings to indicate date of reference structural drawings.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates. Copies of certificates for welding procedures and personnel.

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. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Deck:
   a. Canam Steel Corp.; The Canam Manac Group.
   b. Consolidated Systems, Inc.
   c. Epic Metals Corporation.
   d. Marlyn Steel Decks, Inc.
   e. Nucor Corp.; Vulcraft Division.
   f. Roof Deck, Inc.
   g. United Steel Deck, Inc.
   h. Valley Joist; Division of EBSCO Industries, Inc.
   i. Verco Manufacturing Co.
   j. 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 40 G60 zinc coating.
2. Span Condition: [Double span]
3. Side Laps: #10 screw at center of span if over 4’-0.

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 40, G60 zinc coating.
   2. Span Condition: Double span.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or 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. 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.

E. 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.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [0.0747 inch (1.90 mm)] thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

H. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. 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-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

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.

H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel 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 nominal.
2. Weld Spacing: Weld interior ribs of deck units at 12” o.c. or as indicated on plans.

B. Perimeter Edge Fastening: Weld perimeter edges of roof deck panels to steel supporting members at each flute or 6” o.c. unless otherwise noted on plans.

C. Side-Lap Fastening: Fasten side laps of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 24 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

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 minimum.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds or not more than 12 inches apart with at least one weld at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld.

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 to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

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, nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges 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 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. 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 05 31 00

SECTION 05 41 00

LIGHTGAGE METAL FRAMING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections apply to work of this section.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF THE WORK

A. Work specified within this Section includes, but is not necessarily limited to, the following:

1. Provide and install lightgage framing for interior and exterior walls, as shown on the Drawings.

2. Provide and install lateral strap bracing, anchors and bridging as required.

3. Provide and install miscellaneous fasteners, hat channels, stiffeners, expansion joints, and accessories necessary to complete the work.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09 21 16 Gypsum Assemblies on Metal Framing
B. Section 09 29 00 Gypsum Board

1.04 QUALITY ASSURANCE

A. Materials and installation shall conform to recommendations of the following publications:

1. American Iron and Steel Institute Cold-Formed Steel Design Manual, Parts I & II "Specification for the Design of Cold-Formed Steel Structural Members".
2. AWS D1.1-90 "Structural Welding Code" - Steel.
3. AWS D1.3-89 "Structural Welding Code" - Sheet Steel.

4. ASTM C 954, “Specification for Steel Drill Screws for the Application of Gypsumboard or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. Thickness.”
5. ASTM C 955, “Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.
6. ASTM C 1007 “Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.”
7. ASCE 7-98 "Minimum Design Loads for Building and Other Structures," (formerly ANSI A58.1).

B. Slip Track Tolerances: Where non-bearing light gage framing abuts the structure, provide a slip joint capable of accommodating the vertical movement of the structure. Slip joint gaps shall allow for 1" Live Load deflection of the supporting member

1.04 SUBMITTALS

A. The Engineer shall receive all submittals a minimum of two weeks prior to the start of fabrication. The Contractor shall have reviewed and approved all submittals prior to review by the Engineer. All review of submittals by the Contractor, Architect and Engineer shall be completed prior to fabrication and installation of any material or product.

The Engineer’s review of shop drawings will consist of a review of the design criteria and loads used for calculations and a review of the type and position of elements and connections to the Primary Structural System. Any errors in calculations, shop drawings and verification of field dimensions shall be the responsibility of the General Contractor.

B. Product Data: Submit Manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications.

1. Steel Studs, tracks, cold rolled channels and hat channels.
2. Anchors and anchor bolts
3. Self drilling screws

C. Shop Drawings:

1. General: Submit shop drawings showing the following:

a. Member type, gauge and spacing.
b. Sizes, gauges and fastenings for all built-up members including but not limited to roof trusses, headers and jambs.
c. Shop Coatings
d. Type, size, quantity, locations and spacing of all anchorages and self drilling screws.
e. Details of attachment to structure and adjacent work.

f. Supplemental strapping, bracing, splices, bridging, hat channels and other accessories required for proper installation.
g. Critical installation procedures.

D. Submit (3) reproductions of each shop drawing. Submit (2) copies of design calculations.

PART 2 - PRODUCTS

2.01 FRAMING MEMBERS

A. Steel Studs:

1. Acceptable manufacturers:
   EB Metal
   Dale/Incor
   Marino
   Dietrich
   Superior
   Ware
2. Provide channel-shaped studs, channel-shaped joists, runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, stiffeners, fasteners, and other accessories recommended by manufacturer for complete framing system.
3. Steel framing materials (all gauges) shall comply with ASTM A 653. Fabricate all components from structural quality sheet steel with the following minimum yield points:

   A. Studs and truss components, 40,000 psi
   B. Bracing, bridging and blocking, 33,000 psi

4. Manufacture of studs, runners (track), and other framing members shall comply with ASTM C 955.
5. Framing components shall be galvanized per ASTM A 525, minimum G-60 coating.

B. Screws and other attachment devices:
1. Provide a protective coating equivalent to cadmium or zinc plating and comply with ASTM A 165 type NS.
2. Self-drilling screws shall comply with the Industrial Fastener Institute Standard for steel self-drilling and tapping screws (IFI-113).
3. Penetration through jointed materials shall not be less than three (3) exposed threads.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Product Storage: Store studs, trusses, joists, track etc. on a flat plane. Material damaged (i.e. rusted, dented, bent or twisted) shall be discarded. Protect adhesives and sealants from freezing.

B. Construction Methods: Wall construction may be either piece-by-piece (stick-built), or by fabrication into panels either on or off site.

C. Material Fit up: All framing components shall be cut squarely or at an angle to fit squarely against abutting members. Members shall be held firmly in position until properly fastened. Prefabricated panels, if used, shall be square and braced against racking.

D. Attachment: Components shall be joined by self-drilling screws, so that connection meets or exceeds required design loads. Wire tying of framing components will not be permitted. Field welding will be permitted only where shown on the drawings or approved by the engineer.

E. Anchorage to Structure: Securely anchor studs and track to floor construction and overhead structure. Provide slip joints where non-bearing vertical studs meet floor or roof structural steel, or as indicated on the drawings.

F. Welding: Shop and field welds shall conform to applicable AWS and AISI standards, and may be fillet, plug, butt or seam type. Touch-up damage to galvanizing caused by welding with zinc-rich paint.

G. Openings: Frame openings larger than 2 ft. square with double studs. Provide suitable reinforcements (double studs, headers, jack studs, cripples, bracing, etc.) at control joint intersections, corners, and other special conditions.

H. Tolerances: Finished installation shall be level and plumb within a tolerance of 1/8 inch 10 feet horizontally and vertically. Maximum deviation from plan or section dimension shall not exceed 1/8 inch. Spacing of studs shall not be more than 1/8 inch from design spacing, providing that cumulative error does not exceed requirements of finishing materials.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

1. GENERAL

1.1 REFERENCES

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specifications, apply to work in this section.

B. Rough Carpentry: Section 06 10 00

C. Finish Carpentry: Section 06 20 00

D. Roofing and Flashing: Section 07 53 00

E. Painting: Section 09 90 00

F. American Society of Testing Materials (ASTM)

G. Steel Structures Painting Council (SSPC)

H. National Association of Architectural Metal Manufacturers (NAAMM)

1.2 DESCRIPTION OF WORK

A. Extent of Metal Fabrications is shown on the drawings.
B. Railings.

1.3 QUALITY ASSURANCE

A. Refer to Section 01 33 10, Products and Substitutions, for general provisions covering product selection, substitutions, material storage, and installation.

B. Refer to Section 01 45 00, Quality Control Services, for provisions for testing and inspection.

1.4 SUBMITTALS

A. Issue submittals in accordance with Section 01 33 00, Submittals.

B. Submittals under this section include:

1. Shop drawings showing details of fabrication, assembly, and installation showing all connections to other work.
2. Samples of materials and finished products as may be requested by the Architect.

2. PRODUCTS

2.1 MATERIALS

1. Railing assembly shall withstand a minimum concentrated load of 200 lbs. applied in any direction at any point on top rail. Intermediate rails, balusters, and panel fillers shall be designed for uniform load of not less than 25 lbs./sq. ft. over gross area of guard. Assembly shall comply with all provisions of the applicable Building Codes.

2. Accurately miter and cope intersections, and weld all around. Form rail-to-end post connections and changes in rail direction with mitered corners or radius bends, as detailed. Form elbow bends and wall returns to uniform radius, free from buckles and twists.

3. EXECUTION

3.1 FABRICATION

A. GENERAL

1. Use materials of size and thickness shown, or if not shown, of required size, grade, and thickness to produce strength and durability in finished product.

2. Provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes on exposed surfaces.

3. Form metalwork to required shapes and sizes, with true lines, curves and angles. Provide necessary rebates, lugs and brackets for assembly and installation. Use concealed fasteners wherever possible. Mill joints to tight hairline fit; cope or miter corners.

4. Welding:
   a. Weld corners and seams continuously; grind exposed welds smooth and flush.
   b. Welding Electrodes and Filler Metal: Type and alloy to match metal to be welded.

5. Anchors and Inserts: Furnish as required for installation in other work. Use copper, cadmium or galvanized anchors and inserts for exterior work.

6. Fasteners
   a. Type and alloy to match metal to be fastened; use Phillips flat-head screws for exposed fasteners if not otherwise indicated.
   b. Provide bolts, nuts, lag bolts, machine screws, wood screws, toggle bolts, masonry anchorage devices, lock washers as required for application indicated and complying with applicable Federal standards. Hot-dip galvanize fasteners for exterior applications to comply with ASTM A 153.

7. Shop Finishing

a. Comply with NAAMM "Metal Finishes Manual".
b. Apply shop primer to surface of metal fabrications except those embedded in concrete or galvanized; comply with SSPC-PA1.
c. Surface Preparation: Comply with SSPC-SP6 "Commercial Blast Cleaning" for exterior work, and with SSPC-SP3 "Power Tool Cleaning" for interior work.
d. Shop Primer: Fabricator's standard, fast-curing, lead-free, "universal" primer complying with performance requirements of FS TT-P-645.
e. Stripe paint edges, corners, crevices, bolts, welds and sharp edges.
f. Protect finished metal items.

3.2 INSTALLATION

A. Perform cutting, drilling and fitting required for installation; set work accurately in location, alignment and elevation, measured form established lines and levels.

B. Provide anchorage devices and fasteners where necessary for installation to other work.

C. Repair or replace damaged items as directed by the Architect.

D. Touch-up shop paint after installation. Clean field welds, bolted connections and abraded areas, and apply same type paint as used in shop.

E. Restore damaged protective coverings after installation. Maintain until other work in same areas is completed. Remove protective coverings and clean exposed surfaces prior to final inspection.

END OF SECTION

SECTION 07 21 00

DAMPPROOFING AND WATERPROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Under-Slab-On-Grade Vapor Retarder
2. Below grade foundation waterproofing

B. Related Sections:

1. Section 072000 – Thermal Protection

1.02 SYSTEM DESCRIPTION

A. General: Provide waterproofing that prevents the passage of liquid water under hydrostatic pressure and complies with requirements as demonstrated by testing performed by an independent testing agency of manufacturer's current sheet membrane.

B. Provide waterproofing at slab on grade and at elevator pit.

1.03 SUBMITTALS

A. Submit "Letter of Conformance" with the following supporting data:

1. Include product data on each type of dampproofing and waterproofing product specified, including data substantiating that materials comply with specified requirements.

a. Mark each copy to identify applicable products, characteristics, models, options and other supplemental data to clearly communicate information specific to this project.

B. Samples, 3 x 6 inches minimum size, of each fluid-applied and sheet membrane waterproofing material specified for Project.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed fluid-applied and sheet membrane waterproofing applications similar in material, design, and extent to that indicated for Project and that has resulted in construction with a record of successful in-service performance.

1. Assign work closely associated with waterproofing, including (but not limited to) waterproofing accessories, and flashings used in conjunction with waterproofing, expansion joints in membrane, insulation, and protection course on membrane, to Installer of fluid-applied waterproofing, for single, undivided responsibility.

B. Single-Source Responsibility: Obtain primary waterproofing materials of each type required from a single manufacturer.

C. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer. Protect stored materials from direct sunlight.

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Apply waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during penetration and application of waterproofing materials.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. General Compatibility: Provide products that are recommended by manufacturer to be fully compatible with indicated substrates.

2.02 UNDER-SLAB-ON-GRADE VAPOR RETARDER:

A. Vapor Retarder Under-Slabs-On-Grade:

a. Polyethylene vapor barrier material shall be placed under all concrete slabs on grade. Provide in lengths and widths required for least number of seams.

b. Vapor barrier minimum thickness of ten (15) mils.

c. Lap all joints minimum six (12) inches and seal with mastic or tape. All pipe penetrations sealed with tape.

d. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.03 BELOW GRADE FOUNDATION WATERPROOFING & ELEVATOR PIT:

A. Waterproofing:

1. Trowel applied waterproofing membrane.

2. Manufacturers:

a. “Thoroseal Foundation Coating, No. T1180”; Thoro Consumer Products (216-839-7171)

b. Or equal.

2.04 MISCELLANEOUS MATERIALS

A. In addition to primary waterproofing materials, provide the following:

1. Primer/Filler/Sealer: As recommended by waterproofing manufacturer.

2. Flashings, Cant Strips, and Accessories: As recommended by waterproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions under which waterproofing systems will be applied, with Installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. Do not proceed with installation until after minimum concrete curing period recommended by waterproofing manufacturer.

2. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.

B. Inspect concrete and concrete masonry surfaces for:

1. Contamination: Algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, mildew or other foreign substances.

2. Surface absorption and chalkiness.

3. Cracks: Measure crack width and record location of cracks.

4. Damage and deterioration.

5. Moisture content and moisture damage:

a. Use a moisture meter to determine if the surface is dry enough to receive the air and moisture barrier and record any areas of moisture damage or excess moisture.

6. Compliance with specification tolerances:

a. Record areas that are out of tolerance (greater than 1/4 inch in 8-0 feet deviation in plane).

C. Notify Architect in writing of anticipated problems using waterproofing over substrate.

3.02 PREPARATION

A. Clean substrate of projections and substances detrimental to work; comply with instructions of prime materials manufacturer.

B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.

C. Fill voids, seal joints, and apply bond breakers as recommended by prime materials manufacturer.

D. Prime substrate as recommended by prime materials manufacturer.

3.03 INSTALLATION - GENERAL

A. Comply with manufacturer's written installation recommendations, including preparation of substrate surfaces, detail coatings of joints and planar changes in substrate, and priming of substrates.

B. Mix separately packaged components in accordance with manufacturer's written recommendations.

3.04 INSTALLATION - UNDER-SLAB-ON-GRADE VAPOR RETARDER

A. General: Extend vapor and moisture barriers to extremities of areas to be protected from vapor transmission. Extend vapor and moisture barriers to cover miscellaneous voids in insulated substrates, including those which have been stuffed with loose fiber-type insulation.

B. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape of type recommended by vapor retarder manufacturer to create an air-tight seal between penetrating objects and vapor retarder.

C. Repair any tears or punctures in vapor and moisture barriers immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.05 PROTECTING AND CLEANING

A. Protect waterproofing from damage and wear during application and remainder of construction period, according to manufacturer's written instructions.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 21 11

FOAM BOARD AND BATT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Thermal, air and water resistive barrier wall system for cold-formed metal exterior wall assemblies:
   1. Exterior wall steel stud cavity batt insulation.
   2. Exterior wall insulating sheathing.

B. Related Sections:
   1. Section 05 41 00, Structural Metal Stud Framing.
   2. Section 09 21 16, Gypsum Board Assemblies.
   3. Section 07 26 13, Above Grade Vapor Retarders.
   4. Section 07 27 23, Board Product Air Barriers.

1.2 REFERENCES

A. Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:

   1. American Society for Testing of Materials (ASTM):
      a. ASTM C 272: Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
      b. ASTM C 518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
      c. ASTM C 578: Standard Specification for Rigid Cellular Polystyrene Thermal Insulation.
      d. ASTM C 665: Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
      e. ASTM D 1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
      f. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
      g. ASTM E 96: Standard Test Methods for Water Vapor Transmission of Materials.
      h. ASTM E 119: Standard Test Methods for Fire Tests of Building Constructions and Materials.
      i. ASTM E 331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference.
      j. ASTM E 2178: Standard Test Method for Air Permeance of Building Materials.
   2. National Fire Protection Association (NFPA):
      a. NFPA 285: Standard Fire Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
   3. International Code Council Evaluation Service (ICC-ES):
      a. AC 71: Acceptance Criteria for Foam Plastic Sheathing Panels Used as Water Resistive Barriers.
      b. AC 148: Acceptance Criteria for Flexible Flashing Materials.
   4. American Architectural Manufacturers Association (AAMA):
      a. AAMA 711: Voluntary Specification for Self Adhering Flashing Used for Installation of Exterior Wall Fenestration Products.

1.3 SYSTEM DESCRIPTION

A. Provide and install cold formed steel stud exterior wall framing, non-load bearing ,fire resistance rated, and non-rated system, with exterior gypsum sheathing , with spray applied air and water resistive barrier layer over the exterior gypsum, with continuous insulation sheathing, foam board joints sealed with fiberglass

batt insulation in the stud cavity, without a vapor retarding facer on the fiberglass ,that effectively controls thermal, air and water performance and provides continuous insulation and continuity of the building envelope.

All joints, penetrations and gaps of the insulating [and air barrier] wall system shall be made water [and air] tight.

B. Code Compliance: Exterior wall system and component materials shall comply with the following requirements:
   1. The complete exterior wall assembly shall comply with the passing criteria defined in NFPA 285 for exterior wall limited fire spread performance.
   2. Wall and floor joints shall be fire stopped as required in International Building Code Section 714.
   3. Insulating sheathing and foam joint sealing tape shall comply with ASTM E 2178, AC71 and AC148 for exterior wall products sealed against air and water penetration.

1.4 SUBMITTALS

A. Product Data: Submit data on product characteristics, performance criteria, and limitations, including installation instructions.

B. Sustainable Design: Submit manufacturer's sustainable design certifications as indicated.

C. Warranty: Submit documentation for limited product warranty.

1.5 QUALITY ASSURANCE

A. Each insulation board must be labeled with manufacturer's name, product brand name, ASTM material specification reference, and identification of the third-party inspection agency used for building code qualification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original packaging.

B. Store and protect products in accordance with manufacturer's instructions. Store in a dry area and protect from water, direct sunlight, flame, and ignition sources. Do not install insulation that has been damaged or wet.
   1. In the event the board insulation becomes wet, wipe dry prior to installation.
   2. In the event the batt or blanket insulation becomes wet, remove it from jobsite.
      a. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

PART 2 - PRODUCTS

2.1 MANUFACTURER

SCHEDULE 1 - PRODUCTS

PRODUCT DATA SHEET 0 - MANUFACTURERS

2.1 Extruded Polystyrene Foam Board Insulation - Foundation Walls and Under Slab.

1. "Styrofoam Square Edge"; 2", Dow Chemical Company (800-441-436

2.2 Batt Insulation: Fiberglass by Owens Corning or equal. See Drawings for thickness.

A. Owens Corning Insulating Systems, LLC, Toledo, OH 43659; www.owenscorning.com.

2.3 Manufacturers: Subject to compliance with product criteria, the manufacturers whose products may be incorporated into the work include but are not limited to:

1. DiversiFoam Products.
2. Dow Chemical Company.
3. Owens Corning.
4. Pactiv Corporation.

B. Fasteners: Provide preassembled screw/stress plate fasteners recommended by their manufacturer for securing foam plastic insulating sheathing. Polymer or other corrosion-protected, coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness and fastener manufacturer recommendation.

2.4 FIBERGLASS BATT INSULATION

A. Stud Cavity Batts: Fiberglass batt insulation unfaced], complying with ASTM C665 and meeting the following criteria:

1. ASTM C 665 type [I (batt without facing), , flame spread 25 or less), or III Class A (batt with reflective facing, flame spread 25 or less].
2. Full width batt for use with steel studs spaced 16",&24" on center.
3. Thermal Resistance: Measured in accordance with ASTM C 518, R-value = 13, Unfaced.
4. Indoor Air Quality: Verified to be formaldehyde free by independent third party such as GreenGuard Environmental Institute, Indoor Air Quality and/or GreenGuard Children and Schools Certified

B. Manufacturers: Subject to compliance with product criteria, the manufacturers whose products may be incorporated into the work include but are not limited to:

1. CertainTeed Corporation.
2. Guardian Building Products.
3. Johns Manville.
4. Owens Corning.

C. Acceptable Products: Subject to compliance with product criteria, the products that may be incorporated into the work include but are not limited to:

1. EcoTouch™ Thermal Batt, unfaced;
   a. ASTM C 665 Type I; thickness , 3-1/2" R-13, full width for steel stud framing 16" or 24" on center; 48" or 96" long]

D. [Manufacturers: Subject to compliance with product criteria, the manufacturers whose products may be incorporated into the work include but are not limited to:

1. Owens Corning.]

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that steel wall studs, opening framing, bridging and structural bracing and other framing support members and anchorage have been installed in accordance with good construction practice and are compliant with this specification.

B. Verify that adjacent materials are dry and ready to receive insulation. Verify mechanical and electrical services within walls have been tested and inspected.

C. Report unacceptable conditions in writing. Do not proceed with work until unsatisfactory conditions have been corrected.

D. Installation of products specified in this section constitutes acceptance of existing conditions and assumption of responsibility for satisfactory performance.

3.2 INSTALLATION OF FIBERGLASS BATT STEEL STUD CAVITY INSULATION

A. Install fiberglass batt insulation in accordance with manufacturer's recommendations and not before the exterior sheathing has been installed on one side of the stud cavity and sealed to be water resistant.

B. Protect insulation from damage due to weather and physical abuse until protected by permanent construction.

C. Fit batt insulation tightly into exterior wall steel stud cavity spaces and framing voids to create a continuous insulation layer without gaps. Trim to fill spaces and voids neatly. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation.

D. Within exterior wall framing, install insulation between pipes, mechanical services, electrical boxes, and backside of sheathing. Cut or split insulation material as required to fit around wiring and plumbing.

E. Fiberglass batt support in steel stud cavities:
1. Unfaced batt : Tightly friction fit full width 16”, or full width 24”, batt insulation to fill the interior of the cavities between steel studs, and to completely fill the voids inside the steel stud flanges.
2. Unfaced batt insulation, completely filled cavity depth, both sides of the stud cavity closed: Friction fit is adequate if the insulation completely fills the depth of the stud cavity, and the cavity is enclosed on both sides. No additional support is required
3. Unfaced batt insulation, completely filled cavity depth, one side of the stud cavity open : Friction fit, supplement with straps or wires, described below, installed starting 4’ above the floor and every 2’ on center above 4’.
4. Unfaced batt insulation, does not completely fill depth of stud cavity : Friction fit, supplement with straps or wires, described below, installed starting 4’ above the floor and every 2’ on center above 4’.
5. Supplemental wire or strap supporting devices]: Multiple types of support devices may be used. Wires can be inserted through the batts extending from stud to stud. The wires may be installed continuously through the punch outs of the steel stud framing. Or, heavy gauge wire may be cut slightly larger than each stud space and wedged into place between studs. When the insulation is less than the depth of the stud cavity, the wires should be positioned to hold the batt against the sheathing (gypsum of foam plastic) on the opposite side of the cavity. Another option is the use of punched metal straps attached to the face of the framing. The punched pronged tabs are bent 90 degrees pointing into the stud cavity and are pushed into the insulation after installation. The punched prongs impale the insulation batt and hold it in place.

END OF SECTION

1 GENERAL

1.1 SUMMARY OF WORK

A. This Section specifies stone fiber board insulation for curtain wall, and, other board insulation applications.

1.2 RELATED REQUIREMENTS

A. Section 08 44 13 Curtain Wall

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM).
1. ASTM C165 - [2012], Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
2. ASTM C356 - [2010], Standard Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat.
3. ASTM C411 - [2011], Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
4. ASTM C518 - [2010], Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
5. ASTM C612 - [2010], Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
6. ASTM C665 - [2011], Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
7. ASTM C795 - [2013], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
8. ASTM C1104/C1104M - [2013], Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
10. ASTM E84 - [2012b], Standard Test Method for Surface Burning Characteristics of Building Materials.
12. ASTM E136 - [2011], Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

B. US Green Building Council (USGBC).
1. LEED v4-[2014], LEED (Leadership in Energy and Environmental Design): Green Building Rating System.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Co-ordination: Co-ordinate work of this Section with roofing or deck work and with work of other trades for proper time and sequence to avoid construction delays.

B. Pre-installation Meeting: Convene pre-installation meeting after Award of Contract and [one week] before starting work of this Section to verify project requirements, substrate conditions and coordination with other building sub-trades, and to review manufacturer's written installation instructions.
1. Comply with Section 01 31 19 - Project Meetings and co-ordinate with other similar pre-installation meetings.
2. Notify attendees 2 weeks prior to meeting and ensure meeting attendees include as minimum:
   a. Owner;
   b. Consultant;
   c. Board Insulation Installation Subcontractor;
   d. Manufacturer's Technical Representative.

3. Ensure meeting agenda includes review of methods and procedures related to insulation installation including co-ordination with related work.
4. Record meeting proceedings including corrective measures and other actions required to ensure successful completion of work and distribute to each attendee within 1 week of meeting.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

A. Make submittals to Architect.

B. Product Data: Submit product data including manufacturer's literature for insulation materials and accessories, indicating compliance with specified requirements and material characteristics.
1. Submit list on insulation manufacturer's letterhead of materials and accessories to be incorporated into Work.
2. MSDS report.
3. Include product name.
4. Include preparation instructions and recommendations, installation methods, and storage and handling requirements.
5. Include contact information for manufacturer and their representative for this Project.

C. Samples:
1. Submit [5.5 x 7.5] inches minimum sample of insulation in thickness used on Project.

D. Test Reports:
1. Submit evaluation service reports or other independent testing agency reports showing compliance with specified performance characteristics and physical properties.

E. Field Reports: Submit manufacturer's field reports within 3 days of each manufacturer representative's site visit and inspection.

G. Insulation Installer Qualifications:
1. Submit letter verifying insulation installer's experience with work similar to work of this Section.

1.7 QUALITY ASSURANCE

A. Board Insulation Installer Quality Assurance: Work experience of [5] years minimum with work similar to work of this Section.

1.8 DELIVERY STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:
1. Deliver materials and accessories in insulation manufacture's original packaging with identification labels intact and in sizes to suit project.
2. Ensure insulation materials are not exposed to moisture during delivery.
3. Replace wet or damaged insulation materials.

B. Storage and Handling Requirements: Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
1. Store in original packaging until installed.

C. Packaging Waste Management:
1. Separate and recycle waste packaging materials.
2. Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycling in accordance with Waste Management Plan.

1.9 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other rights Owner may have under Contract Conditions.

C. Warranty period: 1 years commencing on Date of Substantial Performance of Work.

2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: ROXUL INC., 8024 Esquesing Line, Milton, Ontario, L9T 6W3, Phone: 905-878-8474, Toll Free: 1-800-265-6878, e-mail: contactus@roxul.com, URL: www.roxul.com.

2.2 DESCRIPTION

A. Non-combustible, semi-rigid, water repellent, mineral wool insulation board for exterior curtain wall systems to ASTM C612, Type IVB.

2.3 PERFORMANCE CRITERIA

A. Board insulation for exterior curtain wall systems: To ASTM C612, Type IVB.
   1. Fire performance:
      a. Non-combustibility: To ASTM E136.
      b. Surface Burning Characteristics: To ASTM E84.
         1) Flame spread: 0.
         2) Smoke developed: 0.
   2. Thermal resistance R value/1 inch at 75 ºF: 4.2 h ft^2 ºF/Btu to ASTM C518.
   3. Moisture sorption: 1 % maximum to ASTM C1104/C1104M.
   4. Dimensional stability: 2 % maximum linear shrinkage at 1200 ºF to ASTM C356.
   5. Corrosive resistance:
      a. Steel to ASTM C665: Pass.
      b. Stainless steel to ASTM C795: Pass.
   6. Service temperature hot surface performance: 1200 ºF maximum to ASTM C411.
   7. Density: 4.0 lb/ft^3 nominal to ASTM C612.
   8. Recycled content: 40 % minimum.
   9. Acoustical performance sound absorption co-efficients to ASTM C423.

Sound Absorption Co-efficients at Frequencies

Thickness (inches)	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
2	0.26	0.71	1.14	1.09	1.04	1.03	1.00
3	0.65	0.94	1.13	1.07	1.06	1.04	1.05
4	0.92	1.04	1.07	1.07	1.07	1.08	1.05

2.4 MATERIALS

A. Non-combustible, semi-rigid, water repellent, mineral wool insulation board to ASTM C612, Type-IVB.
   1. Size: as required per the drawings
   2. Thickness: [as required per the drawings
   3. Acceptable Material: ROXUL INC., CURTAINROCK® 40 [with RFF Facer].

2.5 ACCESSORIES

A. Mechanical fasteners in accordance with insulation manufacturer's written recommendations.

B. Insulation Clips: in accordance with curtain wall manufacturer's written recommendations.

C. Facings: Use only facings in accordance with insulation manufacturer's written recommendations as follows:
1. RFF facer: Aluminum foil with fiberglass reinforcement to ASTM.
    a. Acceptable material: ROXUL INC., RFF FACER.

2.6 SOURCE QUALITY CONTROL

A. Ensure insulation components and accessories are supplied or approved in writing by single manufacturer.

2.7 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted.

3 EXECUTION

3.1 INSTALLERS

A. Use only installers with [5] years minimum experience with work similar to work of this Section.

3.2 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for insulation installation in accordance with manufacturer's written recommendations.
    1. Visually inspect substrate in presence of Consultant.
    2. Ensure surfaces are free of snow, ice, frost, grease and other deleterious materials.
    3. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

B. Start of insulation installation indicates installer's acceptance of substrate installation conditions.

3.3 INSTALLATION

A. General:
    1. Install insulation in accordance with manufacturer's written recommendations.
    2. Install insulation to maintain continuity of thermal protection to building elements and spaces.
    3. Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
    4. Keep insulation minimum [3] inches from heat emitting devices such as recessed light fixtures, and minimum [2] inches from sidewalls of chimneys and vents.
    5. Do not enclose insulation until before inspection and receipt of Consultant's written approval.

B. Installation of Insulation Board for Curtain Wall Applications:
    1. Install insulation board in accordance with insulation manufacturer's and curtain wall manufacturer's written recommendations.
    2. Attach insulation using insulation clips in accordance with curtain wall manufacturer's written recommendations.
    3. Seal joints with acoustical joint sealant.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection with architect.
B. Manufacturer's Services:
    1. Coordinate manufacturer's services with Section.
        a. Arrange for payment for manufacturer's services.

b. Have manufacturer review work involved in handling, installation, protection, and cleaning of insulation and accessories, and submit written reports in acceptable format to verify compliance of Work with Contract conditions.

2. Manufacturer's Field Services: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for product installation review in accordance with manufacturer's instructions.

a. Report any inconsistencies from manufacturer's recommendations immediately to Consultant.

3. Schedule site visits to review work at stages listed:

a. After delivery and storage of drainage sheet and accessories, and when preparatory work on which Work of this Section depends is complete, but before installation begins.

b. Twice during progress of work at 25% and 60% complete.

c. Upon completion of Work, after cleaning is carried out.

d. Obtain reports within three days of review and submit immediately to Consultant.

3.5 CLEANING

A. Progress Cleaning: Perform cleanup as work progresses.

1. Leave work area clean at end of each day.

B. Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.

C. Waste Management:

1. Co-ordinate recycling of waste materials.

2. Collect recyclable waste and dispose of or recycle field generated construction waste created during construction or final cleaning related to work of this Section.

3. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

A. Protect installed products and accessories from damage during construction.

B. Repair damage to adjacent materials caused by insulation installation.

END OF SECTION 07 21 13 – BOARD INSULATION (CURTAINROCK® 40)

1 GENERAL

1.1 SUMMARY OF WORK

A. This Section specifies stone fiber batt and blanket thermal insulation and stone fiber batt and blanket acoustical insulation.

1.2 RELATED REQUIREMENTS

A. Section [07 84 00 - Firestopping].
B. Section [07 92 19 - Acoustical Joint Sealants].

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM).

1. ASTM C167 - [2009], Standard Test Method for Thickness and Density of Blanket or Batt Thermal Insulations.
2. ASTM C356 - [2010], Standard Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat.
3. ASTM C423 - [2009a], Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
4. ASTM C518 - [2010], Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
5. ASTM C553 - [2011], Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
6. ASTM C665 - [2011], Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
7. ASTM C795 - [2013], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
8. ASTM C1104/C1104M - [2013], Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
9. ASTM E84 - [2012b], Standard Test Method for Surface Burning Characteristics of Building Materials.
10. ASTM E90 - [2009], Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
11. ASTM E136 - [2011], Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

B. Underwriters' Laboratories (UL).
1. UL 181 - [2013], Factory-Made Air Ducts and Connectors.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Co-ordination: Co-ordinate work of this Section with roofing or deck work and with work of other trades for proper time and sequence to avoid construction delays.

B.

B. Pre-installation Meeting: Convene pre-installation meeting after Award of Contract and [one week] before starting work of this Section to verify project requirements, substrate conditions and coordination with other building sub-trades, and to review manufacturer’s written installation instructions.

1. Comply with Section 01 31 19 - Project Meetings and co-ordinate with other similar pre-installation meetings.
2. Notify attendees 2 weeks prior to meeting and ensure meeting attendees include as minimum:
   a. Owner;

b. Consultant;
c. Subcontractor;
d. Manufacturer's Technical Representative.

3. Ensure meeting agenda includes review of methods and procedures related to insulation installation including co-ordination with related work.
4. Record meeting proceedings including corrective measures and other actions required to ensure successful completion of work and distribute to each attendee within 1 week of meeting.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

A. Make submittals in accordance with Contract Conditions and Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit product data including manufacturer's literature for insulation materials and accessories, indicating compliance with specified requirements and material characteristics.

1. Submit list on insulation manufacturer's letterhead of materials and accessories to be incorporated into Work.
2. MSDS report.
3. Include product name.
4. Include preparation instructions and recommendations, installation methods, and storage and handling requirements.
5. Include contact information for manufacturer and their representative for this Project.

C. Samples:

1. Submit [5.5 x 7.5] inches minimum sample of insulation in thickness used on Project.

D. Test Reports:

1. Submit evaluation service reports or other independent testing agency reports showing compliance with specified performance characteristics and physical properties.

E. Field Reports: Submit manufacturer's field reports within 3 days of each manufacturer representative's site visit and inspection.

F. Sustainable Design (LEED).

1. LEED Submittals: In accordance with Section [01 35 21 – LEED Requirements]
2. Submit verification for items as follow:
   a. EA Credit 1: Thermal value of insulation contributing to overall energy performance of building.
   b. MR Credits 4: Recycled content of insulation indicating percentages by weight of preconsumer and postconsumer recycled content.
   c. MR Credits 5: Verify location where insulation is extracted, processed and manufactured.

G. Insulation Installer Qualifications:

1. Submit letter verifying insulation installer's experience with work similar to work of this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Supply maintenance data for insulation materials for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.7 QUALITY ASSURANCE

A. Batt and Blanket Insulation Installer Quality Assurance: Work experience of [5] years minimum with work similar to work of this Section.

1.8 DELIVERY STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:
1. Deliver material in accordance with Section 01 61 00 - Common Product Requirements.
2. Deliver materials and accessories in insulation manufacture's original packaging with identification labels intact and in sizes to suit project.
3. Ensure insulation materials are not exposed to moisture during delivery.
4. Replace wet or damaged insulation materials.

B. Storage and Handling Requirements: Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
1. Store in original packaging until installed.

C. Packaging Waste Management:
1. Separate and recycle waste packaging materials in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
2. Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycling [in accordance with Waste Management Plan].

1.9 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other rights Owner may have under Contract Conditions.

C. Warranty period: [1] years commencing on Date of Substantial Performance of Work.

2 PRODUCTS

2.1 MANUFACTURER

1. Manufacturer: ROXUL INC., 8024 Esquesing Line, Milton, Ontario, L9T 6W3, Phone: 905-878-8474, Toll Free: 1-800-265-6878, e-mail: contactus@roxul.com, URL: www.roxul.com.

2.2 DESCRIPTION

A. Non-combustible, lightweight, semi-rigid stone wool batt insulation to ASTM C655, Type 1.

B. Non-combustible, lightweight, semi-rigid stone wool batt insulation to ASTM C612 that provides fire resistance to ASTM E136.

D. Non-combustible, lightweight, semi-rigid stone wool batt insulation to, ASTM C655 Type 1, that provides fire resistance to ASTM E136 and sound control to ASTM E423.

2.3 PERFORMANCE CRITERIA

A. Batt Insulation for exterior stud walls: To ASTM C655.
1. Fire performance:
a. Non-combustibility: To ASTM E136.
b. Surface Burning Characteristics: To ASTM E84.
1) Flame spread: 0.
2) Smoke developed: 0.
2. Thermal resistance: To ASTM C518.
3. Density: 2 lb/ft^3 to ASTM C167.
4. Recycled content: 40 % minimum.

B. Lightweight batt insulation for firestopping installations to ASTM C612, Type IVA.
1. Fire performance:
a. Non-combustibility: To ASTM E136.
b. Firestopping: To ASTM E 814.
c. Surface Burning Characteristics: To ASTM E84.
1) Flame spread: 0.
2) Smoke developed: 0.
2. Compressive strength: 144 psf to ASTM C165 at 10 %.
3. Moisture sorption: 0.04 % to ASTM C1104/C1104M.
4. Thermal resistance: To ASTM C518.
5. Corrosive resistance: To ASTM C665, Corrosive to steel - Pass.
6. Stainless steel stress corrosion: To ASTM C795.
7. Density: To ASTM C167, 4.5 lb/ft^3.
8. Recycled content: 40% minimum.

C. Blanket insulation to ASTM C553 Type [I] [II] [III] for exterior walls of metal buildings in accordance with Section [13 34 19 - Metal Building Systems].
1. Fire performance:
a. Non-combustibility: To ASTM E136.
b. Surface Burning Characteristics: To ASTM E84.
1) Flame spread: 0.
2) Smoke developed: 0.
2. Dimensional stability: 0.74% linear shrinkage at 450 ºF, to ASTM C356.
3. Water vapour sorption: 0.028 % to ASTM C1104.
4. Thermal resistance: To ASTM C518.
5. Corrosive resistance: To ASTM C665, Corrosive to steel - Pass.
6. Stainless steel stress corrosion: To ASTM C795.
7. Density: 2 lb/ft^3 to ASTM C167.
8. Recycled content: 40% minimum.

D. Acoustical and fire batt insulation for walls and floors to ASTM C655, Type 1 and ASTM C553.
1. Fire performance:
a. Non-combustibility: To ASTM E136.
b. Surface Burning Characteristics: To ASTM E84.
1) Flame spread: 0.
2) Smoke developed: 0.
2. Acoustical Performance:
a. Airborne sound transmission loss: To ASTM E90.
b. Rating sound insulation: To ASTM E413.
c. Sound absorption co-efficients: To ASTM E423.

Sound Absorption Co-efficients at Frequencies

Thickness (Inches)	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
1	0.14	0.25	0.65	0.90	1.01	1.01	0.70
1 1/2	0.18	0.44	0.94	1.04	1.02	1.03	0.85
2	0.28	0.60	1.09	1.09	1.05	1.07	0.95
3	0.52	0.96	1.18	1.07	1.05	1.05	1.05
4	0.86	1.11	1.20	1.07	1.08	1.07	1.10

d. Impedence and absorption of acoustic materials: To ASTM E1050.
3. Air erosion velocity: 1000 ft/min maximum to UL 181.
4. Thermal resistance: To ASTM C518.
5. Corrosive resistance: To ASTM C665, Corrosive to steel - Pass.
6. Stainless steel stress corrosion: To ASTM C795.
7. Density: To ASTM C612, 2.8 lb/ft^3.
8. Recycled content: [416 % minimum.

2.4 MATERIALS

A. Non-combustible, lightweight, semi-rigid stone wool batt insulation to ASTM C665, Type 1.
   1. Size: as required per the drawings
   2. Thickness as required per the drawings
   3. Acceptable Material: ROXUL INC., ROXUL COMFORTBATT™.

B. Non-combustible, lightweight, semi-rigid stone wool batt insulation to ASTM C612 that provides fire resistance to ASTM E136.
   1. Size: as required per the drawings
   2. Thickness: as required per the drawings
   3. Acceptable Material: ROXUL INC., ROXUL SAFE®.

C. Non-combustible, blanket insulation for exterior wall metal building construction to ASTM C553, Types I, II, and III.
   1. Size: as required per the drawings
   2. Thickness: as required per the drawings.
   3. Acceptable Material: ROXUL INC., ROXUL PLUS®METAL BUILDING.

D. Non-combustible, lightweight, semi-rigid stone wool batt insulation to C665, Type 1, that provides fire resistance to ASTM E136 and a sound control to ASTM E90 and ASTM E423.
   1. Size: as required per the drawings
   2. Thickness: as required per the drawings
   3. Acceptable Material: ROXUL INC., ROXUL AFB®.

2.5 ACCESSORIES

A. Mechanical fasteners in accordance with insulation manufacturer's written recommendations.

B. Acoustical sealant in accordance with Section [07 92 19 - Acoustical Joint Sealants].

D. Firestopping materials in accordance with Section [07 84 00 - Firestopping].

2.6 SOURCE QUALITY CONTROL

A. Ensure insulation components and accessories are supplied or approved in writing by single manufacturer.

2.7 PRODUCT SUBSTITUTIONS

A. Substitutions: substitutions permitted

3 EXECUTION

3.1 INSTALLERS

A. Use only installers with [5] years minimum experience with work similar to work of this Section.

3.2 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for insulation installation in accordance with manufacturer's written recommendations.
   1. Visually inspect substrate in presence of Consultant.
   2. Ensure surfaces are free of snow, ice, frost, grease and other deleterious materials.
   3. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

C. Start of insulation installation indicates installer's acceptance of substrate installation conditions.

3.3 INSTALLATION

A. Install insulation in accordance with manufacturer's written recommendations.

B. Install insulation to maintain continuity of thermal protection to building elements and spaces.

D. Do not compress insulation to fit into spaces.

D. Co-ordinate installation of firestopping insulation with Section [07 84 00 - Firestopping].

E. Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

F.

F. Keep insulation minimum 3 inches from heat emitting devices such as recessed light fixtures, and minimum 2 inches from sidewalls of chimneys and vents..

G. Seal joints with acoustical joint sealant in accordance with Section [07 92 19 - Acoustical Joint Sealants].

H. Do not enclose insulation before inspection and receipt of Consultant's written approval.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with Section [01 45 00 - Quality Control].

B. Manufacturer's Services:

1. Coordinate manufacturer's
    a. Arrange for payment for manufacturer's services.
    b. Have manufacturer review work involved in handling, installation, protection, and cleaning of insulation and accessories, and submit written reports in acceptable format to verify compliance of Work with Contract conditions.
2. Manufacturer's Field Services: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for product installation review in accordance with manufacturer's instructions.
    a. Report any inconsistencies from manufacturer's recommendations immediately to Consultant.
3. Schedule site visits to review work at stages listed:
    a. After delivery and storage of drainage sheet and accessories, and when preparatory work on which Work of this Section depends is complete, but before installation begins.
    b. Twice during progress of work at 25% and 60% complete.
    c. Upon completion of Work, after cleaning is carried out.
    d. Obtain reports within three days of review and submit immediately to Consultant.

3.5 CLEANING

A. Progress Cleaning: Perform cleanup as work progresses
1. Leave work area clean at end of each day.

B. Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment

C. Waste Management:
1. Co-ordinate recycling of waste materials
2. Collect recyclable waste and dispose of or recycle field generated construction waste created during construction or final cleaning related to work of this Section.
3. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

A. Protect installed products and accessories from damage during construction.

B. Repair damage to adjacent materials caused by insulation installation.

END OF SECTION 07 2116 – BLANKET (AND BATT) INSULATION

SECTION 07 27 00

SHEET AIR AND VAPOR BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vapor-permeable self-adhered air barrier membrane. (3M 3015VP)

1.2 RELATED SECTIONS

A. Section 061643 - Sheathing.

1.3 REFERENCES

A. American Association (AAMA):
   1. AAMA 711 - Voluntary Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products.

B. American Association of Textile Chemists and Colorists (AATCC):
   1. AATCC-127 - Water Resistance: Hydrostatic Pressure Test.

C. ASTM International (ASTM):
   1. ASTM D882 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
   2. ASTM D3330 - Standard Test Method for Peel Adhesion of Pressure-Sensitive Tape.
   3. ASTM D3652 – Standard Test Method for Thickness of Pressure-Sensitive Tapes.
   4. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   5. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
   6. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
   7. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.
   8. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

D. Underwriters' Laboratory, Canada:
   1. CAN/ULC-S741, Standard for Air Barrier Materials – Specification.
   2. CAN/ULC-S742, Standard for Air Barrier Assemblies – Specification.

E. U.S. Green Building Council - LEED rating systems.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Physical properties, performance criteria, compliance reports, material compatibility, product limitations, and recommendations.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Shop Drawings: Provide manufacturer's typical, scaled, shop drawings with actual product names on details of:
   1. Typical conditions.

2. Transitions to adjacent systems.
3. Mock-up, including plans and elevations.

D. Manufacturer's Letter Indicating Compatibility: Submit letter or technical bulletin listing specific air barrier materials, and typical adjacent system materials; that are compatible, both chemically and adhesively.

E. Qualifications:
1. Submit manufacturer and installer qualifications.
2. Submit 5 project references within the last 5 years of similar-sized projects with self-adhered sheet membrane air barrier assembly installation by the proposed installing contractor.

F. Warranty: Submit manufacturer's sample warranty.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primary weather barrier materials from a single manufacturer. Secondary and accessory materials by other manufacturers shall be approved for compatibility by the primary manufacturer and Architect.

B. Testing Laboratory Qualifications: Accredited by the International Accreditation Service (IAS), American Association for Laboratory Accreditation (A2LA), or Standards Council of Canada (SCC).

C. Manufacturer Qualifications: Minimum 10 years of experience manufacturing similar products.

D. Installer Qualifications: Minimum 5 years of experience installing similar products and approved by the manufacturer.

E. Mock-Up:
1. Demonstrate the proper installation sequence and workmanship required for the air barrier assembly installation at typical conditions, transitions, openings, and penetrations through the exterior building envelope, mock-up instructions are in the drawing and also will be done as indicated blow on the building.
2. Finish areas designated by Architect, minimum size 8 by 8 feet (2.4 by 2.4 m).
3. Exterior wall panel incorporating the back-up wall, window with sill, door frame, through-wall flashing, insulation, cladding, foundation, roof edge, and building corner. Show all air barrier assembly materials and seals. Coordinate with the Third-party Testing Agency for the size of testing area required for field testing the mock-up and allow testing prior to fully installing the insulation and cladding. Refer to Field Quality Control of this Section for test methods and quantity of tests.
4. Do not proceed with remaining work until workmanship is approved by Architect and or Envelope Consultant.
5. Approved mock-up represents the minimum quality for the Work for the air barrier assembly installation. Materials and installation procedures utilized in the mock-up become the standard of quality and construction for all subsequent similar conditions on the building.
6. Remove the mock-up only after approval by the Owner and Architect/Envelope Consultant.

1.6 COORDINATION

1. Coordinate Work of this Section with the work of other Sections that have work or materials connected to or passing through the air barrier assembly.

2. Sequence of construction to ensure continuity of the barrier assembly at openings, transitions, and penetrations.
3. Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed 12 months for 3M Air Barrier 3015VP and 12 months for 3M Air and Vapor Barrier 3015.
4. Coordinate field observations and testing by specified parties.

1.7 PRECONSTRUCTION MEETINGS

A. Preconstruction Meeting: Prior to starting installation of the barrier system, conduct a preconstruction meeting at the job site to review the Project conditions and installation requirements.
   1. Attendance is required by:
      a. Installing contractor of the air barrier assembly.
      b. Representatives of related trades including exterior cladding, air barrier substrate, penetrating work and systems, and adjacent material.
      c. General Contractor.
      d. Architect/Engineer.
      e. Air barrier system manufacturer’s field representative.
      f. Owner’s representative.
      g. Third-party observer.
      h. Field testing agency.
   2. Agenda shall include:
      a. Construction of the mock-up.
      b. Sequence of construction and protection of installed air barrier assembly.
      c. Substrate condition and preparation.
      d. Materials approved for use.
      e. Compatibility of materials.
      f. Transition details between the various different types of barrier systems specified.
      g. Coordination with installation of adjacent and cladding materials.
      h. Project-specific details of construction.
      i. Field observation and testing.
      j. Repair of test and damaged areas.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Store in accordance with the manufacturer's instructions in clean, dry location protected from exposure to direct sunlight. Material that has been unwrapped shall be covered with opaque, light colored tarp or re-wrapped in manufacturer's packaging.

C. Use air barrier materials within 12 months from date of manufacture.

D. Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.
   1. Install membrane in temperature range from 0° F to 150° F (-18° C to 66° C).
   2. Install sealant in temperature range from 40° F to 95° F (5° C to 35° C). For application temperatures outside this range, please contact 3M Technical Services

B. Install on substrates clear of dirt, debris, oils, other chemicals, snow, ice, frost, and moisture

above the allowable limitations of the product.

C. Maximum exposure time of the air barrier assembly without cover or cladding is 12 months for 3015VP and 12 months for 3015.

D. Provide weather protection at the top of walls and unfinished roofs at the end of each day.

1.10 WARRANTY

A. Product Warranty: Provide manufacturer's product warranty for a minimum of ten (10) years from date of Substantial Completion with installation completed by a certified 3M applicator.

B. Workmanship Warranty: Provide workmanship warranty for a minimum of one year from date of Substantial Completion including all air barrier assembly materials and accessories, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of adhesion, and failure to cure properly.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: 3M Industrial Adhesives and Tapes, which is located at: 3M Center Bldg. 225-3S-06; St. Paul, MN 55144-1000; Toll Free Tel: 800-362-3550; Fax: 877-369-2923; Web www/3M.com/construction

B. Substitutions: Not permitted.

2.2 SYSTEM REQUIREMENTS

A. Assembly Performance:
1. Membrane: 3M Air and Vapor Barrier 3015 Membrane, self-adhered, vapor impermeable in manufacturer's standard widths. This refers to tie-in tapes only for this project.
2. Standards Compliance:
   a. ASTM E 2357.
   b. CAN/ULC-S741.
   c. CAN/ULC-S742.
3. Air Leakage: ASTM E2357:
   a. Opaque Wall: Less than 0.002 cfm/ft^2 at 1.57 psf (0.01 L/s/m^2 at 75 Pa).
   b. Penetrated Wall: Less than 0.006 cfm/ft^2 at 1.57 psf (0.03 L/s/m^2 at 75 Pa).
4. Loads from imposed pressures: Withstands design wind, fan, and stack pressures, both positive and negative, without damage or displacement of the air barrier assembly or adjacent materials. Allows transfer of these loads to the structure.
5. Movement: Allows for thermal, creep, and anticipated seismic and building movement within the air barrier assembly, each air barrier detail, and transitions to adjacent systems without breaching the air barrier system or negating specified air leakage performance.
6. Continuity: Joins air barrier materials and adjacent compatible materials and systems preventing air leakage and maintaining specified air leakage performance at the following locations and as shown on the Drawings:
   a. Transitions from roof air barrier to wall.
   b. Transitions from window, curtain wall, storefront, louvers, and doors to wall.
   c. Transitions from foundation waterproofing to wall.
   d. Transitions from one type of exterior cladding to another.
   e. Across construction, control, expansion, and seismic joints.
   f. Penetrations of utilities, pipes, conduit, and ducts.
   g. Penetrations of ties, anchors, and channels for exterior finishes.

h. Pathways for potential air leakage into the building envelope.

2.3 AIR BARRIERS

A. Membrane: 3M Air Barrier 3015VP Membrane, self-adhered, vapor permeable:
1. Description: White proprietary film with acrylic adhesive, elastomeric coated, nonwoven backing, and polyester liner.
2. Permeable to water vapor and impermeable to air and bulk water.
3. Resists UV exposure for up to 12 months.
4. Meets requirements of ASTM E2178 and CAN/ULC S741-8.
5. Liner Thickness (ASTM D3652): 3 mils (0.078 mm).
6. Total Membrane Thickness (ASTM D3652): 15 mils (0.50 mm).
7. Elongation at Break (ASTM D882): 40 percent.
8. Tensile Strength (ASTM D882): 1177 psi (8.1 MPa).
9. Lap Adhesion (ASTM D3330): 50 oz/inch (0.44 N/mm).
10. Nail Sealability: ASTM D1970, Section 7.9: 5 inches (127 mm) of water head after 3 days, dry and passes.
11. Water Vapor Permeance (ASTM E96, Desiccant method): Not to exceed 12 US Perm (687 ng/Pa s m2).
12. Service Temperature: -40 to 240 degrees F (-40 to 116 degrees C).
13. Flammability: Membrane in an approved wall assembly meets performance requirements of NFPA 285.

2.4 ACCESSORIES

A. Sealant: Polyurethane Sealant, one component, moisture curing: ASTM C920, Type S, Grade NS, Class 25:
1. Product: 3M Polyurethane Sealant 540:
a. Tack free: 60-90 minutes at 73 degrees F at 50% relative humidity.
b. Elongation at Break (ASTM D882): 600 percent.
c. Tensile Strength (ASTM D882): 300 psi (2.1 MPa).
2. Product: 3M Polyurethane Sealant 525:
a. Tack free: 90-150 minutes at 73 degrees F at 50% relative humidity.
b. Elongation at Break (ASTM D882): 600 percent.
c. Tensile Strength (ASTM D882): 400 psi (2.6 MPa).

B. Flashing: 3M Self-Adhered Air and Vapor Barrier 3015 Membrane in detail widths.
1. Description: Tan colored, semi-transparent proprietary film with acrylic adhesive and silicone coated release liner.
2. Total Thickness (ASTM D3652): 10 mils (0.25 mm).
3. Width: 2-3/8 inches (60 mm).
4. Width: 4 inches (102 mm).
5. Width: 6 inches (152 mm).
6. Width: 9 inches (229 mm).
7. Width: 12 inches (305 mm).
8. Elongation at Break (ASTM D882): 700 percent.
9. Tensile Strength (ASTM D882): 1740 psi (12 MPa).
10. Lap Adhesion (ASTM 3330): 40 oz/inch (0.44 N/mm).

C. Primer for Difficult Substrates: Test adhesion before application, where adhesion fails primers may be required and are listed below.
1. 3M Hi-Strength 94 ET Spray Adhesive.
2. 3M Scotch-Weld Holdfast 70.
3. 3M Fastbond Contact Adhesive 30NF.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Substrate surfaces shall be free of grease, oil, unbonded paint, construction dust, condensation, rain water, frost, corrosion or other substances.

C. Verify that substrate construction is complete, clean, dry, and ready to receive barrier system with no damaged or unsupported areas; or sharp protrusions or voids. Substrate must meet the following requirements:
   1. Exterior gypsum sheathing: Moisture content below 19 percent; no open joints or cracks wider than 1/4 inch (6 mm). All joints wider than ¼" found to be covered will be cut out and redone with no additional cost or time allowed.
   2. Plywood: Moisture content below 16 percent; no open joints or cracks wider than 1/4 inch (6 mm).
   3. Concrete surfaces: Cured minimum 7 days, fins and extrusions ground flush and void areas filled and cured.
   4. Masonry: Mortar joints struck flush.
   5. Metal: Wipe down with a wax and grease remover to remove any release agents or coatings in all cases.

D. If substrate preparation is the responsibility of another installer, notify Architect and General Contractor of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Connection to Difficult Substrates and Other Systems:
   1. Test adhesion by installing a 6 inch (152 mm) square test patch of barrier product over the difficult substrate or other system. Removal of the test patch should not be possible without permanent damage to either the test patch or substrate material.
   2. Consult the manufacturer for detailing connections that fail this test.

B. Gaps or cracks in substrate exceeding 1/4 inch (6 mm) width: Fill gap or crack with sealant and tool surface flush and smooth.

C. Penetrations of air barrier assembly: Fill gaps or cracks exceeding 1/4 inch (6 mm) width between the substrate and the penetration with sealant.

D. Gaps or cracks in substrate exceeding 1/2 inch (12 mm) width: Fill gap or crack with closed-cell backer rod or spray foam. Once the spray foam is cured, shave flush to adjoining substrate.

3.3 INSTALLATION

A. Install 3M 3015VP in accordance with manufacturer's instructions in locations shown on the drawings to provide a continuous weather barrier.
   1. 3M 3015VP may be installed horizontally or vertically
   2. A 2 inch min. overlap is required
   3. Horizontal applications should be applied so the top row overlaps the lower row, creating a shingling effect
   4. Remove the roll from the protective packaging.
   5. Remove and save the protective release liner on the outside of the roll
   6. Unroll approximately 6 inches of material and position it onto the substrate. Positioning to allow for a minimum 2 inch overlap onto the adjoining section of 3M Air Barrier Membrane.

7. Unroll the 3M Air Barrier 3015VP material onto the approved substrate. Hand wipe the material into place to ensure full contact of membrane to the substrate.
8. Using a hand rubber roller, apply sufficient pressure to the rubber roller to work out any entrapped air and secure a tight permanent bond to the substrate. Pay attention to the 2-inch overlap area of the air barrier membrane.
9. Remove the clear plastic surface liner and discard per local laws including the recycling of the clear plastic liner.
10. Install the next section of membrane following steps #3 to 6 listed above.
11. Install 6 inch (152 mm) wide membrane at inside and outside vertical corners and construction joints, lapping a minimum of 2 inches (51 mm) on either side.
12. Carefully execute detail work to ensure a continuously sealed building envelope.
13. Through-wall flashings: Lap membrane over through-wall flashing top edge minimum 2 inches (51 mm). Seal top edge of through-wall flashing with air barrier sealant, if a negative, or reverse, lap is used.
14. Transitions to adjacent systems: See the Drawings for project specific detailing of transitions to the roof, foundation waterproofing, and door systems.
15. Repair all wrinkles and fish mouths extending within 2 inches (51 mm) of the membrane edge with a repair membrane piece extending 2 inches (152 mm) beyond the defect.
16. At the end of the installation, reinstall the protective release liner on the remaining roll of 3M Air Barrier 3015VP. This will protect the adhesive from contamination until the material is ready to be installed.

B. Window and Louver Openings:
1. Wrap rough openings as detailed in the Drawings with either flashing or membrane material in detail widths.
2. Install sealant at each inside corner of the window sill, jamb, and head.
3. Apply detail strips of membrane at each inside corner extending the full depth of the sill and a minimum 2 inches (51 mm) onto the face.
4. Install detail strips at the sill, jambs, and head in lengths beyond window opening extending the full depth of the sill.
5. Apply reinforcing piece cut into a football, bowtie, or butterfly shape at each corner.
6. Install membrane in “weatherboard” or “shingle fashion” with a minimum 2 inch (51 mm) overlap at all detail strips.

C. Penetrations:
1. Seal all penetrations with sealant. Install flashing or membrane material cut to length to allow installation around the full circumference of penetration.
2. Masonry Ties or Anchors:
   a. Post-applied: Install back plate of tie or anchor over the air barrier with self-tapping screws. Apply sealant over the screw heads.
   b. Knife plate: Cut a one piece membrane to overlap minimum 2 inches (51 mm) in each direction of the knife plate. Cut a slot for the knife plate and apply the membrane over. Apply sealant at the knife plate penetration perimeter.
3. Utilities, Pipes, Conduit, and Duct Penetrations:
   a. Apply sealant between the penetration and the exterior wall.
   b. Apply membrane to allow continuous 2 inch (51 mm) overlap onto vent/pipe penetration and cut “fingers” to transition to the exterior wall.
   c. Install a narrow membrane collar strip around the circumference of the penetration perimeter, lapping onto the penetration and substrate.
   d. Install one piece membrane with penetration shape cut out on to the substrate. Apply over “fingers” on the substrate and extend a minimum of 2 inches (51 mm) beyond the penetration perimeter.
   e. Apply sealant at the penetration perimeter and cut edge of the one piece

membrane.

D. Substrate transitions and building joints: See Drawings for project specific detailing with backer rod, sealant, and membrane.

E. Repairs: Apply membrane 2 inch (152 mm) larger than test or damage area. Seal leading cut edges of membrane with sealant.

3.4 FIELD QUALITY CONTROL

A. Coordinate with Owner's testing agency to inspect installation areas with the manufacturer's authorized technical representative and the Architect. Do not cover weather barriers until accepted.

B. Test:
1. Qualitative air leakage: ASTM E1186. Conduct 1 at the mock-up and 2 at select locations of the Work.
2. Quantitative air leakage: ASTM E783, at 1.57 psf (75 Pa). Conduct 1 at the mock-up and 2 at select locations of the Work.
3. Water penetration: ASTM E1105). Conduct 1at the mock-up and 1 at select locations of the Work.
4. Membrane adhesion: ASTM D4541, modified. Use a Type II Pull Tester. Cut through the membrane at the perimeter of the disc.
   a. Conduct 1 sets at the mock-up and 6 sets at select locations 24 hours after installation. Each set includes three adhesion tests.
   b. Record the mode of failure and area where material failed.
   c. Record the adhesion level from the gauge at the end of the test.
5. Repair all test areas to conform to the project specifications.
6. Repair or take corrective action all non-conforming work to meet the project specifications.

3.5 CLEANING AND PROTECTION

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the air barrier assembly manufacturer.

B. Protect air barrier materials from damage during installation and the remainder of the construction period.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

07 42 00

FACADE/CLADDING SPECIFICATIONS UTILIZING ALUCOBOND® PLUS MATERIAL

PART 1: GENERAL

1.01 SCOPE

A. SECTION INCLUDES

1. The extent of panel system work is indicated on the drawings and in these specifications.
2. Panel system requirements include the following components:
   a. Aluminum faced composite panels with mounting system. Panel mounting system including anchorages, shims, furring, fasteners, gaskets and sealants, related flashing adapters, and masking (as required) for a complete installation.
   b. Parapet coping, column covers, soffits, sills, border, and filler items indicated as integral components of the panel system or as designed.
   c. Interior panel system work that basically matches exterior panel system work.

B. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Technical Specification Divisions 2 through 16 apply to this Section.

C. RELATED WORK SPECIFIED ELSEWHERE

1. Section 052100: Structural steel
2. Section 072000: Insulation
3. Section 076000: Metal flashing and counter flashing
4. Section 079200: Caulking and sealants

1.02 QUALITY ASSURANCE

1. Composite Panel Manufacturer shall have a minimum of 20 years experience in the manufacturing of this product.
2. Composite Panel Manufacturer shall be solely responsible for panel manufacture and application of the finish.
3. Fabricator/installer shall be acceptable to the composite panel manufacturer.
4. Fabricator/Installer shall have a minimum 5 years experience of metal panel work similar in scope and size to this project.
5. Field measurements should be taken prior to the completion of shop fabrication whenever possible. However, coordinate fabrication schedule with construction progress as directed by the Contractor to avoid delay of work. Field fabrication may be allowed to ensure proper fit. However, field fabrication shall be kept to an absolute minimum with the majority of the fabrication being done under controlled shop conditions.
6. Shop drawings shall show the preferred joint details providing a structurally sound wall panel system that allows no uncontrolled water penetration on the inside face of the panel system as determined by ASTM E 331. Systems not utilizing a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated System) shall provide a means

of concealed drainage with baffles and weeps for water which may accumulate in members of the system.

7. Maximum deviation from vertical and horizontal alignment of erected panels: 6mm (1/4") in 6m (20') non-accumulative.

8. Panel fabricator/installer shall assume undivided 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 material joinery, and joint seal associated with the panel system.

9. Composite panel manufacturer shall have established a Certification Program acceptable to the local Code Authorities.

1.03 REFERENCES

A. ALUMINUM ASSOCIATION

1. AA-M12C22A41: Anodized - Clear Coating
2. AA-M12C22A44: Anodized - Color Coating

B. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

1. AAMA 508-05: Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS

1. E 330 Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads
2. E 283 Rate of Leakage through Exterior Windows, Curtain Walls, and Doors
3. D 1781 Climbing Drum Peel Test for Adhesives
4. E 84 Surface Burning Characteristics of Building Materials
5. D 1929 Standard Test for Ignition Properties of Plastics
6. D 3363 Method for Film Hardness by Pencil Test
7. D 2794 Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
8. D 3359 Methods for Measuring Adhesion by Tape Test
9. D 2247 Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
10. B 117 Method of Salt Spray (Fog) Testing
11. D 2244 Calculation of Color Differences from Instrumentally Measured Color Coordinates
12. D 4214 Evaluating the Degree of Chalking of Exterior Paint Films
13. D 822 Practice for Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products
14. D 1308 Effect of Household Chemicals on Clear and Pigmented Organic Finishes

D. INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS

1. NFPA 285 Intermediate Scale Multi Story Test

1.04 SUBMITTALS

A. SAMPLES

1. Panel System Assembly: Two samples of each type of assembly. 304mm (12") x 304mm (12") minimum.
2. Two samples of each color or finish selected, 76mm (3") x 102mm (4") minimum.

B. SHOP DRAWINGS

Submit shop drawings showing project layout and elevations; fastening and anchoring methods; detail and location of joints, sealants, and gaskets, including joints necessary to accommodate thermal movement; trim; flashing; and accessories.

C. AFFIDAVIT CERTIFYING MATERIAL MEETS REQUIREMENTS SPECIFIED.

D. TWO COPIES OF MANUFACTURER'S LITERATURE FOR PANEL MATERIAL.

E. CODE COMPLIANCE

Documents showing product compliance with the national and local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product.

F. ALTERNATE MATERIALS MUST BE APPROVED BY THE ARCHITECT PRIOR TO THE BID DATE.

1.05 DELIVERY, STORAGE AND HANDLING

1. Protect finish and edges in accordance with panel manufacturer's recommendations.
2. Store material in accordance with panel manufacturer's recommendations.

PART 2: PRODUCTS

2.01 PANELS

A. COMPOSITE PANELS

1. ALUCOBOND Plus material manufactured by 3A Composites USA, Inc. 208 West 5th Street Benton, KY 42025 (800-626-3365 or 270-527-4200)
2. Items of the same function and performance, which have received prior approval from the architect, shall be allowed for this project. Approval shall be based on documentation submitted showing the adequacy of the material.

B. THICKNESS: 4MM (0.157")

C. PRODUCT PERFORMANCE

1. Bond Integrity

When tested for bond integrity, in accordance with ASTM D 1781 (simulating resistance to panel delamination), there shall be no adhesive failure of the bond a) between the core and the skin nor b) cohesive failure of the core itself below the following values:

Peel Strength: 100 N·mm/mm (22.5 in lb/in) as manufactured
100 N·mm/mm (22.5 in lb/in) after 21 days soaking in water at 70°F (21°C)

2. Fire Performance

ASTM E 84	Max. Flame Spread 25, Max. Smoke Developed 450
NFPA 285	Panels shall meet requirements of the Intermediate Scale Multi Story Test

D. FINISHES

1. Coil coated KYNAR® 500 or HYLAR® 5000 based Polyvinylidene Fluoride (PVDF) or Fluoro Ethylene – Alkyl Vinyl Ether (FEVE) resin in conformance with the following general requirements of AAMA 2605.

   a. Color:
      1) Standard color as selected by the owner / architect / from manufacturer's standard colors.

   b. Coating Thickness:
      1) Colors: 1.0 mil (±0.2 mil)
      2) Clear: 0.50 mil (±0.05 mil)

   c. Hardness: ASTM D 3363; HB minimum using Eagle Turquoise Pencil.

   d. Impact:
      1) Test method: ASTM D 2794; Gardner Variable Impact Tester with 5/8" (15.9mm) mandrel.
      2) Coating shall withstand reverse impact of 1.5 in·lb per mil substrate thickness (0.681 m·kg per mm substrate).
      3) Coating shall adhere tightly to metal when subjected to #600 Scotch Tape pick-off test. Slight minute cracking permissible. No removal of film to substrate.

   e. Adhesion:
      1) Test Method: ASTM D 3359.
      2) Coating shall not pick off when subjected to a grid of 11 cuts x 11 cuts, 1/16" apart, and taped with #600 Scotch Tape.

   f. Humidity Resistance
      1) Test Method: ASTM D 2247.
      2) No formation of blisters when subjected to condensing water fog at 100% relative humidity and 100°F (37.8°C) for 4000 hours.

   g. Salt Spray Resistance:
      1) Test Method: ASTM B 117; Expose coating system to 4000 hours, using 5% NaCl solution.
      2) Corrosion creepage from scribe line: 1/16" max. (1.6mm).
      3) Minimum blister rating of 8 within the test specimen field.

   h. Weather Exposure
      1) Outdoor:
         a. Ten-year exposure at 45° angle facing south Florida exposure.
         b. Maximum color change of 5 Delta E units as calculated in accordance with ASTM D 2244.
         c. Maximum chalk rating of 8 in accordance with ASTM D 4214.
         d. No checking, crazing, adhesion loss.

i. Chemical Resistance:

1) ASTM D 1308 utilizing 10% Muriatic Acid for an exposure time of 15 minutes. No loss of film adhesion or visual change when viewed by the unaided eye.

2) ASTM D 1308 utilizing 20% Sulfuric Acid for an exposure time of 18 hours. No loss of film adhesion or visual change when viewed by the unaided eye.

3) AAMA 2605 utilizing 70% reagent grade Nitric Acid vapor for an exposure time of 30 minutes. Maximum color change of 5 Delta E units as calculated in accordance with ASTM D 2244.

2. Anodized:
Clear Coating: AA-M12C22A41 Architectural Class I
Color Coating: AA-M12C22A44, light bronze, medium bronze, dark bronze and black, Architectural Class I

3. Urethane Coating:
For small quantity aluminum accent panels or custom color applications, provide a multi coat urethane finish in accordance with the paint manufacturer's requirements.

4. High Performance Clear:

For application over pretreated natural and brushed aluminum substrates, provide a high performance single coat clear finish.

2.02 PANEL FABRICATION

A. COMPOSITION:

Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain foamed insulation material. Products laminated sheet by sheet in a batch process using glues or adhesives between materials shall not be acceptable.

B. ALUMINUM FACE SHEETS:

Thickness:	0.5mm (0.0197") (nominal)
Alloy:	AA3000 Series (Painted material)
	AA5000 Series (Anodized material)

Delete alloy not required.

C. PANEL WEIGHT:

4mm (0.157"): 7.57 kg/m^2 (1.55 lb/ft^2)

D. TOLERANCES

1. Panel Bow: Maximum 0.8% of any 1828mm (72”) panel dimension.

2. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to an absolute minimum. All fabrication shall be done under controlled shop conditions when possible.

3. Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.

4. Maximum deviation from panel flatness shall be 1/8" (3.2mm) in 5'0" (1.52m) on panel in any direction for assembled units. (Non-accumulative - No Oil Canning)

E. SYSTEM CHARACTERISTICS

1. Plans, elevations, details, characteristics, and other requirements indicated are based upon standards by one manufacturer. It is intended that other manufacturers, receiving prior

approval, may be acceptable, provided their details and characteristics comply with size and profile requirements, and material/performance standards.

2. System must not generally have any visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.

3. System shall comply with the applicable provisions of the "Metal Curtain Wall, Window, Storefront, and Entrance Guide Specifications Manual" by AAMA and ANSI/AAMA 302.9 requirements for aluminum windows.

4. Fabricate panel system to dimension, size, and profile indicated on the drawings based on a design temperature of 70°F (21°C).

5. Fabricate panel system so that no restraints can be placed on the panel, which might result in compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature change and at all times remain air and water tight.

6. The finish side of the panel shall have a removable plastic masking applied prior to fabrication, which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.

F. SYSTEM TYPE

1. Rear Ventilated Rain Screen:
System must provide a reveal joint as detailed on drawings. Provide Air Vapor Barrier as specified and sheathing as shown on drawings. Attach using SAF Series C-4000 ACM system.

G. SYSTEM PERFORMANCE

1. Composite panels shall be capable of withstanding building movements and weather exposures based on the following test standards required by the Architect and/or the local building code.

a. Wind Load

If system tests are not available, mock-ups shall be constructed and tests performed under the direction of an independent third party laboratory, which show compliance to the following minimum standards:

Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 20 lb/ft^2 (959 N/m^2) and 30 lb/ft^2 (1438 N/m^2) on parapet and corner panels. Wind load testing shall be conducted in accordance with ASTM E 330 to obtain the following results.

Normal to the plane of the wall between supports, deflection of the secured perimeter-framing members shall not exceed L/175 or 3/4" (19mm), whichever is less.

Normal to the plane of the wall, the maximum panel deflection shall not exceed L/60 of the full span.

Maximum anchor deflection shall not exceed 1/16" (1.6mm).

At 1-1/2 times design pressure, permanent deflections of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16" (1.6mm).

b. Air/Water System Test
If system tests are not available, mock-ups shall be constructed and tests performed under the direction of an independent third party laboratory, which show compliance to the following minimum standards:

Air Infiltration - When tested in accordance with ASTM E 283, air infiltration at 1.57 lb/ft^2 (75 Pa) must not exceed 0.06 ft^3/min. per ft² of wall area (305 cm^3/s per m^2 of wall area).

Water Infiltration - Water infiltration is defined as uncontrolled water leakage through the exterior face of the assembly. Systems not using a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated Systems) shall be designed to drain any water leakage occurring at the joints. No water infiltration shall occur in any system under a differential static pressure of 6.24 lb/ft^2 (300 Pa) after 15 minutes of exposure in accordance with ASTM E 331.

c. Pressure Equalized Rain Screen Systems shall comply with AAMA 508-05 Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems.

2.03 ACCESSORIES

1. Extrusions, formed members, sheet, and plate shall conform with ASTM B 209 and the recommendations of the manufacturer.
2. Panel stiffeners, if required, shall be structurally fastened or restrained at the ends and shall be secured to the rear face of the composite panel with silicone of sufficient size and strength to maintain panel flatness. Stiffener material and/or finish shall be compatible with the silicone.
3. Sealants and gaskets within the panel system shall be as per manufacturer's standards to meet performance requirements.
4. Fabricate flashing materials from 0.030" (0.76mm) minimum thickness aluminum sheet painted to match the adjacent curtain wall / panel system where exposed. Provide a lap strap under the flashing at abutted conditions and seal lapped surfaces with a full bed of non-hardening sealant.
5. Fasteners (concealed/exposed/non-corrosive): Fasteners as recommended by panel manufacturer. Do not expose fasteners except where unavoidable and then match finish of adjoining metal.

PART 3: EXECUTION

3.01 INSPECTION

1. Surfaces to receive panels shall be even, smooth, sound, clean, dry and free from defects detrimental to work. Notify contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with erection until unsatisfactory conditions have been corrected.
2. Surfaces to receive panels shall be structurally sound as determined by a registered Architect/Engineer.

3.02 INSTALLATION

1. Erect panels plumb, level, and true.
2. Attachment system shall allow for the free and noiseless vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -20°F to +180°F (-29°C to +82°C). Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement will not be permitted.
   Fabrication, assembly, and erection procedure shall account for the ambient temperature at the time of the respective operation.
3. Panels shall be erected in accordance with an approved set of shop drawings.

4. Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.

5. Conform to panel fabricator's instructions for installation of concealed fasteners.

6. Do not install component parts that are observed to be defective, including warped, bowed, dented, abraised, and broken members.

7. Do not cut, trim, weld, or braze component parts during erection in a manner which would damage the finish, decrease strength, or result in visual imperfection or a failure in performance. Return component parts which require alteration to shop for refabrication, if possible, or for replacement with new parts.

8. Separate dissimilar metals and use gasketed fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.

3.03 ADJUSTING AND CLEANING

1. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.

2. Repair panels with minor damage.

3. Remove masking (if used) as soon as possible after installation. Masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor.

4. Any additional protection, after installation, shall be the responsibility of the General Contractor.

5. Make sure weep holes and drainage channels are unobstructed and free of dirt and sealants.

6. Final cleaning shall not be part of the work of this section.

End of Section

SECTION 07 50 00

MEMBRANE ROOFING

PART 1: GENERAL

1.01 SUMMARY

A. Project Name: 0 Hancock Street - Wex

B. Furnish and install a fully adhered .060 EPDM single ply elastomeric sheet membrane roofing system to the defined areas of the project, including:
   1. Roofing manufacturer's requirements for the specified warranty
   2. Wood nailers for roofing attachment
   3. Insulation
   4. Cover boards
   5. Elastomeric membrane roofing
   6. Metal roof edgings, copings, gutters, and downspouts
   7. Flashings, terminations, and counter flashings
   8. Walkway pads
   9. Other roofing-related items to provide a complete weatherproof roofing system.

C. Testing of Roofing for Hazardous Materials and disposal of demolition debris and construction waste is the responsibility of Contractor. Perform in manner complying with all applicable federal, state, and local regulations.

D. Comply with the published recommendations and instructions of the roofing membrane manufacturer, at http://manual.fsbp.com.

E. Notify Architect of any discrepancies between specified roofing system and existing observable conditions that may prohibit implementation of specifications.

E. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer.

1.02 REFERENCES

A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.

B. ASTM C-1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2004.

C. ASTM D-1079 - Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials; 2005a.

D. ASTM D-4637 - Standard Specification for EPDM Sheet used in Single-Ply Roof Membrane.

E. ASTM D-4811 - Standard Specification for Non-vulcanized (Uncured) Rubber Sheet Used as Roof Flashing; 2004.

F. ASTM E-84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

G. CAN-ULC-S770 - Standard Test Method Determination of L-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams

H. PS-1 : Construction and Industrial Plywood

I. PS- 20: American Softwood Lumber Standard

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D-1079 for definition of terms related to roofing work not otherwise defined in the section.

B. LTTR: Long Term Thermal Resistance, as defined by CAN-ULC S770.

1.03 PERFORMANCE REEQUIREMENTS

A. General: Install sheet membrane roofing and flashings that are watertight and will withstand the wind loads, thermally induced movement, and exposure to weather without failure.

B. Compatibility: Provide materials that are compatible with one another under application and service conditions required.

C. Fire Resistance: The complete roof covering assembly shall meet ASTM E-108, Class A or UL 790, Class A.

D. Uplift Resistance: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing agency to resist uplift pressure (lbf/ sq. ft.) calculated according to ASCE/ SEI-7. A Safety Factor of 2 has been added:

Field Uplift Pressure = Reference structural drawings

Perimeter Uplift Pressure = Reference structural drawings

Corner Uplift Pressure = Reference structural drawings

1.04 SUBMITTALS

A. Product Data:
   1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
   2. Provide a printed statement of VOC content for adhesives, primers, and sealants indicating compliance with VOC limits of authorities having jurisdiction.

B. Samples: Submit samples of membrane, insulation, cover board, edge metal color charts and fasteners along with a letter approving the application for the requested warranty from the manufacturer. Submit sample warranties and product literature along with drawings for tapered insulation layout.

D. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the specified qualifications and has installed warrantied systems of this nature.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Roofing installer shall have the following:
   1. Current Firestone Red Shield Licensed Contractor status.
   2. Current approval, license, or authorization as applicator by the manufacturer.
   3. Fully staffed office within 100 miles of the job site.
   4. At least 10 years verifiable experience in installing specified system.
   5. Capability to provide payment and performance bond to building owner.

B. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
   1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
   2. Notify building owner's representative well in advance of meeting.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

B. Store materials clear of ground and moisture with weather protective covering.

C. Keep combustible materials away from ignition sources.

1.07 SYSTEM DESCRIPTION

All Roof Area: Fully Adhered EPDM

- Firestone V-Force Vapor Barrier adhered to the DensDeck substrate (V-Force Primer is required). Seal at all wood deck penetrations.
- Firestone ISO 95+ GL (Flat or Tapered) adhered to the vapor barrier with Firestone Twin Pack Insulation Adhesive at a rate of 12"/ 6"/ 6" o.c. For the field, perimeter, and corner areas respectively. Max. 4'x4' boards.
- New Firestone .060 LS-FR RubberGard EPDM fully adhered with Single Ply LVOC Bonding Adhesive

1.08 WARRANTY

A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

B. Warranty: Firestone 25 year Medallion Limited Warranty covering membrane, roof insulation, membrane accessories and metal edges.
   1. Limit of Liability: No dollar limitation.
   2. Scope of Coverage: Repair leaks in the roofing system caused by:
      a. Ordinary wear and tear of the elements.
      b. Unintentional damage due to normal rooftop inspections, maintenance, or service.
      c. Manufacturing defect in Firestone brand materials.
      d. Defective workmanship used to install these materials.
      e. Damage due to winds up to 55 mph (88 km/h).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer - Roofing System Basis of Design: Firestone Building Products Co., Carmel, IN. www.firestonebpco.com.
   1. Roofing systems manufactured by others are acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
      a. Specializing in manufacturing the roofing system to be provided.
      b. Minimum ten years of experience manufacturing the roofing system to be provided.
      c. Able to provide a no dollar limit, single source roof system warranty that is backed by corporate assets in excess of one billion dollars.
      d. ISO 9002 certified.
      e. Able to provide isocyanurate insulation and cover boards that are produced in own facilities.

B. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.

C. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
   1. Metal roof edging products by other manufacturers are not acceptable.
   2. Shop-fabricated metal roof edgings are acceptable.

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System:
   1. Membrane: Ethylene propylene diene monomer (EPDM)
   2. Thickness: .060" thick
   3. Membrane Attachment: Fully adhered
   4. Comply with applicable local building code requirements.

B. Insulation: Polyisocyanurate; nominal 20 psi; thickness as noted elsewhere

C. Tapered polyisocyanurate insulation; 1",1/4" and 1/8" slope; or as indicated on drawing. Provide tapered polyisocyanurate drain sumps and crickets as noted.

2.03 EPDM MEMBRANE MATERIALS

A. Roofing and Flashing Membrane: Black (Gray at Entrance Canopy) cured synthetic single-ply membrane composed of ethylene propylene diene terpolymer (EPDM) with the following properties:
   1. Membrane complying with ASTM D 4637, Type I, Class U (unreinforced).
   2. Thickness, nominal: 0.060 inch (and .090" for front canopy roof areas).
   3. Sheet Width: Provide the widest available sheets to minimize field seaming.
   4. Acceptable Product: RubberGard Non-Reinforced Low Slope Fire Retardant (LS-FR) EPDM Membrane by Firestone.

B. Self-Adhesive Flashing Membrane: Semi-cured 45 mil EPDM membrane laminated to 35 mil (0.9 mm) EPDM tape adhesive; QuickSeam Flashing by Firestone.

C. Self-Adhesive Lap Splice Tape: 35 mil (0.9 mm) EPDM-based, formulated for compatibility with EPDM membrane and high-solids primer; QuickSeam 6" Splice Tape by Firestone.

D. Bonding Adhesive: Neoprene-based, formulated for compatibility with EPDM membrane and wide variety of substrate materials, including masonry, wood, and insulation facings; LVOC Bonding Adhesive by Firestone.

E. Insulation Adhesive: Manufacturer's two-part low rise urethane insulation adhesive specifically formulated and approved for the application meeting VOC regulations currently in effect.

F. Roof Walkway Pads: EPDM, 0.30 inch (7.6 mm) thick by 30 by 30 inches (760 by 760 mm) with EPDM tape adhesive strips laminated to the bottom; QuickSeam Walkway Pads by Firestone. Provide around all mechanical areas and walking paths from access doors and hatches.

2.04 ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces complying with ASTM C-1289, Type II, Class 1, with the following additional characteristics:
   1. Thickness:
      a. As specified in the drawings and details min 4" prior to taper to drains.
   2. Compressive Strength:
      a. Insulation: 20 psi (138 kPa) when tested in accordance with ASTM C-1289.
      b. Cover Board: 120 psi when tested in accordance with ASTM C 1289 for cover board.
   3. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.

4. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
5. Acceptable Insulation Product: ISO 95+ GL Polyisocyanurate Insulation by Firestone.
6. Acceptable Cover Board Product: IsoGard HD by Firestone.

B. Insulation Fasteners: Fully adhered and screw/plate fastened as show in the drawings.

2.05 METAL ACCESSORIES

A. Metal Roof Edging and Fascia: Continuous break metal coping serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to parapet nailer with continuous cleat as shown in the details.
   1. Fascia Face Height: as shown in the drawings.
   2. Fascia Material and Finish: Color TBD by architect as shown in the details.
   3. Continuous Cleat: as shown in the details

B. Metal Counterflashings: Provide metal counterflashings as required to properly terminate membrane roofing system at all roof curbs and penetrations at interior of roof.

2.06 ACCESSORY MATERIALS

A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.

All wood in contact with masonry or concrete to be Pressure Treated and installed with stainless steel fasteners.

1. Width: As indicated in the drawings.
2. Thickness: As indicated in the drawings.

PART 3 INSTALLATION

3.01 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation.

C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

D. Perform work using competent and properly equipped personnel.

E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. ***Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).***

G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
   1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
   2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
   3. Protect finished areas of the roofing system from roofing related work traffic and traffic

by other trades.

H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

C. Examine roof substrate to verify that it is properly sloped to drains.

D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes. Coordinate construction with owner.

B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.

D. Wood Nailers: Provide new wood nailers at all perimeters and other locations as required to match the height of the new roofing assembly; reuse existing wood mailers to the greatest extent possible. Attach new wood nailers in accordance with manufacturer’s instructions.
   1. Install with 1/8 inch gap between each length and at each change of direction.
   2. Mechanically fasten to deck to resist force of 200 lbf per linear foot (35 kN/m).

3.04 INSULATION INSTALLATION

A. Evenly apply Firestone V-Force Primer in accordance with manufacturer’s recommended coverage rates and application guidelines.

B. Install Firestone V-Force vapor barrier to the primed substrate allowing for 3” side laps and 6” end laps. Remove the release paper and roll the V-Force Vapor Barrier using a 75 lb. lawn/ carpet roller to ensure adequate adhesion to the substrate. Contractor to note that V-Force VB is under curbing and sealed to wall Air Vapor Barrier.

D. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather. Daily night tie-ins are required and shall consist of a sealed, watertight connection every night, regardless of weather.

C. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not

greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).

3.05 SINGLE-PLY MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.

D. Install membrane adhered to the substrate, with edge securement as specified.

E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.

F. Install all field seams using 6” Quickseam Tape (3” seam tape is not acceptable for this project).

G. Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches (1:6) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.

3.06 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Metal Accessories: Install metal edgings, gravel stops, and copings with horizontal leg of edge member over membrane and flashing over metal onto membrane.
   1. Follow roofing manufacturer's instructions.
   2. Remove protective plastic surface film immediately before installation.
   3. Adhere primary roofing membrane over roof edge nailers to cover the vertical face of the nailers entirely.
   4. Install continuous cleat fastened in accordance with manufacturer’s details and specifications.
   5. Install new copper coping to match existing fascia heights (adding for new cover board thickness) and attach in accordance with manufacturer’s details and specifications.

C. Roofing Expansion Joints: Install acceptable expansion joint detail at all expansion joint locations in accordance with roofing manufacturer’s details and specifications.

D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; raise curbs as required to extend flashing at least 8 inches high above membrane surface.

   1. Use the longest practical flashing pieces.
   2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
   3. Provide termination directly to the vertical substrate.
   4. Provide new metal counterflashings at units, walls, and other areas as required to properly terminate roofing system.

E. Roof Drains: Provide new drains as specified. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations**.**

F. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.

3.07 FINISHING AND WALKWAY INSTALLATION

A. Install walkway pads around mechanical equipment.

B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch (25 mm) and maximum of 3.0 inches (75 mm) from each other to allow for drainage.
   1. Do not install walkway pads over any seams.

3.08 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes.

B. Perform all corrections necessary for issuance of warranty.

3.09 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.10 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

SECTION 07 62 00

Through Wall Penetration
FLASHING PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flashing panels to weatherproof plumbing, mechanical and electrical penetrations in exterior walls.

1.2 RELATED SECTIONS

A. Section 23 00 00 & 22 00 00 -Mechanical: Plumbing piping, venting.

B. Section 26 00 00 - Electrical: Electrical boxes.

1.3 REFERENCES

A. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.

B. ASTM D 638 – Standard Test Method for Tensile Properties of Plastics.

C. ASTM D 792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

D. ASTM D 1505 – Standard Test Method for Density of Plastics by the Density-Gradient Technique.

E. ASTM D 2240 – Standard Test Method for Rubber Property—Durometer Hardness.

1.4 SUBMITTALS

A. Comply with Section 01330 (01 33 00) – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Warranty: Submit manufacturer's standard warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

1.6 WARRANTY

A. Warranty Period: 10 years.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Quickflash Weatherproofing Products, Inc., 4129 Wagon Trail Avenue, Las Vegas, Nevada 89118. Phone (702) 614-6100. Fax (702) 614-4090. Website www.quickflashproducts.com. E-mail qfinfo@quickflashproducts.com.

2.2 FLASHING PANELS

A. Flashing Panels: Quickflash Weatherproofing Flashing Panels.

B. Plumbing Flashing Panels:
   1. Materials:
      a. Panel: Combination of high-density polyethylene (HDPE) and low-density polyethylene (LDPE).
         1) HDPE, Specific Gravity, ASTM D 1505: 0.953 g/cm^3.
         2) HDPE, Tensile Strength at Yield, ASTM D 638: 3,100 psi.
         3) LDPE, Specific Gravity, ASTM D 792: 0.917 g/cm^3.
         4) LDPE, Tensile Strength at Yield, ASTM D 638: 1,300 psi.
      b. Weatherproof Seal: Thermoplastic elastomer.
         1) Hardness, ASTM D 2240, Shore A, 10 Seconds: 46.
         2) Specific Gravity, ASTM D 792: 1.05 g/cm^3.
         3) Tensile Strength, ASTM D 412: 490 psi.
   2. Model: P-50.
      a. Fits: 1/2-inch to 3/4-inch pipes; copper, rigid, PVC, and ABS.
      b. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
   3. Model: P-100.
      a. Fits: 1-inch to 1-1/4-inch pipes; copper, rigid, PVC, and ABS.
      b. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
   4. Model: P-150.
      a. Fits: 1-1/2-inch to 1-3/4-inch pipes; copper, rigid, PVC, and ABS.
      b. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
   5. Model: P-200.
      a. Fits: 2-inch to 2-1/2-inch pipes; copper, rigid, PVC, and ABS.
      b. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
   6. Model: P-300.
      a. Fits: 3-inch pipes, ABS.
      b. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
   7. Model: P-400.
      a. Fits: 4-inch pipes, ABS.

b. Size: 12-1/2 inches by 12-1/2 inches by 3/32 inch.

8. Model: P-600.
   a. Fits: 6-inch sheet metal duct.
   b. Size: 12-1/2 inches by 12-1/2 inches by 3/32 inch.
9. Model: P-2PS.
   a. Fits: Cut out center to fit 1/2-inch to 2-inch copper pipes with exterior tees sweated on.
   b. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch. 2-piece panel.

C. Electrical Flashing Panels:
1. Material: Thermoplastic elastomer.
   a. Hardness, ASTM D 2240, Shore A, 10 Seconds: 93.
   b. Specific Gravity, ASTM D 792: 1.05 g/cm^3.
   c. Tensile Strength, ASTM D 412: 1,300 psi.
2. Model: E-3/0 B, electrical 3/0 box flashing panel.
   a. Use: 3-coat stucco and lap siding.
   b. Fits: Specified electrical 3/0 plastic boxes.
   c. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
3. Model: E-4/0 B, electrical 4/0 box flashing panel.
   a. Use: 3-coat stucco and lap siding.
   b. Fits: Specified electrical 4/0 plastic boxes.
   c. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
4. Model: E-PC 3/0, electrical pancake 3/0 box flashing panel.
   a. Use: 3-coat stucco and lap siding.
   b. Fits: Specified electrical pancake 3/0 metal boxes.
   c. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
5. Model: E-PC 4/0, electrical pancake 4/0 box flashing panel.
   a. Use: 3-coat stucco and lap siding.
   b. Fits: Specified electrical pancake 4/0 metal boxes.
   c. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
6. Model: E-SGB, electrical single-gang box flashing panel.
   a. Use: 3-coat stucco and lap siding.
   b. Fits: Specified electrical single-gang plastic boxes.
   c. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.
7. Model: E-SGR, electrical single-gang 1/2-inch raised-plaster-ring cover flashing panel.
   a. Use: 3-coat stucco and lap siding.
   b. Fits: Specified electrical single-gang raised-plastic-ring cover.
   c. Size: 11-1/8 inches by 11-1/8 inches by 3/32 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive flashing panels.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 PREPARATION

A. Copper Pipes:
   1. Heat sweat copper pipes before installation of flashing panels.

3.3 INSTALLATION

A. Install flashing panels in accordance with manufacturer's instructions.

B. Plumbing Flashing Panels, 1 Piece:
   1. Select flashing panel required for specific pipe sizes.
   2. Push flashing panel over pipe with label facing to exterior to form weatherproof seal around pipe.
   3. Nail flashing panels to walls with corrosion-resistant nails at top of panels.

C. Electrical Flashing Panels:
   1. Select flashing panel required for specific electrical boxes.
   2. Push flashing panel over electrical box with label facing to exterior to form weatherproof seal around box.
   3. Ensure flashing panel collar edge is flush with electrical box opening edge.
   4. Nail flashing panels to walls with corrosion-resistant nails at top of panels.

D. Weather Barriers:
   1. Place weather barrier up behind bottom of flashing panel to bottom of pipe or electrical box.
   2. Place second layer of weather barrier over top of flashing panel to bottom front edge or further down.

3.4 PROTECTION

A. Protect installed flashing panels from damage during construction.

END OF SECTION

SECTION 07 81 50

SPRAYED CEMENTITIOUS FIREPROOFING

PART 1 - GENERAL

1.0 DESCRIPTION OF WORK: Spray fireproofing of steel structure (columns and beams and as indicated on drawings) to provide required amount of protection, in hours, based upon the Building Codes described on the Cover Sheet and within the construction documents. Work to include, but is not limited to:

a. The protection of exposed steel members

1.01 SECTION INCLUDES

A. Cementitious one (1) hour spray-on fireproofing of structural steel with clean up of all areas affected by the work of this section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Fire Stopping: Section 07840

1.03 REFERENCES:

A. ASTM E 84 - Surface Burning Characteristics
B. ASTM E 119 - Standard Methods of Fire Tests of Building Construction and Materials
C. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C
D. ASTM E 736 - Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
E. ASTM E 761 - Test Method for Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members
F. ASTM E 859 - Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members
G. ASTM E 937 - Corrosion Resistance
H. UBC Standard 7-6 - "Thickness and Density Determination for Spray-Applied Fireproofing"
I. UL - "Fire Resistance Directory"

1.04 QUALITY ASSURANCE

A. The applicator shall be licensed (or otherwise approved) by the manufacturer of the fireproofing materials and have 3 years experience in spraying fireproofing on similar projects.
B. Products, execution and fireproofing material thickness and density shall conform to the applicable IBC 2003, UL "Fire Resistance Directory" and UL test reports or to this specification, which ever is more stringent.

1.05 SUBMITTALS

A. Submit manufacturer's product literature, test reports, and application instructions for each fireproofing material to be used. All test reports shall be representative of current application standards. All test reports shall indicate all materials not in the original fireproofing bags to be

added by the applicator. The test report shall indicate concentration and quantity added for the specimens prepared.

B. After manufacturer approval and prior to application, submit table showing the thickness, density and UL Design Number to be used for each condition. Submit any laboratory test reports used in this table not included in the current UL Fire Resistance Directory.

C. LEED Submittals: Complete the LEED Materials Documentation Sheet and provide manufacturers' product data for construction adhesives and sealants, including printed statement of VOC content and MSDS Sheets.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver fireproofing material in manufacturer's original, unopened packaging, clearly identified with manufacturer's name, brand, batch number and UL label.

B. Store materials above ground in a dry location, protected from the weather. Discard and remove from jobsite all materials exposed to moisture or otherwise damaged or deteriorated.

1.07 PROJECT CONDITIONS

A. Maintain temperature of substrate and ambient air at 40 degrees F minimum for 24 hours before, during and after application of fireproofing. If required, use heaters to maintain minimum temperatures.

B. Provide natural or mechanical ventilation to allow proper curing and drying of the sprayed material during and after its application.

1.08 MOCK-UP

A. Install the proposed materials to an area not less than one bay, demonstrating typical conditions present on the project.

B. Comply with project requirements as to thickness and density. Testing lab to measure density of mockup.

C. The mock-up area shall be inspected by the architect prior to proceeding with the work of this section. The mock-up area shall not be disturbed or covered until the completion of the work, unless ordered by the architect.

D. All work of this section shall be in accordance with the approved mock-up.

1.09 WARRANTY

A. Provide warranty that fireproofing will remain free of cracking, dusting, flaking and loss of bond for a period of 2 years and that failed areas will be repaired to the satisfaction of the owner at no additional cost.

PART 2 - MATERIALS

2.01 ACCEPTABLE MANUFACTURERS: Products which meet the performance required in this specification:

A. A.W.R Grace or Equal.

1. 1st floor beams, columns and bracing , Monokote Z-106/HY Medium Density, three (3) hour rating.

2.02 MATERIALS

A. Install materials with the following performance characteristics:

	Standard (15# Density)
Minimum Individual and Average Density (unless higher in the UL Fire Resistance Directory)	15 pcf
Compressive Strength ASTM E-761	1,200 psf
Bond Strength ASTM E736	200 psf

2. Flame Spread of “0" per ASTM E-84;
3. Classified as to fire resistance in accordance with the designs in the UL "Fire Resistance Directory" using ASTM E-119;
4. Non-combustible per ASTM E-136

5. Maximum allowable weight loss shall be 0.005 grams/sq. ft. when tested under ASTM E-859;
6. Fireproofing shall not promote corrosion when measured by ASTM E-937. Testing shall evaluate “as applied” conditions including any accelerators added at the mixer or nozzle.

B. Fireproofing materials shall contain no asbestos and be formulated to be applied with a wet-slurry, not sprayed fibers with water added at the application site.

C. Water shall be potable and free of substances which would adversely affect fireproofing materials.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean substrates of rust, mill scale, paint, primers, dirt, dust, grease, oil and other substances which may affect the bond strength.
B. Painted or primed steel members shall be treated following the requirements in the UL Fire Resistance Directory.

3.03 INSTALLATION

A. Coordinate installation of fireproofing with other Work in order to minimize the need to cut or remove fireproofing.

B. Mix and apply fireproofing materials in accordance with manufacturer's printed instructions and fire-resistive ratings specified. Apply to all areas requiring fireproofing, as shown on the Drawings. Thickness and density, as measured by UBC Standard 7-6, to comply with the specifications and UL "Fire Resistance Directory".

C. Protect fireproofing until permanent cover is installed, or until completion where exposed to view in the completed Work.

3.04 FIELD QUALITY CONTROL

A. As the work progresses, the Testing Agency shall perform thickness and density testing using UBC Standard 7-6. The results of that testing shall be made available to contractor and architect at the completion of each Test Area. The Testing Agency shall perform bond tests, if required, using ASTM E 736.

3.05 CLEANING

A. After completion of each day's work, remove overspray materials and clean exposed surfaces to remove evidence of soiling by fireproofing materials.

END OF SECTION

SECTION 07 84 13
FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

A. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

B. Safing slot gaps between edge of floor slabs and curtain walls.

C. Openings between structurally separate sections of wall or floors.

D. Gaps between the top of walls and ceilings or roof assemblies.

E. Expansion joints in walls and floors.

F. Openings and penetrations in fire-rated partitions or walls containing fire doors.

G. Openings around structural members which penetrate floors or walls.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 04 20 00 - Unit Masonry
3. Section 07 90 00 - Joint Sealants
4. Section 09 20 00 - Plaster and Gypsum Board
5. Section 13 48 00 - Sound, Vibration and Seismic Control
6. Section 21 00 00 - Fire Suppression
7. Section 22 00 00 - Plumbing
8. Section 23 00 00 - Heating, Ventilating, and Air Conditioning (HVAC)
9. Section 26 00 00 - Electrical
10. Section 26 00 00 – Communications

1.05 REFERENCES

A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Test Requirements: UL 1479, “Fire Tests of Through-Penetration Firestops”

C. Test Requirements: UL 2079, “Tests for Fire Resistance of Building Joint Systems”

D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:
   a. Firestop Devices (XHJI)
   b. Fire Resistance Ratings (BXRH)
   c. Through-Penetration Firestop Systems (XHEZ)
   d. Fill, Voids, or Cavity Material (XHHW)
   e. Forming Materials (XHKU)
   f. Joint Systems (XHBN)
   g. Perimeter Fire Containment Systems (XHDG)

2. Alternate Systems: “Omega Point Laboratories Directory” (updated annually).

E. Test Requirements: ASTM E 1966, “Standard Test Method for Fire Resistive Joint Systems”

F. Test Requirements: ASTM E 2307, “Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus”

G. Inspection Requirements: ASTM E 2174, “Standard Practice for On-site Inspection of Installed Fire Stops”

H. ASTM E 84, “Standard Test Method for Surface Burning Characteristics of Building Materials”

I. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

J. International Building Code (IBC 2009)

K. NFPA 101 - Life Safety Code

L. NFPA 70 - National Electric Code

1.06 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide through-penetration fire stop systems and fire-resistive joint systems that comply with specified requirements of tested systems.

B. Fire stop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed fire stop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Fire stop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified tested firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00.

B. Manufacturer's engineering judgment identification number and document details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor’s name who will install firestop system as described in document.

C. Submit material safety data sheets provided with product delivered to job-site.

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A supplier’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

B. Installation Responsibility: assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.

- NOTE: THE REQUIREMENT FOR A SINGLE SOLE SOURCE FIRESTOP SPECIALTY CONTRACTOR IS A CONDITION OF THE BUILDING PERMIT FROM THE CITY OF PORTLAND AND IS NOT NEGOTIABLE. FIRESTOPPING CANNOT BE INSTALLED ON A TRADE-BY-TRADE BASIS.

C. The work is to be installed by a contractor with at least one of the following qualifications:

FM 4991 Approved Contractor
UL Approved Contractor
Hilti Accredited Fire Stop Specialty Contractor

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 FIRESTOPPING - GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.

D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
3. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.

F. Mold Resistance: Provide penetration firestoppping with mold and mildew resistance rating of 0 as determined by ASTM G21.

G. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma
800-879-8000
www.us.hilti.com
Chris Allington 508-509-8316
Chris.allington@hilti.com

2. Substitution requests shall be considered in accordance with contract provisions.

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable:

1. Hilti Cast-In Place Firestop Device (CP 680-P)
   a. Add Aerator Adaptor when used in conjunction with aerator system.
2. Hilti Tub Box Kit (CP 681) for use with tub installations.
3. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
4. Hilti Speed Sleeve (CP 653) for use with cable penetrations.
5. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
6. Hilti Firestop Block (CFS-BL)

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE)
2. Hilti Self-leveling Firestop Sealant (CP 604)
3. Hilti Fire Foam (CP 620)
4. Hilti Flexible Firestop Sealant (CP 606)
5. Hilti Elastomeric Firestop Sealant (CP 601S)

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti Elastomeric Firestop Sealant (CP 601S)
2. Hilti Flexible Firestop Sealant (CP 606)
3. Hilti Intumescent Firestop Sealant (FS-ONE)

E. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. Hilti Firestop Joint Spray (CFS-SP WB)
2. Hilti Elastomeric Firestop Sealant (CP 601S)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Self-leveling Firestop Sealant (CP 604)

F. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.

1. Hilti Speed Plugs (CP 777)
2. Hilti Speed Strips (CP 767)

G. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE)

H. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE)
2. Hilti Fire Foam (CP 620)
3. Hilti Elastomeric Firestop Sealant (CP 601S)
4. Hilti Flexible Firestop Sealant (CP 606)

I. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti Firestop Putty Stick (CP 618)
2. Hilti Firestop Plug (CFS-PL)

J. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. Hilti Firestop Putty Pad (CP 617)
2. Hilti Firestop Box Insert

K. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti Firestop Collar (CP 643N)
2. Hilti Firestop Collar (CP 644)
3. Hilti Wrap Strips (CP 648E/648S)

L. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti Firestop Mortar (CP 637)
2. Hilti Firestop Block (CFS-BL)
3. Hilti Fire Foam (CP 620)
4. Hilti Firestop Board (CP 675T)

M. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti Firestop Block (CFS-BL)
2. Hilti Firestop Board (CP 675T)

N. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:

1. Hilti Firestop Joint Spray (CFS-SP WB)
2. Hilti Elastomeric Firestop Sealant (CP 601S)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Self-leveling Firestop Sealant (CP 604)

O. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:

1. Hilti CFS-BL Firestop Block
2. Hilti CFS-PL Firestop Plug

P. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

Q. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

C. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.

D. Do not cover up through-penetration fire stop and joint system installations that will become Concealed behind other construction until each installation has been examined by the building inspector.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

E. Manufacturer’s Field Services: During Installation, provide periodic destructive testing inspections to assure proper installation/application. After installation is complete, submit findings in writing indicating whether or not the installation of the tested system identified was installed correctly.

3.05 IDENTIFICATION & DOCUMENTATION

A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.

A.1 The Documentation Form for through penetrations is to include:

1. A Sequential Location Number
2. The Project Name
3. Date of Installation
4. Detailed description of the penetrations location
5. Tested System or Engineered Judgment Number
6. Type of assembly penetrated
7. A detailed description of the size and type of penetrating item
8. Size of opening
9. Number of sides of assemblies addressed
10. Hourly rating to be achieved
11. Installers Name

A.2 The Documentation Form for Construction Joints is to include:

1. A Sequential Location Number
2. The Project Name
3. Date of Installation
4. Detailed description of the Construction Joints location
5. Tested System or Engineered Judgment Number
6. Type of Construction Joint
7. The Width of the Joint
8. The Lineal Footage of the Joint
9. Number of sides addressed
10. Hourly rating to be achieved
11. Installers Name

B. Copies of these documents are to be provided to the general contractor at the completion of the project.

C. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. 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.

3.06 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.07 LABOR USE TO INSTALL FIRESTOP SYSTEMS

A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Solvent-release-curing joint sealants.
5. Acoustical joint sealants.
6. Preformed seals.

1.2 RELATED REQUIREMENTS

A.

1. Division 07 air barrier section for compatibility requirements with air barrier components.
2. Section 07 84 46 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
3. Section 08 85 00 "Glazing Sealants" for sealants for glazing installation, glazing framing perimeters, and structural glazing.

1.3 REFERENCES

A. ASTM International (ASTM): www.astm.org:

1. ASTM C 510 - Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
2. ASTM C 661 - Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.
3. ASTM C 719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
4. ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
5. ASTM C 834 - Specification for Latex Sealants.
6. ASTM C 920 - Specification for Elastomeric Joint Sealants.
7. ASTM C 1087 - Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
8. ASTM C 1193 - Guide for Use of Joint Sealants.
9. ASTM C 1247 - Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.
10. ASTM C 1248 - Test Method for Staining of Porous Substrate by Joint Sealants.
11. ASTM C 1311 - Specification for Solvent Release Sealants.
12. ASTM C 1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
13. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
14. ASTM D 624 - Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

15. ASTM D 2203 - Standard Test Method for Staining from Sealants.
16. ASTM D 2240 - Test Method for Rubber Property - Durometer Hardness.

B. California Department of Public Health: www.cdph.ca.gov

1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

C. NSF International (NSF): www.nsf.org:

1. Standard 51 - Food Equipment Materials.

D. Sealant, Waterproofing, and Restoration Institute (SWRI): www.swrionline.org:

1. SWRI Validation Program.

E. U. S. Environmental Protection Agency (EPA): www.epa.gov:

1. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings.

F. U.S. Food and Drug Administration (FDA): www.fda.gov:

1. 21 CFR 177.2600 - Title 21 Part 177 Indirect Food Additives: Polymers.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

B. Preinstallation Conference: Conduct conference at Project Site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of joint sealant product specified, including:

1. Preparation instructions and recommendations.
2. Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project.

B. Samples for Color Selection: For each joint sealant type.

C. Samples for Verification: For each exterior joint sealant product, for each color selected.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified applicator.

B. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

C. Warranty: Sample of unexecuted manufacturer and installer special warranties.

D. Preconstruction Compatibility and Adhesion Pull Test Reports: From manufacturer. Include written interpretation of reports and recommendations for primers and substrate preparation.

E. Preconstruction field-adhesion test reports.

F. Field quality control adhesion test reports.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Company with minimum of three years experience specializing in work of this section, employing applicators trained for application of joint sealants required for this project, with record of successful completion of projects of similar scope, and approved by manufacturer.

B. Single Source Responsibility: Provide exterior joint sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility and adhesion of joint sealants.

C. Preconstruction Manufacturer Laboratory Compatibility, Staining, and Adhesion Testing: Submit samples of each substrate or adjacent material that will be in contact with or affect joint sealants. Current manufacturer test data of products on matching substrates will be acceptable.

1. Adhesion: Use ASTM C 719 and ASTM C 794 to determine requirements for joint preparation, including cleaning and priming.
2. Compatibility: Use ASTM C 1087 to determine materials forming joints and adjacent materials do not adversely affect sealant materials and do not affect sealant color.
3. Stain Testing: Use ASTM C 510, ASTM C 1248, or ASTM D 2203 to verify non-staining characteristics of proposed sealants on specified substrates.
4. Pre-construction manufacturer laboratory testing is not required when sealant manufacturer can furnish data acceptable to Architect based on previous testing for materials matching those of the Work.

D. Preconstruction Field-Adhesion Testing: Prior to installing joint sealants, field test adhesion to joint substrates using ASTM C 1193 Method A. Verify adhesion is adequate. Modify joint preparation recommendations for failed joints and re-test. Submit written test report.

E. Mockups: Provide joint sealant application within mockups required in other sections identical to specified joint sealants and installation methods.

1.8 DELIVERY, STORAGE AND HANDLING

A. Accept materials on site in manufacturer's unopened original packaging.

B. Store primers and sealants in dry location with ambient temperature range of 60 to 80 deg. F (15 to 27deg. C).

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install primers or sealants when atmospheric temperatures or joint surface temperatures are less than 40 deg. F (4 deg. C).

1.10 SCHEDULING

A. Schedule work so waterproofing, water repellents and preservative finishes are installed after sealants, unless sealant manufacturer approves otherwise in writing.

B. Ensure sealants are cured before covering with other materials.

1.11 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or adhesive or cohesive failure under normal use within warranty period specified.

1. Warranty Period for Silicone Sealants: Five years date of Substantial Completion.

B. Special Installer's Warranty: Original statement on Installer's letterhead in which Installer agrees to repair or replace joint sealants that demonstrate deterioration or failure within warranty period specified.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Provide joint sealant products manufactured by **Tremco, Inc., Commercial Sealants and Waterproofing Division, An RPM Company**, Beachwood OH; (866) 321-6357; email: techresources@tremcoinc.com; www.tremcosealants.com, [or comparable products of other manufacturer approved by Architect in accordance with Instructions to Bidders and Division 01 General Requirements].

2.2 MATERIALS, GENERAL

A. VOC Content for Interior Applications: Provide sealants and sealant primers complying with the following VOC content limits per 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Low-Emitting Sealants for Interior Applications: Provide sealants and sealant primers complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, and with adjacent materials, as demonstrated by sealant manufacturer using ASTM C 1087 testing and related experience.

D. Joint Sealant Standard: Comply with ASTM C 920 and other specified requirements for each joint sealant.

E. Stain Test Characteristics: Where sealants are required to be nonstaining, provide sealants tested per ASTM C 1248 as non-staining on porous joint substrates specified.

2.3 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, Use NT; SWRI validated.

1. Basis of Design Product: **Tremco, Inc., Spectrem 1**.
2. Volatile Organic Compound (VOC) Content: 1 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Staining, ASTM C 1248: None on concrete, marble, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's standard line of not less than 12 colors.

B. Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, Use NT; SWRI validated.

1. Basis of Design Product: **Tremco, Inc., Spectrem 2**.
2. Volatile Organic Compound (VOC) Content: 50 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Staining, ASTM C 1248: None on concrete, marble, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's standard line of not less than 10 colors.

C. Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Basis of Design Product: **Tremco, Inc., Spectrem 3**.
2. Volatile Organic Compound (VOC) Content: 20 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Staining, ASTM C 1248: None on concrete, marble, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's standard line of not less than 15 colors.

D. Multi-Component, Nonsag, Non-Staining, Field-Tintable Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Basis of Design Product: **Tremco, Inc., Spectrem 4-TS**.
2. Volatile Organic Compound (VOC) Content: 20 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Staining, ASTM C 1248: None on concrete, marble, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's standard line of not less than 70 colors.

E. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Basis of Design Product: **Tremco, Inc., Tremsil 200 Sanitary**.

2. Volatile Organic Compound (VOC) Content: 1 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Color: TBD

2.4 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Moisture-Cure, Polyurethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, Use NT; Greenguard certified.

1. Basis of Design Product: **Tremco, Inc., Dymonic 100**.
2. Volatile Organic Compound (VOC) Content: 40 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Tensile Strength ASTM D412: 350 to 450 psi
5. Percent Elongation ASTM D412: 800 to 900%
6. Modulus at 100% ASTM D412: 75 to 85 psi
7. Tear Strength ASTM D412: 65 to 75 psi
8. Smoke Development ASTM E84: 5
9. Color: As selected by Architect from manufacturer's standard line of not less than 20 colors.

B. Single-Component, Nonsag, Moisture-Cure, Polyurethane Hybrid Joint Sealant: ASTM C 920, Type S, Grade NS, Class 35, Use NT; Greenguard certified.

1. Basis of Design Product: **Tremco, Inc., Dymonic FC**.
2. Extrusion Rate ASTM C1183: 93.1 mL/min
3. Weight Loss ASTM C1246: Pass
4. Tack Free Time ASTM C679: 3 to 4 hr
5. Volatile Organic Compound (VOC) Content: 10 g/L maximum.
6. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
7. Color: As selected by Architect from manufacturer's standard line of not less than 15 colors.

C. Single-Component, Nonsag, Polyurethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Basis of Design Product: **Tremco, Inc., Vulkem 116**.
2. Volatile Organic Compound (VOC) Content: 60 g/L maximum.
3. Color: As selected by Architect from manufacturer's standard line of not less than 15 colors.

D. Immersible, Single-Component, Pourable, Traffic Grade Polyurethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 50, Use T and I.

1. Basis of Design Product: **Tremco, Inc., Vulkem 45 SSL**.
2. Volatile Organic Compound (VOC) Content: 110 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Color: As selected by Architect from manufacturer's standard line of not less than 5 colors.

E. Immersible, Multi-Component, Pourable, Traffic-Grade Polyurethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 35, Use T, O, and I.

1. Basis of Design Product: **Tremco, Inc., Vulkem 445SSL**.
2. Tensile Strength, ASTM D 412: 250 psi (1.7 MPa), at 100 percent elongation.
3. Tear Strength, ASTM D 412: 35 pli (6.1 kN/m).
4. Adhesion to Concrete, After Water, ASTM C 794: 28 pli (4.4 kN/m)
5. Hardness, ASTM C 661: 40 durometer Shore A, minimum.
6. Accelerated Weathering, ASTM C 793: Pass.
7. Volatile Organic Compound (VOC) Content: 106 g/L maximum.
8. Color: As selected by Architect from manufacturer's standard line of 70 colors

F. Multi-Component, Non-sag, Polyurethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, Use I.

1. Basis of Design Product: **Tremco, Inc., Dymeric 240 FC**.
2. Volatile Organic Compound (VOC) Content: 0 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Color: As selected by Architect from manufacturer's standard line of not less than 70 colors.

2.5 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Basis of Design Product: **Tremco, Inc., Tremflex 834**.
2. Volatile Organic Compound (VOC) Content: 35 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Color: White, paintable.

2.6 SOLVENT-RELEASE-CURING JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.

1. Basis of Design Product: **Tremco, Inc., Tremco Butyl Sealant**.
2. Volatile Organic Compound (VOC) Content: 250 g/L maximum.
3. Color: As selected by Architect from manufacturer's standard colors.

2.7 ACOUSTICAL SEALANTS

A. **Acoustical/Curtainwall Sealant**: Single-component, non-hardening, non-sag, paintable synthetic rubber-tested to reduce airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing of similar assemblies according to ASTM E 90.

1. Basis of Design Product: **Tremco, Inc., Tremco Acoustical/Curtainwall Sealant**.
2. Volatile Organic Compound (VOC) Content: 160 g/L maximum.
3. Color: White, paintable.

2.8 PRE-FORMED SEALS

A. Preformed Silicone Joint Seals: Manufacturer's standard seal consisting of precured low-modulus silicone extrusion, in sizes to fit applications indicated on Drawings, combined with a neutral-curing liquid silicone sealant for bonding seals to substrates.

1. Basis of Design Product: **Tremco, Inc.; Spectrem SimpleSeal**.

B. Preformed Foam Joint Seals: Manufacturer's standard preformed, pre-compressed, open-cell foam seal manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m), impregnated with water-repellent agent. Provide factory-produced pre-compressed sizes selected to fit joint widths; coated on one side with a pressure-sensitive adhesive.
1. Basis of Design Product: Tremco, illmod 600.
2. Thermal conductivity ASTM C 518: .28-0.30 BTU-in/hr-°F-ft2
3. Thermal resistance ASTM C 518: 3.3-3.6 hr-°F-ft2/BTU
4. Frame spread ASTM E84: 0
5. Smoke development ASTM E84: 5
6. Volatile Organic Compound (VOC) Content: 0 g/L maximum.
7. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
8. Color: Black or Grey.

2.9 JOINT SEALANT ACCESSORIES

A. Cylindrical Sealant Backing: ASTM C 1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for application.

B. Bond Breaker Tape: Polymer tape compatible with joint sealant and adjacent materials and recommended by sealant manufacturer.

C. Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.

D. Cleaners: Chemical cleaners acceptable to joint sealant manufacturer.

E. Masking tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joint profiles and surfaces to determine if work is ready to receive joint sealants. Verify joint dimensions are adequate for development of sealant movement capability. Verify joint surfaces are clean, dry, and adequately cured. Proceed with joint sealant work once conditions meet sealant manufacturer's written recommendations.

3.2 PREPARATION

A. Joint Surface Cleaning: Clean joints prior to installing joint sealants using materials and methods recommended by sealant manufacturer. Comply with ASTM C 1193.

1. Remove curing compounds, laitance, form-release agents, dust, and other contaminants.
2. Clean nonporous and porous surfaces utilizing chemical cleaners acceptable to sealant manufacturer.
3. Protect elements surrounding the Work of this section from damage or disfiguration. Apply masking tape to adjacent surfaces when required to prevent damage to finishes from sealant installation.

3.3 SEALANT APPLICATION

A. Sealant and Primer Installation Standard: Comply with ASTM C 1193 and manufacturer's written instructions.

B. Joint Backing: Select joint backing materials recommended by sealant manufacturer as compatible with sealant and adjacent materials. Install backing material at depth required to produce profile of joint sealant allowing optimal sealant movement.

1. Install joint backing to maintain the following joint ratios:

a. Joints up to 1/2 inch (13 mm) wide: 1:1 width to depth ratio.
b. Joints greater than 1/2 inch (13 mm) wide: 2:1 width to depth ratio; maximum 1/2 inch (13 mm) joint depth.

2. Install bond breaker tape over substrates when sealant backings are not used.

C. Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.

D. Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.

E. Liquid Sealant Application: Install sealants using methods recommended by sealant manufacturer, in depths recommended for application. Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width.

1. Tool sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.
2. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
3. Tool exposed joint surface concave using tooling agents approved by sealant manufacturer for application.

F. Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.

1. Remove masking tape immediately after tooling joint without disturbing seal.
2. Remove excess sealant from surfaces while still uncured.

G. Installation of Acoustical Sealant: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations on both sides of assemblies with a continuous bead of acoustical sealant. Comply with ASTM C 919 and with manufacturer's written recommendations.

H. Installation of Preformed Seals: Install seals immediately after removing protective wrapping. Do not stretch or misshape material. Place seals to provide continuity at ends, turns, and intersections. Apply heat to sealant when recommended by sealant manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Perform adhesion tests in accordance with manufacturer's instructions and with ASTM C 1193, Method A.

1. Perform [5] tests for the first [1000 feet (300 m)] of joint length for each kind of sealant and joint substrate, and one test for each [1000 feet (300 m)] of joint length thereafter or 1 test per each floor per building elevation, minimum.
2. For sealant applied between dissimilar materials, test both sides of joint.

B. Remove sealants failing adhesion test, clean substrates, reapply sealants, and re-test. Test adjacent sealants to failed sealants.

C. Submit report of field adhesion testing to Architect indicating tests, locations, dates, results, and remedial actions taken.

3.5 EXTERIOR JOINT-SEALANT SCHEDULE

A. Exterior concealed transition joints in air barrier.
1. Joint Sealant: Single-component non-sag urethane sealant Dymonic 100 or 3M as part of the system.
2. Compatibility: Compatible with air barrier components specified in Division 07 air barrier section.

B. Exterior construction joints in [cast-in-place] [and] [tilt-up] concrete.
1. Joint Sealant: Single-component non-sag urethane sealant Dymonic 100.
2. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors.

C. Exterior movement joints in concrete unit masonry.
1. Joint Sealant: Single-component non-sag urethane sealant Dymonic 100.
2. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors.

D. Exterior movement joints in brick masonry.
1. Joint Sealant: Single-component non-sag urethane sealant Dymonic 100.
2. Joint-Sealant Color, Vertical Joints: As selected by Architect from manufacturer's standard colors.
3. Joint-Sealant Color, Horizontal Joints: As selected by Architect from manufacturer's full range] [Approved custom match to mortar at horizontal joints.

E. Exterior joints within exterior insulation finish systems (EIFS).
1. Joint Sealant: Single-component non-sag urethane sealant Dymonic FC.
2. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors] [Approved custom match to EIFS colors

F. Exterior exposed joints in metal panel cladding systems.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant Spectrem 1.

2. Joint Sealant: Multi-component neutral-curing non-staining field tintable silicone sealant Spectrem 4-TS.
3. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors.

G. Exterior joints between different materials listed above.
1. Joint Sealant: Single-component non-sag urethane sealant Dymonic 100.
2. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors.

H. Exterior perimeter joints at frames of doors, windows, storefront frames, curtain wall frames, and louvers.
1. Joint Sealant: Single-component non-sag urethane sealant Dymonic 100.
2. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors.

I. Exterior joints within aluminum storefront framing, curtain walls, and window systems:

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant Dymonic 100at perimeter to Precast concrete and metal panels.
2. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors.

J. Exterior joints within structural glazing, aluminum storefront framing, curtain walls, and window systems: Refer to Division 08 Section ["Glazing Sealants"] ["Structural-Sealant-Glazed Curtain Walls"].
1. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors.

END OF SECTION

SECTION 08 11 13

STEEL DOORS AND FRAMES TITLE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Steel doors.

B. Steel frames.

C. Steel sidelights and borrowed lights.

1.2 RELATED SECTIONS

1.3 REFERENCES

A. ASTM A568 - Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.

B. ASTM A591 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hop-Dip Process

C. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

E. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

F. ASTM A1011 - Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

G. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames.

H. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.

I. ANSI/SDI A250.6 Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

J. ANSI/SDI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 1998.

K. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

L. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames (Formerly SDI-105).

M. DHI A115.1G - Installation Guide for Doors and Hardware.

N. SDI 111 - Recommended Standard Details for Steel Doors & Frames.

O. ANSI/NFPA 252 - Fire Tests of Door Assemblies.

P. ANSI/UL 10B - Fire Tests of Door Assemblies.

Q. ANSI/UL 10C - Positive Pressure Fire Tests of Door Assemblies.

R. ANSI/UL 1784 - Air Leakage Tests of Door Assemblies

S. UL - Building Materials Directory; Underwriters Laboratories Inc.

T. WH - Certification Listings; Warnock Hersey International Inc.

U. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Submit manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Certificates:
1. Provide manufacturer's certification that products comply with referenced standards as applicable.
2. Provide evidence of manufacturer's membership in the Steel Door Institute.

D. Shop Drawings:
1. Show all openings in the door schedule and/or the Drawings.
2. Provide details of door design, door construction details and methods of assembling sections, hardware locations, anchorage and fastening methods, door frame types and details, anchor types and spacing, and finish requirements.
3. Provide door, frame, and hardware schedule in accordance with SDI 111.

E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.

F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and finishes.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide all products from a single manufacturer who is a member of the Steel Door Institute.

B. Doors and frames shall conform to the requirements of ANSI A250.8-(R2008) (SDI-100) and other specifications herein named.

C. Fire Rated Doors and Frames: Ratings as indicated on Door Schedule, when tested in

accordance with NFPA 252 or UL 10C.
1. Labeled by UL, WH, or other agency acceptable to the authority having jurisdiction.
2. Stairwell Doors: 250 degrees F (121 degrees C) or 450 degrees F (232 degrees C) temperature rise rating as well as the required fire rating.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Products shall be marked with Architect's opening number on all doors, frames, misc. parts and cartons.

B. Upon delivery, inspect all materials for damage; notify shipper and supplier if damage is found.

C. Protect products from moisture, construction traffic, and damage.
1. Store vertically under cover.
2. Place units on 4 inch (102 mm) high wood sills or in a manner that will prevent rust or damage.
3. Do not use non-vented plastic or canvas shelters.
4. Should wrappers become wet, remove immediately.
5. Provide 1/2 inch (6 mm) space between doors to promote air circulation.

1.7 COORDINATION

A. Coordinate with door opening construction and door frame and door hardware installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Products shall be manufactured by a member of the Steel Door Institute, 30200 Detroit Road, Cleveland, Ohio 44145. ASD. Tel: (440) 899-0010, Fax: (440) 892-1404. Steel Door Institute Members are as follows:
1. Black Mountain Door.
2. Ceco Door Products.
3. Curries Company.
4. Deansteel Manufacturing Co.
5. Door Components, Inc.
6. Mesker Door, Inc.
7. MPI Manufacturing.
8. Pioneer Industries, Inc.
9. Republic.
10. Security Metal Products Corp.
11. Steelcraft.

B. Substitutions: Not permitted.

2.2 MATERIALS

A. Doors, frames, frame anchors, and hardware reinforcing for each of the levels and models specified shall be provided to meet the requirements of the performance levels specified. The material used in manufacturing these products and components shall comply with ANSI/SDI A250.8. Hardware reinforcing on doors and frames shall comply with ANSI/SDI A250.6. The physical performance levels shall be in accordance with ANSI/SDI A250.4.

B. All steels used to manufacture doors, frames, anchors, and accessories shall meet at

least one or more of the following requirements:
1. Cold rolled steel shall conform to ASTM A1008 and A568.
2. Hot rolled, pickled and oiled steel shall comply with ASTM A1011 and A568.
3. Hot dipped zinc coated steel shall be of the alloyed type and comply with ASTM A924 and A653.
4. Steel Sheet, Electrolytic Zinc-Coated shall conform to ASTM A591.

2.3 FRAMES

A. Provide Levels and Models in accordance with ANSI/SDI A250.8 as indicated in the door schedule.

B. Interior frames: Frame configuration and depth as indicated. Minimum thickness as follows:
   1. Level 1 Standard duty: For use with:
      a. Door Model 1 (full flush design): 0.042 inch (1.0 mm) minimum steel frame thickness.
      b. Door Model 2 (seamless design): 0.042 inch (1.0 mm) minimum steel frame thickness.
   2. Level 2 Heavy duty: For use with:
      a. Door Model 1 (full flush design): 0.053 inch (1.3 mm) minimum steel frame thickness.
      b. Door Model 2 (seamless design): 0.053 inch (1.3 mm) minimum steel frame thickness.
   3. Level 3 Extra heavy-duty: For use with:
      a. Door Model 1 (full flush design): 0.053 inch (1.3 mm) minimum steel frame thickness.
      b. Door Model 2 (seamless design): 0.053 inch (1.3 mm) minimum steel frame thickness.
      c. Door Model 3, 0.067 inch (1.7 mm) minimum steel frame thickness.

C. Exterior frames: Provide in accordance with ANSI/SDI A250.8 in the frame configuration and depth as indicated on the Drawings. Minimum thickness as follows:
   1. Level 1 Standard duty: For use with:
      a. Door Model 1 (full flush design): 0.042 inch (1.0 mm) minimum steel frame thickness.
      b. Door Model 2 (seamless design): 0.042 inch (1.0 mm) minimum steel frame thickness.
   2. Level 2 Heavy duty: For use with:
      a. Door Model 1 (full flush design): 0.053 inch (1.3 mm) minimum steel frame thickness.
      b. Door Model 2 (seamless design): 0.053 inch (1.3 mm) minimum steel frame thickness.
   3. Level 3 Extra heavy-duty: For use with:
      a. Door Model 1 (full flush design): 0.053 inch (1.3 mm) minimum steel frame thickness.
      b. Door Model 2 (seamless design): 0.053 inch (1.3 mm) minimum steel frame thickness.
      c. Door Model 3 (stile and rail design): 0.067 inch (1.7 mm) minimum steel frame thickness.
   4. Level 4 Maximum-duty: For use with:
      a. Door Model 1 (full flush design): 0.067 inch (1.7 mm) minimum steel frame thickness.
      b. Door Model 2 (seamless design): 0.067 inch (1.7 mm) minimum steel frame thickness.

D. Provide units of galvanized steel where indicated on the door schedule.

E. Provide units of galvanized steel in the following locations:
   1. Exterior openings, as noted on door schedule.
   2. Kitchens, as noted on door schedule.
   3. Toilets, as noted on door schedule.
   4. Washrooms, as noted on door schedule.
   5. Locker rooms, as noted on door schedule.
   6. Showers, as noted on door schedule.
   7. Laboratories, as noted on door schedule.

F. Provide knockdown field assembled type frames unless otherwise indicated.

G. Provide face welded type frames unless otherwise indicated.

H. Provide frames, other than slip-on drywall type with a minimum of three anchors per jamb suitable for the adjoining wall construction. Provide anchors of not less than 0.042 inch (1.0 mm) in thickness or 0.167 inch (4.2 mm) diameter wire. Frames over 7 feet 6 inches (2286 mm) shall be provided with an additional anchor per jamb.

I. Slip-on drywall frame anchors shall be as provided by the manufacturer to assure performance specified.

J. Base anchors shall be provided, other than slip-on drywall type, with minimum thickness of 0.042 inch (1.0mm). For existing masonry wall conditions that do not allow for the use of a floor anchor, an additional jamb anchor shall be provided.

K. Prepare all frames for all mortise template hardware and reinforced only for surface mounted hardware. Drilling and/or tapping shall be completed by others.

L. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.

M. Provide glazing stops and beads where glazed lights are indicated.

2.4 DOORS

A. Exterior doors: Provide exterior doors in accordance with ANSI/SDI A250.8 and in the configuration and size as indicated on the door schedule:
   1. Level 1 - Standard duty 1-3/8 inches (34.9 mm):
      a. Model 1 - Full flush
      b. Model 2 - Seamless
   2. Level 1 - Standard duty 1-3/4 inches (44.5 mm):
      a. Model 1 - Full flush
      b. Model 2 - Seamless
   3. Level 2 - Heavy duty 1-3/4 inches (44.5 mm):
      a. Model 1 - Full flush
      b. Model 2 - Seamless
   4. Level 3 - Extra heavy-duty 1-3/4 inches (44.5 mm):
      a. Model 1 - Full flush
      b. Model 2 - Seamless
      c. Model 3 - Stile and rail
   5. Level 4 - Maximum-duty 1-3/4 inches (44.5 mm):
      a. Model 1 - Full flush
      b. Model 2 - Seamless

B. Face steel sheet shall meet at least one or more of the following requirements:
   1. Level 1
      a. Model 1 - 0.032 inch (0.8 mm) minimum thickness
      b. Model 2 - 0.032 inch (0.8 mm) minimum thickness

2. Level 2
   a. Model 1 - 0.042 inch (1.0 mm) minimum thickness
   b. Model 2 - 0.042 inch (1.0 mm) minimum thickness
3. Level 3
   a. Model 1 - 0.053 inch (1.3 mm) minimum thickness
   b. Model 2 - 0.053 inch (1.3 mm) minimum thickness
   c. Model 3 - 0.053 inch (1.3 mm) minimum thickness
4. Level 4
   a. Model 1 - 0.067 inch (1.7 mm) minimum thickness
   b. Model 2 - 0.067 inch (1.7 mm) minimum thickness

C. End closure: The top and bottom of the doors shall be closed with channels or closures. The channels or closures shall have a minimum material thickness of 0.042 inch (1.0 mm).
   1. Inverted closure channels: Set flange edges flush with door top/bottom.
   2. Flush closure channels: Set back face of channel web flush with door top/bottom.

D. Core: Provide in accordance with ANSI/SDI A250.8.

E. Door edge design: Provide in accordance with ANSI/SDI A250.8.

F. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.

G. Provide louvers and vision lights where indicated on the Drawings in accordance with ANSI/SDI A250.8.

H. Provide steel astragals where indicated on the Drawings or where required by the manufacturer's listing.

2.5 FABRICATION

A. Fabricate doors and frames in accordance with ANSI/SDI A250.8.

B. Prime finish: Doors and frames shall be thoroughly cleaned, and chemically treated to ensure maximum paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on. The finish shall meet the requirements for acceptance stated in ANSI/SDI A250.10 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

C. Factory applied finish: Meet the performance requirements and acceptance criteria as stated in ANSI/SDI A250.3. Color shall be:
   1. As selected from the manufacturers standard colors.
   2. Custom color as selected by the Architect.

D. Design clearances: Fabricate doors and frames to maintain the following clearances:
   1. The clearance between the door and frame shall be 1/8 inch (3.2 mm) in the case of both single swing and pairs of doors.
   2. The clearance between the meeting edges of pairs of doors shall be 3/16 inch (4.8 mm) plus or minus 1/16 inch (1.6 mm). For fire rated applications, the clearances between the meeting edges of pairs of doors shall be 1/8 inch (3.2 mm) plus or minus 1/16 inch (1.6 mm).
   3. The clearance measured from the bottom of the door to the bottom of the frame (undercut) shall be a maximum of 3/4 inch (19.1 mm) unless otherwise specified. Fire door undercuts shall comply with ANSI/NFPA 80, "Fire Doors and Fire Windows."

4. The clearance between the face of the door and the stop shall be 1/16 inch (1.6 mm) to 3/32 inch (2.4 mm).
5. All clearances shall be, unless otherwise specified in this document, subject to a tolerance of plus or minus 1/32 inch (0.8 mm).
6. The clearance at the bottom shall be 5/8 inch (15.8 mm).
7. The clearance at the bottom shall be 3/4 inch (19.1 mm).
8. The clearance between the face of the door and doorstop shall be 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm).
9. All clearances shall be, unless otherwise specified, subject to a tolerance of plus or minus 1/32 inch (0.8 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are suitable before beginning installation of frames. Do not begin installation until conditions have been properly prepared.
   1. Verify that completed openings to receive knock-down wrap-around frames are of correct size and thickness.
   2. Verify that completed concrete or masonry openings to receive butt type frames are of correct size.
   3. Verify that drywall construction walls are the correct thickness.

B. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install frames plumb, level, rigid, and in true alignment in accordance with ANSI A250.11.

B. Inspect and install fire rated doors and frames in accordance with NFPA 80.

C. All frames other than slip-on types shall be fastened to the adjacent structure so as to retain their position and stability. Drywall slip-on frames shall be installed in prepared wall openings in accordance with manufacturer's instructions.

D. Install frames as masonry is laid-up. Fill welded wrap-around frames in masonry construction solid with grout. Brace or fasten frame in such a way to prevent pressure of the grout from deforming frame. Coordinate with work specified in Section 04 20 00.

E. Install frames in stucco construction as work progresses. Fill welded wrap-around frames solid with grout where indicated. Brace or fasten frame in such a way to prevent pressure of the grout from deforming frame. Coordinate with work specified in Section 09 24 00.

F. Grout shall be mixed to provide a 4 inch (102 mm) maximum slump consistency, hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.

G. If additives are used in masonry or plaster work during cold weather, field coat the inside of steel frames with a bituminous compound to prevent corrosion.

H. Doors shall be installed and fastened to maintain alignment with frames to achieve maximum operational effectiveness and appearance. Doors shall be adjusted to maintain perimeter clearances specified. Shimming shall be performed by the installer as needed to assure the proper clearances are achieved.

3.3 ADJUST AND CLEAN

A. Adjust doors for proper operation, free from binding or other defects.

B. Clean and restore soiled surfaces. Remove scraps and debris and leave site in a clean condition.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 SCHEDULE

A. Refer to Door and Frame Schedule appended to this section.

END OF SECTION

SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALL (RELIANCE-SS SCREW SPLINE CURTAIN WALL)

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: Conditions of the Contract and Drawings apply to Work of this Section.

B. Section Includes:
   1. Aluminum curtain wall systems, complete with reinforcing, shims, anchors, and attachment devices.
   2. Accessories necessary to complete Work.

C. Products Furnished But Not Installed Under this Section: Inserts and anchoring devices that are to be built into structure.

D. Related Sections: Those that apply to the installation of curtain wall systems.

1.02 REFERENCES

A. Aluminum Association (AA):
   1. DAF-45 Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA):
   1. CW-DG-1 Aluminum Curtain Wall Design Guide Manual.
   2. 501.2 Field Check of Metal Curtain Walls for Water Leakage.
   3. 2605 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
   4. 611 Voluntary Specification for Anodized Architectural Aluminum..

C. American National Standards Institute (ANSI):
   1. Z97.1 Specifications and Methods of Test for Safety Glazing Material Used in Buildings.

D. American Society for Testing and Materials (ASTM):
   1. A36 Structural Steel.
   2. A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. A525 General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   4. A526 Sheet Steel, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
   5. B209 Aluminum and Aluminum-Alloy Sheet and Plate.
   6. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
   7. B308 Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
   8. C716 Installing Lock-Strip Gaskets and Infill Glazing Materials.
   9. C920 Elastomeric Joint Sealants.
   10. E283 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
   11. E330 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   12. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   13. E773 Test Method for Seal Durability of Sealed Insulating Glass Units.
   14. E774 Sealed Insulating Glass Units.

E. Consumer Product Safety Commission (CPSC):
   1. 16 CFR 1201 Safety Standard for Architectural Glazing Materials.

F. Federal Specifications (FS):
   1. TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.

G. Glass Association of North America (GANA):
   1. Glazing Manual.

H. Steel Structures Painting Council (SSPC):
   1. SP2 Hand Tool Cleaning.
   2. SP3 Power Tool Cleaning.
   3. Paint 12 Cold-Applied Asphalt Mastic (Extra Thick Film).

1.03 SYSTEM REQUIREMENTS

A. General Standard: In addition to requirements shown or specified, comply with applicable provisions of Aluminum Curtain Wall Design Guide Manual for design, materials, fabrication and installation of component parts.

B. Design Requirements:
   1. Metal stick framed systems with interior and exterior exposed metal framing.
   2. Operable vent with sight line concealed from the exterior. Perimeter members to be integral with window wall framing.
   3. System manufacturer shall provide low profile entrance frames as an integral part of the curtain wall system.
   4. System manufacturer shall provide curtainwall systems, including necessary modifications to meet specified requirements and maintaining visual design concepts.
   5. Fabricate glazing systems for exterior glazing at vision areas and exterior glazing at spandrel areas.
   6. Perimeter conditions shall allow for installation tolerances, expansion and contraction of adjacent materials, and sealant manufacturer's recommended joint design.
   7. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
   8. Requirements shown by details are intended to establish basic dimension of unit, sight lines and profiles of members.
   9. Do not assume glass, sealants, and interior finishes contribute to framing member strength, stiffness, or lateral stability.
   10. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
   11. Allow for expansion and contraction due to structural movement without detriment to appearance or performance.
   12. System shall drain to exterior face of wall, water entering joints and condensation occurring within system by drain holes and gutters of adequate size to evacuate water without infiltration to interior or the top of lower lites of glass.
   13. Provide concealed fastening.
   14. Metal faces are required to be visually flat under all lighting conditions, subject to acceptance of Architect.
   15. Use dense EPDM isolators to maintain adequate compression on glazing material.
   16. Provide uniform color and profile appearance at components exposed to view.
   17. Provide interior dense EPDM [closed cell EPDM sponge] gasket with sealed corners, with maximum 30% compression when glazed, to create a water and air seal. Provide exterior dense EPDM wedge gasket at the verticals and exterior EPDM gasket at the horizontals, with a maximum 30% compression when glazed, to create a water & air seal.
   18. Provide pre-punched pressure plates to ensure correct quantity and spacing of fasteners.
   19. Provide 22 gauge galvanized steel back pan @ spandrel areas. Spandrel area to include insulation with project specific R-value requirements. Spandrel areas should be properly vented and / or weeped to prevent condensation in this area.)
   20. Stresses placed on structural silicone sealants shall be kept within sealant manufacturer's recommended maximum.
   21. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.
   22. Provide two-piece split vertical mullions for screw spline assembly of frames that allows for assembly and sealing of bays in the shop.

C. Performance Requirements:
   1. Air infiltration: Air leakage shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf (300 Pa).
   2. Water Resistance (static): No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 15.0 psf (720 Pa) as defined in AAMA 501.
   3. Water Resistance (dynamic): No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 15.0 psf (720 Pa) as defined in AAMA 501.
   4. Uniform Load: A static air design load of 40 psf (1915 Pa) shall be applied in a positive and negative direction in accordance with ASTM E 330. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
   5. Vertical Live Load: A static test for vertical movement shall be conducted per AAMA 501.7 with vertical displacement using 2 piece horizontal assemblies as allowed by the manufacturer as is pertains to the structural drawings.

D. Structural Requirements:
   1. Wind loading: As dictated in the structural drawings.
   2. Deflection under uniform loading: When tested in accordance with ASTM E330 at design pressure, maximum deflection of exterior member shall not exceed L/175 for spans up to 13'-6" or L/240 + 1/4" for spans greater than 13'-6".
   3. Parallel to wall and corner mullion deflections: 75% of glass edge bite or 3/8 inch, whichever is less.
   4. Compression flanges of flexural members may be assumed to receive effective lateral bracing only from:
      a. Anchors to building structure and
      b. Horizontal glazing rails or interior trim, which are in actual contact with compression flange.
   5. Do not regard points of contra-flexture as lateral braces or as end points of un-braced length; un-braced length is actual distance between effective lateral braces as defined above.
   6. Where framing member reaction is resisted by continuous element, maximum assumed effective length of the resisting element is 4 times bearing length, but not more than 12 inches.

E. Thermal Requirements: Framing systems shall accommodate expansion and contraction movement due to surface temperature differential of 180°F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance or other detrimental effects.

F. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-Factor) shall not be more than .67 Btu/h-ft² (3.80 W/m²-K) (with clear glass), [.44 Btu/h-ft² (2.49 W/m²-K) (with Low-E, e =0.021)]

G. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 65frame and 56 glass (with clear glass) [67 frame and 70 glass (with Low-E, e=.021)].

H. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement, 0.015 x the story height, and 0.025 x the story height.

I. Sound Transmission: When tested to ASTM E90, the Sound Transmission Class (STC) shall not be less than 32 based upon 1" insulating glass (1/4", 1/2" AS, 1/4"); OR, not less than 37 based upon 1" insulating laminated glass (1/4" Lam, 1/2" AS, 1/4" Lam).

J. Interstory (vertical live load movement) in accordance with the project specs and the AAMA 501.7 method. The intermediate chamber beam supporting the mock-up shall be lifted and lowered 1/2". The ystem shall be cycled three (3) times. One (1) cycle shall consist of the chamber beam supporting the system being lifted to the noted dimension, back to start point, then lowered to the noted dimension and back to the start point. Project criteria required the system be left in the full open position and remain at the setting for the remainder of all subsequent testing.

K. Laboratory Testing: Refer to Section 01411 for requirements.]

L. Interface:
   1. Furnish inserts and anchoring devices, which need to be preset and built into structure to appropriate trade.
   2. Supply on timely basis to avoid delay in Work.
   3. Instruct other trades of proper location and position.
   4. Furnish setting drawings, diagrams, templates and installation instructions.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01 30 00.

B. Product Data:
   1. Submit manufacturer's descriptive literature for each manufactured products.
   2. Include information for factory finishes, accessories and other required components.
   3. Include color charts for finish indicating manufacturer's standard colors available for selection.

C. Shop Drawings:
   1. Submit drawings indicating elevations, detailed design, dimensions, member profiles, joint locations, arrangement of units, member connections, and thickness of various components.
   2. Show following items:
      a. Details of special shapes.
      b. Reinforcing.
      c. Drainage details and flow diagrams.
      d. Anchorage system.
      e. Interfacing with building construction.
      f. Provisions for system expansion and contraction
      [g. Thermal breaks.]

4. Indicate glazing details, methods, [locations of various types and thickness of glass] [, emergency breakout locations,] and internal sealant requirements.
5. Clearly indicate locations of exposed fasteners and joints for Architect's acceptance.
6. Clearly show where and how manufacturer's system deviates from Contract Drawings and these Specifications.

D. Mock-up Drawings: Submit drawings for mock-ups.

E. Samples:
1. Submit manufactures samples indicating quality of finish in required colors.
2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
3. Submit samples of structural glazing gaskets, 12 inch lengths.
4. Submit samples of sealants for color selection.

F. Certificates:
1. Submit manufacturer's certification stating that installed system is in compliance with specified requirements.

G. Manufacturer's Instructions: Submit manufacturer's printed installation instructions. [Include detailed instructions describing each step of re-glazing procedures.]

H. Warranty: Submit specified warranties.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility:
1. Provide curtainwall systems that are products of a single manufacturer.

B. Engineer Qualifications: Professional Structural Engineer registered in State where Project is located.
C. Installer Qualifications: Certified in writing by system manufacturer as qualified for specified systems.

[1.06 PRE-INSTALLATION CONFERENCE
A. Conduct pre-installation conference.

B. Conference Purpose and Agenda:
1. Arrange with Architect and representatives of window and sealant manufacturer to visit Project site before beginning glazing operations to analyze site conditions, and inspect surfaces and joints to be sealed in order that recommendations may be made should adverse conditions exist.
2. Discuss following items:
a. Weather conditions under which work will be done.
b. Anticipated frequency and extent of joint movement.
c. Joint design.
d. Glazing procedures.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Comply with requirements of Section 01 65 00 - 01 66 00.
B. Protect finished surfaces to prevent damage.
C. Do not use adhesive papers or sprayed coatings, which become firmly bonded when exposed to sun.
D. Do not leave coating residue on surfaces.
E. Deliver glass units with manufacturer's labels intact on interior side of glass. Ensure labels indicate glass thickness, unit location, glass strength and orientation of units in vertical position.]
F. Protect glass edges and corners to prevent chipping, cracking, and other similar damages.

1.08 PROJECT CONDITIONS
A. Ensure ambient and surface temperatures and joint conditions are suitable for installation of materials.

1.09 WARRANTY

A. Provide warranties in accordance with Section 01 78 36.

B. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from deflective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.

C. Warranty shall cover following:

1. Complete watertight and airtight system installation within specified tolerances.
2. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement or structural loading.
3. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.

D. Provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for 5 years from date of Substantial Completion and agreeing to promptly correct defects.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Subject to compliance with requirements indicated, provide products by one of the following:

1. **Oldcastle BuildingEnvelope®**, Terrell, TX.

B. Substitutions: Submit under provisions of Section 01630, a minimum of 10 days prior to bid date.

Oldcastle BuildingEnvelope® curtainwall systems included in this section are as follows:

RELIANCE-SS WALL -

1” Glazing: 2-1/2" x 6", or 7-1/4" mullion profiles; pressure glazed, front set, exterior glazed, stick wall system.

1/4” Glazing: 2-1/2” x 5-1/4”, or 6-1/2” mullion profiles; pressure glazed, front set, exterior glazed, stick wall system.

1” and 1/4” systems are available with structural silicone glazing (SSG) option.

2.02 FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:

1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:

1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
2. Shapes and sizes to suit installation.
3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Inserts and Anchorage Devices:

1. Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
2. Hot-dip galvanize steel assemblies after fabrication, comply with ASTM A123, 2.0 ounce minimum coating.

D. Fasteners:

1. Non-magnetic stainless steel or cadmium plated steel coated with yellow or silver iridescence plating, compatible with materials being fastened.
2. Series 300 stainless steel for exposed locations. Cadmium plated steel with 0.0005 inch plating thickness and color chromate coated for concealed locations.
3. Provide nuts or washers of design having the means to prevent disengagement; deforming of fastener threads is not acceptable.
4. Provide concealed fasteners wherever possible.
5. For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Shims: Non-staining, non-ferrous, type as recommended by system manufacturer.
G. Protective Coatings: Cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc rich primer complying with FS TT-P-645.
H. Glazing Gaskets:
   1. Compression type design, exterior replaceable, extruded EPDM. Interior is a dense EPDM [closed cell EPDM sponge] gasket.
   2. Comply with ASTM C509 or C864.
   3. Profile and hardness as necessary to maintain uniform pressure for watertight seal.
   4. Manufacturer's standard black color.
I. Internal Sealants: Types recommended by system manufacturer to remain permanently non-hardening, non-migrating and weather-tight.
K. Spandrel Panels and Exterior Column Covers
   1. Type: Aluminum sheet, 1/8 inch thick, suitably reinforced on concealed surface for surface flatness, or prefabricated sandwich panels at manufacturer's option.
   2. Surface flatness: 0.015 inch maximum deviation when measured with 6 inch rule.
   3. Squareness: 0.002 inch maximum for each inch of length at panel edge.
   4. Anchorage: Allow for expansion and contraction, to eliminate oilcanning and distortion.
L. Sunshades:
   1. Type: Extruded aluminum anchors, outriggers, louvers, and fascia.
   2. Shapes: May be chosen from manufacturer's standard shapes shown on website or in Detail Catalog.
   3. Engineering: Manufacturer to verify sufficient strength of wall system to support loads imposed by the sunshade.

2.03 GLASS AND GLAZING ACCESSORIES

A. As supplied by the curtain wall installer and coordinated with the project owner.

2.04 SYSTEM FABRICATION

A. Take accurate field measurements to verify required dimensions prior to fabrication.
B. Location of exposed joints is subject to Architect's acceptance.
C. Provide dense EPDM continuous isolator to separate exterior pressure plates and interior framing members.
D. Fabricate components in accord with approved shop drawings. Remove burrs and ease edges. Shop fabricate to greatest extent practicable to minimize field cutting, splicing, and assembly. Disassemble only to extent necessary for shipping and handling limitations.
E. Steel Components:
   1. Clean surfaces after fabrication and immediately prior to application of primer in accord with SSPC-SP2 or SSPC-SP3 at manufacturer's option.
   2. Apply specified shop coat primer in accord with manufacturer's instructions to provide 2.0 minimum dry film thickness.
F. Fabricate components true to detail and free from defects impairing appearance, strength or durability. [Fabricate custom extrusions indicated and as necessary for complete installation.]
G. Fabricate components to allow for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Ensure joints and connections will be flush and weather-tight. Ensure slip joints make full, tight contact and are weather-tight.
H. Reinforce components as required at anchorage and support points, at joints, and at attachment points for interfacing work.
I. Provide structural reinforcing within framing members where required to maintain rigidity and accommodate design loads.
J. System design and sealants to accommodate internal weep and drainage system not visible to the exterior.
K. Head and sill extrusions act as gutter and weep water to exterior; do not penetrate sections with fasteners.
L. Allow for adequate clearance around perimeter of system to enable proper installation and for thermal movement within system.
M. Separate dissimilar metals with protective coating or preformed separators to prevent contact and corrosion.
N. Provide framing members to rigidly glaze spandrel panels and column covers within framing system.
O. Provide special shapes and filler pieces with tight corners.

2.05 FINISH

A. Organic Coating (high performance fluorocarbon):
   1. Comply with requirements of AAMA 2605.

2. Surfaces cleaned and given conversion coating pre-treatment prior to application of 0.3 mil dry film thickness of epoxy or acrylic primer following recommendations of finish coat manufacturer.
3. Finish coat of 70% minimum fluorocarbon resin fused to primed surfaces at temperature recommended by manufacturer, 1.0 mil minimum dry film thickness.
4. Acceptable coatings are Trinar by Akzo Coatings, Inc.; Nubelar by Glidden Company; Fluoroceram by Morton International, Inc.; Duranar by PPG Industries Inc.; and Fluropon by Valspar Corporation.
5. Provide in either 2, 3, or 4 coat system as required for color selected.
6. Colors as indicated on the drawings and coordinate with the owner.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions and proceed with Work in all specifications and drawings.
B. Verify dimensions, tolerances, and method of attachment with other Work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and applicable provisions of AAMA Aluminum Curtain Wall Design Guide Manual.
B. Align assemblies plumb and level, free of warp or twist, aligning with adjacent Work.
C. Tolerances:
   1. Limit variations from plumb and level:
      a. 1/8 inch in 20'-0" vertically and horizontally.
      b. 1/4 inch in 40'-0" either direction.
   2. Limit offsets in theoretical end-to-end and edge-to-edge alignment:
      a. 1/16 inch where surfaces are flush or less than 1/2 inch out of flush and separated by not more than 2 inches.
      b. 1/8 inch for surfaces separated by more than 2 inches.
   3. Step in face: 1/16 inch maximum.
   4. Jog in alignment: 1/16 inch maximum.
   5. Location: 1/4 inch maximum deviation of any member at any location.
   6. Tolerances are not accumulative.
D. Provide attachments and shims to permanently fasten system to building structure.
E. Anchor securely in place, allowing for required movement, including expansion and contraction.
F. Separate dissimilar materials at contract points, including metal in contact with masonry or concrete surfaces, with protective coating or preformed separators to prevent contact and electrolytic action.
G. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weather-tight construction.
H. Water Drainage: Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building. DO NOT ALLOW FOR WEEPS TO BE PLUGGED WITH SEALANT.
I. Do not apply mullion covers until building is closed in, roofing is installed and no alkaline substances can be washed from building onto curtain wall system.
K. Glazing:
   1. Install glazing gaskets and sealants in accordance with manufacturer's instructions without exception; including surface preparations.
   2. Outside glazed and held in place with extruded aluminum pressure plates anchored to the mullion using Drill-Flex fasteners spaced no greater than 9” on center.
L. Fire-Safing and Curtain Wall Insulation:
   1. Install fire safing and curtain wall insulation as shown in the drawings.

A. Field Tests: Independent testing laboratory will perform air infiltration, water infiltration, and hose test; as indicated by the owner, architect or the Building Code.

3.04 CLEANING

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, and other foreign

materials.

B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08 71 00 – FINISH HARDWARE

PART 1 –GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.02 DESCRIPTION OF WORK

A. The work of this section includes, but is not limited to, the following:

1. Providing hardware for all doors, except doors provided with their own hardware.
2. Providing lock cylinders for all work requiring cylinders.
3. Providing the services of a qualified hardware consultant to prepare detailed schedules of hardware required for the project.

1.03 RELATED WORK

A. Carefully examine all of the Contrast Documents for requirements which affect the work of this section. Other specifications sections which directly relate to the work of this section include, but are not limited to, the following:

1. Section 08100 – Hollow Metal Doors and Frames; work requiring template coordination, metal astragals for fire-rated doors.
2. Section 08210 – Wood Doors; work requiring template coordination, metal astragals for fire-rated doors.

1.04 INTENT

A. A major intent of the work of this section is to provide hardware for every door in the project, except as indicated, so that each door functions correctly for its intended use. Provide only hardware that complies with applicable codes and requirements of authorities having jurisdiction including requirements for barrier–free accessibility.

1.05 QUALITY ASSURANCE

A. Hardware supplier shall have in his employ one or more members of the Door and Hardware Institute to include at least one Certified Architectural Hardware Consultant in good standing, who shall be responsible for preparation of the Finish Hardware Schedule. This Consultant shall be acceptable to the Architect and is to ensure that the intent requirement of this specification is fulfilled, and certify that the work of this section meets or exceeds the requirements specified in this section and the requirements of authorities having jurisdiction.

B. Hardware supplier shall warrant and guarantee, in writing, that hardware supplied is free of defective material and workmanship. Supplier shall further warrant and guarantee for a period of one year from Owner's Use and Occupancy that the hardware shall function in a satisfactory manner without binding, collapse, or dislodging of its parts, provide the installation is made to the manufacturer's recommendations.

C. The hardware supplier shall repair of remedy, without charge, any defect of workmanship or material for which he is responsible hereunder.

1.06 SUBMITTALS

A. Submit the following in accordance with SECTION 01300-SUBMITTALS:

1. Schedule: Submit to the Architect six (6) copies of the complete hardware schedule within the fourteen (14) days after receipt of contract award. Submit therewith complete catalog cuts and descriptive data of all products specifically scheduled therein. No materials shall be ordered or templates issued until the hardware schedule has been approved by the Architect. Form and detail of hardware schedule shall be in vertical format in conformance to the door and hardware industry standards. All hardware sets shall be clearly cross-referenced to the hardware set numbers listed in the specifications.

2. Keying System Submission: Before cylinders are ordered, submit a complete proposed keying system for approval. This should be done after a keying meeting has been held with the owner's representative.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of hardware shall be made to the project by the Hardware Supplier in accordance with the instructions of the General Contractor.

B. The finish hardware shall be delivered to the jobsite and received there by the General Contractor. The General Contractor shall prepare a locked storage room with adequate shelving, for all hardware. The storage room shall be in a dry, secure area, and shall not include storage of other products by other trades.

C. The General Contractor shall furnish the Hardware Supplier with receipts for all hardware and accessory items received, and shall send copies of these receipts to the Architect, if requested.

1.08 REGULATORY REQUIREMENTS

A. Conform to all applicable codes. Provide all throws, projections, coatings, knurling, opening and closing forces, and other special functions required by State and Local Building Codes, and all applicable Handicap Code requirements.

B. For fire rated openings, provide hardware complying with NFPA 80 and NFPA 101 without exception. Provide only hardware tested by UL for the type and size of door installed and fire resistance rating required.

1.09 SPECIAL REQUIREMENTS

A. Hardware Supplier shall determine conditions and materials of all doors and frames for proper application of hardware.

B. The Hardware Schedule shall list the actual product series numbers. Bidders are required to follow the manufacturers' catalog requirement for the actual size of door closers, brackets and holders. All door opening sizes are as noted on the Door Schedule and all hardware shall be in strict accordance with requirements of height, width, and thickness.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Hinges	McKinney Ives	Scranton, PA Indianapolis, IN
Locksets	Sargent Schlage (No Exception)	New Haven, CT Colorado Springs, CO
Exit Devices	Sargent Von Duprin (No Exception)	New Haven, CT Indianapolis, IN
Keying	Medeco (No Exception)	Salem, VA
Door Closers	Sargent LCN (No Exception)	New Haven, CT Princeton, IL
Door Stop	Glynn Johnson Ives Rockwood	Indianapolis, IN New Haven, CT Rockwood, PA
Push/Pulls	Rockwood Ives	Rockwood, PA Indianapolis, IN
Protective Plates	Rockwood Ives	Rockwood, PA Indianapolis, IN
Thresholds/ Weatherstripping/ Rain Drips	NGP Pemko	Memphis, TN Memphis, TN
Silencers	Ives Glynn Johnson Rockwood	New Haven, CT Indianapolis, IN Rockwood, PA

2.02 MATERIALS AND QUALITY

A. All hardware shall be of the best grade of solid metal entirely free from imperfections manufacturer and finish.

B. Qualities, weights, and sizes given herein are the minimum that will be accepted. It is the responsibility of the Hardware Supplier to supply the specified size and weight of hardware and the proper function of hardware in each case and to provide UL approved hardware at all fire rated doors.

C. Provide, as far as possible, locks of one lock manufacturer and hinges of one hinge manufacturer. Modifications to hardware that are necessary to conform to construction shown or specified shall be provided as required for the specified operation and functional features.

2.03 HARDWARE DESIGNATIONS

A. All items of hardware are referenced by manufacturer's names and numbers. The manufacturer's names and numbers are used to define the function, design, and the quality of the material to be supplied.

Substitution of products other than those listed shall be submitted to the Architect at least ten (10) days PRIOR to the bid date. The Architect shall be the sole judge of any proposed substitution.

2.04 TEMPLATES

A. Hardware supplier shall immediately, but not later than three (3) days after approval of his Schedule by the Architect, furnish the General Contractor with complete template information necessary for the fabrication of doors, frames, etc. No templates shall be furnished prior to the approval of the hardware schedule.

2.05 HARDWARE FOR LABELED FIRE DOORS, EXIT DEVICES AND SMOKE DOORS

A. Hardware shall conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Labeling and listing by UL Building Materials Directory, for class of door being used will be accepted as evidence of conformance to these requirements. Install minimum latch throw as specified on label of individual doors. Provide hardware listed by UL except where heavier materials, larger sizes, or better grades are specified herein under paragraph entitled "Hardware Sets". In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may b e submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements. Specific hardware requirements of door or frame manufacturers which exceed sized or weights of hardware herein listed shall be provided with no additional charge.

2.06 KEYS AND KEYING

A. The hardware supplier shall review the specific hardware functions with the Architect and owner at the time of the keying review, to assure the appropriateness of each of the hardware functions. Failure to make this review does not relieve the hardware supplier from providing the proper functions.

B. Key System: All cylinders shall be Masterkeyed and/or Grandmaster Keys: Furnish six (6) keys for each set, if required.

1. Master keys, Grandmaster Keys: Furnish six (6) keys for each set, if required.

2. Furnish three (3) change keys for each cylinder keyed differently; six (6) change keys for each set keyed alike, and in sets where only (2) cylinders are keyed alike, four (4) change keys will be required.

3. All keying is to be done at the factory to avoid duplication of the new cylinders.

4. Master Keys shall be sent to the Owner by registered mail, return receipt required.

5. Supply a bitting list for all change keys and master keys to the Owner.

6. All lock cylinders shall be set to Construction key for use by the Contractor during the construction period. Furnish ten (10) Construction keys and two (2) voiding the Construction key feature.

2.07 FASTENERS

A. Manufacture hardware to conform to published templates, generally prepared for machine screw installation.

B. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Furnish exposed screws to match the hardware finish, or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, except as otherwise indicated.

C. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard manufactured units of the type specified are available with concealed fasteners. Do not use thru-bolts unless specifically approved by the Architect.

D. All hardware shall be installed only with fasteners supplied by manufacturers of specific products.

2.08 PACKING AND MARKING

A. All hardware shall have the required screws, bolts and fastenings necessary for proper installation and shall be wrapped in the same package as the hardware item for which it is intended and shall match finish of hardware with which to be used.

B. Each package shall be clearly labeled indicating the portion of the work for which it is intended.

2.09 ENVIROMENTAL CONCERN FOR PACKGING

A. The hardware shipped to the jobsite is to be packaged in biodegradable packs such as paper or cardboard boxes and wrapping. If non-biodegradable packing such as plastic, plastic bags or large amounts of Styrofoam is utilized, then the Contractor will be responsible for the disposal of the non-biodegradable packing to a licensed or authorized collector for recycling of the non-degradable packing.

2.10 FINISH HARDWARE DESCRIPTION

A. Hardware items shall conform to respective specifications and standards and to requirements specified herein.

B. MATERIALS AND FINISH MATERIALS AND FINISHES SHALL BE:

1. Interior Butts: US26D
2. Door Closers: Sprayed to match hardware finish.
3. Exit Devices: US32D
4. Kick, Push Plates: US32D
5. All other hardware shall be: US26D

C. HINGES

1. Number of hinges per door, two hinges for doors up to and including five feet in height and an additional hinge for each two and one half feet or fraction thereof.

2. Hinges shall be as follows:

Exterior	McKinney	MCK12 HD	
	Ives	112HD	
	McKinney	TA2314	4 ½ x 4 ½ NRP
	Ives	5BB1	4 ½ x 4 ½ NRP
Interior	McKinney	TA2714	4 ½ x 4 ½
	Ives	5BB 1	4 ½ x 4 ½

D. DOOR CLOSERS:

1. Door closers shall have fully hydraulic, full rack and pinion action. Cylinder body shall be 1-1/2" in diameter, and double heat treated pinion shall be 11/16" in diameter.

2. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

3. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and hydraulic back-check.

4. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).

5. Closer arms (and metal covers when specified) shall have a powder coating finish.

6. Provide drop, mounting plates, where required.

7. Do not locate closers on the side of doors facing corridors, passageways or similar type areas. Where it is necessary, due to certain conditions and approval of the Architect, to have closers in corridors, provide such closers with parallel or track type arms.

8. All door closers shall be adjusted by the installer in accordance with the manufacturer's templates and written instructions. Closers with parallel arms shall have back-check features adjusted prior to installation.

9. Closers shall conform to all applicable code requirements relative to setting closing speeds for closers and maximum pressure for operating interior and exterior doors.

10. Door closers meeting this specification are as follows: (No Exception)

	LCN	Sargent
Exterior	4111S-CUSH	281 – CPS
	4111S-H-CUSH	281 – CPSH
Interior	4011	1431

E. EXIT DEVICES:

1. Shall be Von Duprin or Sargent as follows: (No Exception)

Function	Von Duprin	Sargent
A	EL RX 3327	55 56 8406
B	98F-NL x 996 NL	12 8804 ETL
C	98F-BE x 996	12 8815 ETL
D	98L-NL x 996	8804 ETL
E	3327 x 360L	8413 ETL
F	33L x 360L	8513 ETL

NOTE: Lever design shall match lock trim

F. LOCKSETS, LATCH SETS, DEADBOLTS:

1. Mortise Lock type shall be, Grade 1
Operational, 2-3/4" backset, six pin cylinder with lever handles.. (No Exception)

Manufacturer	Series	Lever Design
Schlage	L9000	06
Sargent	8200	LNL

Lock functions as indicated in the hardware schedule shall be as follows:

Function	Schlage	Sargent
A (Storeroom)	80	04
B (Office)	50	05
C (Passage)	10	15
D (Classroom)	70	37
E (Privacy)	40	65

Deadbolt style shall be standard duty.

Manufacturer	Schlage	Sargent
F	L9460	4877

G. PUSH PLATES, DOOR PULLS, PUSH/PULL BARS:

1. Shall be as manufactured by Rockwood, Burns or Ives.

a. Push plates shall be 4" x 16" x .050 thickness unless otherwise listed in hardware sets.

Rockwood	70 Series
Ives	8200 Series

b. Door pulls shall be 1" x 10"

Type A	
Rockwood	BF111
Ives	8100

H. KICK PLATES, ARMOR PLATES, MOP PLATES:

1. Kick plates shall be 8 in. high. Armor plates shall be 34 in. high. Mop plates shall be 4 in. high. All plates shall be 2 in. less the width of door. Plates shall be .050 thickness, bevel 4 edges, screws shall be oval head counter-sunk.

I. STOPS, FLUSH BOLTS

1. Shall be furnished at all doors. Wherever and opened door or any item of hardware thereon strikes a wall, at 90 degrees. Provide wall bumpers, unless otherwise indicated in hardware sets.

2. Where wall bumpers cannot be effectively used, a floor stop shall be furnished and installed.

Manufacturer	Wall Bumpers	Floor Stops
Rockwood	409	440, 442
Ives	407 ½	436B, 438B

4. Where flush bolts are called for

Manufacturer	Metal Door	Wood Door
Rockwood	555	557
Ives	FB51	FB61

5. Where Auto flush bolts Coordinator are called for

Manufacturer	Coordinator	Wood Door
Rockwood	2672	2942
Ives	COR52	FB41P

J. ELECTONIC POWER TRANSFER / ELECTRIC STRIKE

1. EPT to be Securitron Model EL-CEPT
2. Power Supply to be Securitron Model BPS-2-24V
3. Electric Strike to be HES 9600 / 9500

K. THRESHOLDS, WEATHERSTIP, SEAL:

1. Thresholds shall be as detailed and furnished on all doors where shown on drawings. Thresholds shall be aluminum unless otherwise indicated. Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants".

2. Weatherstripping shall be furnished on all exterior doors unless otherwise indicated.

Product	Pemko	NGP
Threshold	271A	513
Brush Seal	45062AP	A626A
Door Sweep	315CN	200N
Set Astragals	351C x 351CP	140 x 140P
Astragal	357SP	139SP
Rain Drip	346C	16A
Gasketing	S88	5050

L. KEYING:

1. All cylinders for all locks shall be 12 pin tumbler, key removable core, Maximum Security type cylinder, with 12 key pins located in 3 rows, on 3 intersecting axis, all in one key plug. All keys shall be symmetrical and reversible. They shall not be warded or cut away in the conventional manner and shall not be capable of duplication on any conventional key cutting machine.

2. The keying information shall be obtained from the Owner by the hardware supplier. It is required that for identification, that the key symbols be of the alphanumeric type as recommended in the Nomenclature for Masterkey Systems established by the Door and Hardware Institute.

3. All Cylinders for Project are to be Medeco High Security. No Exception

4. The owner must fill out the factory registration form and one copy of the factory order to allow the hardware supplier to enter the factory order. It is required that at least 3 persons sign the registration form and that those persons be responsible for security and the issuance of keys.

5. Provide a total of three (3) masterkeys for each masterkey group. Each keyed different change shall have at least four (4) keys.

PART 3—EXECUTION

3.01. INSPECTION

1. It shall be the general contractors responsibility to inspect all doors openings and doors to determine that each door and door frame has been properly prepared for the required hardware. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

3.02 PREPARATION

1. All doors and frames, requiring field preparation for finish hardware, shall be carefully mortised, drilled for pilot holes, or tapped for machine screws for all items of finish hardware in accordance with the manufacturers' templates and instructions.

3.03 INSTALLATION/ADJUSTMENT/LOCATION

1. All materials shall be installed in a workmanlike manner following the manufacture's recommended instructions.

2. Exit Devices shall be carefully installed so as to permit friction free operation of crossbar, touch bar, lever. Latching mechanism shall also operate freely without friction or binding.

3. Door Closers shall be installed in accordance with the manufacturer's instructions. Each door closer shall be carefully installed, on each door, at the degree of opening indicated on the hardware schedule. Arm position shall be shown on the instruction sheets and required by the finish hardware schedule.

4. The adjustments for all door closers shall be the installer's responsibility and these adjustments shall be made at the time of installation of the door closer. The closing speed and the latching speed valves, shall be adjusted individually to provide a smooth, continuous closing action without slamming. The delayed action feature or back check valve shall also be adjusted so as to permit the correct delayed action cycle or hydraulic back check valve shall also be adjusted so as the opening cycle. All valves must be properly adjusted at the time of installation. Each door closer has adjustable spring power capable of being adjusted, in the field from size 2 thru 6. It shall be the installers' responsibility to adjust the spring power for each door closer in exact accordance with the spring power adjustment chart illustrated in the door closer installation sheet packed with each door closed.

5. Installation of all other hardware, including locksets, push-pull latches, overhead holders, door stops, plates and other items, shall be carefully coordinated with the hardware schedule and the manufacturer's instruction sheets.

6. Locations for finish hardware shall be in accordance with dimensions listed in the pamphlet "Recommended locations for Builders' Hardware" published by the Door and Hardware Institute.

3.04 PROTECTION

1. All exposed portions of finish hardware shall be carefully protected, by use of cloth, adhesive backed paper or other materials, immediately after installation of the hardware item on the door. The finish shall remain protected until completion of the project. Prior to acceptance of the project by the Architect and owner, the general contractor shall remove the protective material exposing the finish hardware.

3.05 CLEANING

1. It shall be the responsibility of the general contractor to clean all items of finish hardware and to remove any remaining pieces of protective materials and labels.

3.06 INSTRUCTIONS AND TOOLS

1. It shall be the responsibility of the finish hardware supplier to provide installation and repair manuals and adjusting tools, wrenches, etc… for the following operating products.
   a. Locksets (all types)
   b. Exit Devices (all types)
   c. Door Closers

3.07 HARDWARE SETS

1. Each Hardware Set listed below represents the complete hardware requirements for one opening. (Single Door or Pair of Doors). Furnish the quantities required for each set for the work.

HW Set 1

Door 106, 116
Each Leaf to Have: Continuous Hinge, EPT, Exit Device (Type A), ADA Operator, Kick Plate, Threshold

Weather-stripping by Aluminum Door Manufacture

HW Set 2

Door 111
Each To Have: Cylinder as Required

Balance of Hardware by Overhead Door Manufacture

HW Set 3

Door 103, 105
Each Door to Have: Hinges NRP (HW), Exit Device (Function D), Closer, Kick Plate, Threshold, Weather-stripping, Door Bottom, Silencers

HW Set 4

Door 110, 114
Each Door to Have: Hinges NRP, Lockset (Function A), Closer, Kick Plate, Threshold, Weather-stripping, Door Bottom, Silencers

HW Set 5

Door 112, 115
Each Door to Have: Hinges, Lockset (Function D), Closer, Kick Plate, Threshold, Weather-stripping, Door Bottom, Silencers

HW Set 6

Door 107, 117, 118, 119
Each Door To Have: Continuous Hinge, Exit Device (Function F), Closer, Drop Plate, Kick Plate, Threshold

Weather-stripping by Aluminum Door Manufacture

HW Set 7

Door 108, 109, 204, 205, 304, 205, 404
Each Door to Have: Hinges, Exit Device (Function B), Closer, Kick Plate, Stop, Smoke Seal

HW Set 8

Door 101, 102, 104
Each Door To Have: Hinges, Passage Set (Function C), Closer, Stop, Kick Plate, Smoke Seal

HW Set 9

Door 113
Each Door To Have: Hinges, Lockset (Function A), Closer, Kick plate, Smoke Seal, Stop

HW Set 10

Door 201, 202, 203, 301, 302, 303, 401, 402, 403, 501
Each Door to Have: Hinges, Exit Device (Function C), Closer, Kick Plate, Stop, Smoke Seal

HW Set 11

Door 405, 407
Each Leaf to Have: Continuous Hinge, Exit Device (Function E), Closer, Drop Plate, Threshold

Weather-stripping by Aluminum Door Manufacture

HW Set 12

Door 406
Each Door to Have: Continuous Hinge, Lockset (Function D), Closer, Drop Plate, Threshold

Weather-stripping by Aluminum Door Manufacture

HW Set 13

Door 408
Active Leaf: Hinges, Lockset (Function A), Closer, Kick Plate, Silencers
Inactive Leaf: Hinges, Flush Bolts, Kick Plate, Stop

HW Set 14

Door 409, 502, 503
Each Door to Have: Hinges, Lockset (Function A), Closer, Weather-stripping, Door Bottom, Threshold

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES ON METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Description of Work: Work of this section includes, but is not limited to, the following:
   1. Gypsum board and accessories
   2. Metal studs and furring
   3. Metal shaftwall systems
   4. Metal suspension systems
   5. Sound-rated construction and accessories
   6. Gypsum board finishing
   7. Trim and accessories

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 41 00 Lightgage Metal Framing.
B. Section 06 10 00 Rough Carpentry.
C. Section 07 21 16 Thermal and Acoustic Insulation.
D. Section 07 84 13 Firestopping.
E. Section 09 90 00 Painting

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions with project conditions and materials clearly identified or detailed for each required system.

1.4 SYSTEM REQUIREMENTS

A. Performance Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 under the following conditions:
   1. Gypsum board partitions:
      a. Standard systems: Maximum deflection of l/240 of partition height.
   2. Cavity shaftwall systems: Withstand minimum positive and negative pressure of 5 psf.
   3. Interior suspended ceilings and soffits: Maximum deflection of l/360 of distance between supports.
   4. Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.

B. Fire Resistance Ratings: Where fire resistance classifications are indicated, provide materials and application procedures identical to those listed by UL or tested according to ASTM E119 for type of construction shown.

C. Acoustical Ratings: Where sound ratings are indicated, provide materials and application procedures identical to those tested by manufacturer to achieve Sound Transmission Class (STC) scheduled or indicated in accordance with ASTM E90.

1.5 QUALITY ASSURANCE

A. Reference Standards:
1. Applicable requirements of ASTM C754 for installation of steel framing.
2. Install gypsum board in accordance with applicable requirements and recommendations of Gypsum Association GA 216, "Recommended Specifications for the Application and Finishing of Gypsum Board" except for more stringent requirements of manufacturer.
3. Apply acoustical sealant in accordance with applicable requirements of ASTM C919.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery:
1. Deliver material to site promptly without undue exposure to weather.
2. Deliver in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.

B. Storage:
1. Store above ground in dry, ventilated space.
2. Protect materials from soiling, rusting and damage.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:
1. Do not install gypsum board when ambient temperature is below 40°F.
2. For adhesive attachment of gypsum board, and for finishing of gypsum board, maintain ambient temperature above 55°F from one week prior to attachment or joint treatment, and until joint treatment is complete and dry.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Gypsum Board and Accessories: Listed products establish standard of quality and are manufactured by United States Gypsum Company (USG), Chicago, IL. Or approved equal.

B. Steel Framing and Furring: Company acceptable to installer**.**

C. Grid Suspension Assemblies: Listed products establish standard of quality and are manufactured by United States Gypsum Company (USG), Chicago, IL. Or approved equal.

2.2 BOARD MATERIALS

A. Gypsum Board:
1. ASTM C1396 (Section 5), regular type except where Type X fire-resistant type is indicated or required to meet UL assembly types.
2. Edges: Tapered.
3. Acceptable products:
a. Typical partitions and ceilings: Equivalent to SHEETROCK® brand SW, FIRECODE® or FIRECODE® "C" Core gypsum panels by USG.

b. OR Equivalent to SHEETROCK® brand Regular, FIRECODE® or FIRECODE® "C" Core gypsum panels by USG.
c. Acceptable product for fire-rated walls: Equivalent to ULTRACODE® Core, 3/4 inch thick, by USG.
d. Use gypsum board and joint compound with little or no VOCs and formaldehyde emissions. Gypsum board shall have a minimum of 5% Post- consumer and 20% Post-industrial (nation-wide average for company) as defined by FTC (Federal Trade Commission) by USG.

B. Moisture & Mold Resistant
1. ASTM C1396 (Section 5), regular type except where Type X fire-resistant type is indicated or required to meet UL assembly types.
2. Edges: Tapered.
3. Thickness: 5/8 inch.
4. Acceptable products: Sheetrock® brand Mold Tough™ Firecode (Type X), Firecode® C Core or ULTRACODE® Core gypsum panels by USG.

C. Shaftwall:
1. Liner boards:
a. ASTM C442, Type SLX.
b. Edges: Beveled.
c. Thickness: 1 inch.
d. Acceptable product: Equivalent to SHEETROCK® gypsum liner panels by USG.
2. Face boards:
a. ASTM C1396 (Section 5), Type X.
b. Thickness: 1/2 inch, unless otherwise indicated.
c. Acceptable product: Equivalent to SHEETROCK® FIRECODE® C Core and FIRECODE® Core gypsum panels by USG.

2.3 METAL FRAMING AND FURRING MATERIALS

A. Metal Studs and Runners:
1. ASTM C645, "C" shaped, gauge:
a. Provide gauge as indicated for studs; runner gauge as recommended by stud manufacturer.
b. Provide runner gauge as recommended by stud manufacturer.
2. Depth of sections: As indicated.
3. Corrosion protection: G40 hot-dipped galvanized coating per ASTM A525.

B. Shaft Wall Supports:
1. Conform to ASTM A446, Grade A, with G40 hot-dipped galvanized coating per ASTM A525.
2. Studs:
a. Shape: "CH", or as standard with manufacturer.
b. Gauge: As required to fulfill performance criteria, minimum 25 gauge. Provide 20 gauge for jamb and lintel components.
c. Size: As indicated.
d. J runners: 24 gauge, size as required for coordination with studs.
e. Jamb struts: 20 gauge with 3 inch back leg for use at elevator frames.

C. Metal Furring Channels:
   1. Hat-shaped:
      a. ASTM C645, 7/8 inch high, 25 gauge, with G40 hot-dipped galvanized coating per ASTM A525.
      b. Provide 20 gauge at furring to receive tile backer board.
      c. Acceptable products: DWC-25 for ½" and 5/8" gypsum board and DWC-20 by USG.
   2. Z-shaped: ASTM C645, depths as indicated, 24 gauge minimum, with G40 hot-dipped galvanized coating per ASTM A525.
   3. Resilient: Manufacturer's standard type designed to reduce sound transmission; 1/2 inch deep, 25 gauge steel with G40 hot-dipped galvanized coating per ASTM A525.

2.4 CEILING AND SOFFIT SUPPORT MATERIALS

A. Hanger Anchorage Devices: Screws, clips, bolts or other devices compatible with indicated structural anchorage for ceiling hangers and whose suitability has been proven through standard construction practices or by certified test data.

B. Hangers:
   1. Steel wire or rods, sizes to comply with requirements of ASTM C754 for ceiling or soffit area and loads to be supported.
   2. Wire: ASTM A 641, soft, Class 1 galvanized.
   3. Rods and flats:
      1. Mild steel components.
      2. Finish: Galvanized or painted with rust-inhibitive paint for interior work; galvanized for exterior work.

C. Framing System:
   1. Main runners:
      1. Cold-rolled, "C" shaped steel channels, 16 gauge minimum.
      2. Finish:Galvanized or painted with rust-inhibitive paint for other interior work.
   2. Cross furring: Hat-shaped steel furring channels, ASTM C645, 7/8 inch high, 25 gauge, galvanized.
   3. Furring anchorages: 16 gauge galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws recommended by furring manufacturer and complying with ASTM C754.
   4. Provide compression posts and other accessories as required to comply with seismic requirements.

D. Proprietary Framing System:
   1. Framing system for gypsum board panels consisting of cold-rolled steel members conforming to ASTM C635, with exposed surfaces finished in manufacturer’s standard enamel paint finish.
   2. Fire rating: 1 hour rating in accordance with UL assembly indicated.
   3. Components: Main tees, furring cross channels, furring cross tees, and cross tees.
   4. Accessories:
      a. U-shaped channel molding.
      b. Galvanized carbon steel (12 ga.) hanger wire.
   5. Acceptable product: Equivalent to Drywall Suspension System by USG.

2.5 ACCESSORIES

A. Metal Trim for Gypsum Board:
   1. Conform to profile and dimensions indicated.
   2. Material for interior work: Galvanized steel, 26 gauge minimum.
   3. Corner beads: Equivalent to Dur-A-Bead No. 103by USG.
   4. Casing beads (edge beads): Equivalent to 200A by USG.
   5. J-Beads.

B. Adhesives and Joint Treatment Materials:
   1. Conform to requirements of ASTM C475.
   2. Joint compounds:
      a. Drying-type (ready-mixed): Equivalent to SHEETROCK® brand taping joint compound and topping joint compound, or SHEETROCK® all purpose joint compound [or ready-mixed lightweight all purpose joint compound by USG.

C. Gypsum Board Screws: Self-drilling, self-tapping steel screws.
   1. For steel framing less than 0.03 inch thick: Comply with ASTM C1002.
   2. For steel framing from 0.033 inch thick to 0.112 inch thick: Comply with ASTM C954.
   3. Provide Type S or Type S-12 screws.

D. Backer Board Accessories: Provide accessories and corrosion-resistant-coated steel screws as recommended by backer board manufacturer and required for complete installation.

E. Acoustical Sealant: Equivalent to to SHEETROCK® acoustical sealant by USG.

F. Miscellaneous Accessories: Provide as required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and adjoining construction and conditions under which work is to be installed. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with reference standards and manufacturer's instructions [and as required to comply with seismic requirements].

B. Tolerances:
   1. Do not exceed 1/8 inch in 8'-0" variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
   2. Do not exceed 1/16 inch variation between planes of abutting edges or ends.

3. Shim as required to comply with specified tolerances.

C. Install framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation.

D. Install supplementary framing, blocking and bracing at terminations in gypsum board assemblies to support fixtures, equipment, heavy trim, grab bars, toilet accessories, furnishings or similar construction.

3.3 METAL SUPPORT INSTALLATION

A. Metal Runners:
1. Align and secure runner tracks accurately to partition layout at both floor and ceiling.
2. Provide fasteners appropriate to substrate construction as recommended by manufacturer.

B. Metal Studs:
1. Position metal studs vertically in the runners, spaced as indicated.
2. Place studs so that flanges face in same direction.
3. Cut studs 1/2 inch short of full height to provide perimeter relief.
4. Align and plumb partition framing accurately.
5. Where partitions abut ceiling or deck construction or vertical structural elements, provide slip or cushion type joint between partition and structure as recommended by stud manufacturer to prevent transfer of structural loads or movements to partitions, and to provide lateral support.
6. Provide horizontal bracing where necessary for lateral support.
7. Chase walls:
   a. Position steel studs on opposite sides of chase directly across from each other.
   b. Cut cross-bracing from gypsum board 12 inches high by chase wall width.

C. Ceiling and Soffit Support Systems:
1. Secure hangers or rods to structural support by connecting directly to structure where possible; otherwise connect to inserts, clips or other anchorage devices or fasteners indicated.
2. Space main runners, hangers and furring according to requirements of ASTM C754, except as otherwise indicated.
3. Where spacing of structural members, or width of ducts or other equipment, prevents regular spacing of hangers, provide supplemental hangers and suspension members and reinforce nearest affected hangers to span extra distance.
4. Install compression posts, splay wires and other accessories as required to comply with seismic requirements.
5. Extend runners to within 6 inches of walls.
6. Wire-tie or clip furring members to main runners and to other structural supports indicated. In fire resistance rated assemblies, wire-tie furring members; do not clip.
7. Do not permit furring or runners to contact masonry or concrete walls.
8. Provide 1 inch clearance between furring or runners and abutting walls and partitions.

3.4 FINISHING

A. Provide levels of gypsum board finish for locations as follows, in accordance with Gypsum Association GA 214, "Recommended Specification: Levels of Gypsum Board Finish".
1. Level 1: Ceiling plenum areas and concealed areas, except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
2. Level 2: Gypsum board substrate at tile [stone], except remove tool marks and ridges.

3. Level 3: Gypsum board surfaces, where textured finishes or heavy vinyl wall papering will be used [High-build Primer required as specified in Division 09 or USG First Coat primer].
4. Level 4: Gypsum board surfaces, except where another finish level is indicated High-build Primer required as specified in Division 09 or USG First Coat primer.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

1. GENERAL

1.1 REFERENCES:

A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.

B. NOTE: Selection of Finish colors and patterns in overall color scheme to be made by Architect. Contractor to notify Architect prior to commencing Gypsum Board work, to allow adequate time for color selections, Owner's approval and material ordering lead time.

1.2 DESCRIPTION OF WORK: The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet the requirements of these Specifications. The work covered by this section of Specifications consists of the following:

A. Drywall installation as required by Drawings and noted in these Specifications.
B. Taping and finishing all walls and ceilings, except where other kind of finish is specified.

2. PRODUCTS

2.1 Acceptable Manufactures

- American Gypsum
- Atlantic Group Limited
- Celotix Corporation
- Continental Gypsum Company
- James Hardie Gypsum
- Lafarge Gypsum
- United States Gypsum Company

2.2 NOTE: GWB types are shown as U.S.G. brand names “Sheetrock”, “Firecode”, “Firecode C”, “M.R. Board” and “Shaftwall”. Substitutions must have equal U.L. and STC ratings. See Drawings for Specific assembly.

2.3 EXTERIOR & INTERIOR WALLS & CEILINGS: See rated & non rated assemblies and wall types on the drawings.

2.4 NOTE: Type M.R. in bathrooms, walls and ceiling. See Drawings for double layer of gyp board to cover fiberglass tub flange.

2.5 RESILIENT CHANNEL: USG-RC-1

2.6 USG Drywall Suspension System.

2.7 Corner Bead

3. EXECUTION

3.1 THE DRYWALL CONTRACTOR shall inspect all areas affected by his work to ascertain that all work is complete and has been accepted. Defective installations shall be corrected before finished surfaces are painted or sprayed with acoustical material.

3.2 DRYWALL INSTALLATION. Install drywall as shown on plans, noted in the UL Specifications, and as set forth in U.S.G. Handbook. Installation of non-UL rated drywall assemblies on steel studs shall comply with the following minimum requirements:

A. Spacing for attachment members shall not exceed 24" o.c. for walls and 16" o.c. for ceilings. All drywall shall be screwed with approved drywall screws made specifically for the purpose and of length adequate for wall types. On walls, screws shall not be placed more than 16" apart for 16" o.c. framing or 12" apart for 24" o.c. framing. Screw all edges 12" o.c. maximum. See Structural Drawings S3.2 and S3.3 for shear walls sheathing attachment.

B. The drywall contractor may use a few drywall nails to temporarily secure a sheet of drywall before securing with drywall screws. In this event, the drywall nails must be countersunk prior to taping. Corner beads shall be used on all corners and casing beads used whenever Gypsum Board abuts dissimilar material. Caulking to also be applied at these junctions. At all party and unit/corridor walls, Gypsum Board to be set in caulking (for sound).

C. Drywall shall be laid vertically or horizontally. No tapered joints at floor base. See Structural Drawings for shear walls.

D. Gypsum Sheathing Application
Apply 24” wide sheathing horizontally with tongue edge up. Install supplementary bracing as required by applicable code. Fasten sheathing with nails spaced 8” o.c. along each stud.
Apply 48” wide sheathing vertically with bottom edge bearing on foundation or subfloor. Install supplementary bracing (and adhesive) as required by applicable code. Fasten sheathing to studs and plates with nails 8” o.c.

E. Joint System
Prefill Application

a. Mix SHEETROCK Brand Setting-Type (DURABOND) or Lightweight Setting-Type (EASY SAND) Joint Compound according to directions on bag. Do not over mix, or use extremely cold water or cold joint compound.

b. Prefill all “V” grooves formed by abutting tapered eased edges of SHEETROCK Brand Gypsum Panels, SW Edge, with SHEETROCK Brand Setting-Type (DURABOND) or Lightweight Setting-Type (EASY SAND) Joint Compound using a flexible 5” or 6” joint finishing knife or Ames Pre-Fill Tool. Fill “V” joint flush and wipe off excess compound beyond the “V” groove, leaving a clear depression to receive tape. Allow prefill to harden prior to the next application (tape or embedding coat).
SHEETROCK Brand Joint Tape

c Mix joint compound in strict accordance with manufacturer’s recommendations.

d Apply joint compound in a thin uniform layer to all joints and angles to be reinforced. Immediately apply SHEETROCK Brand Joint Tape centered over joint and seated into compound. Sufficient compound—approx. 1/64" to 1/32"— must remain under the tape to provide proper bond. Follow immediately with a thin skim coat to embed tape, but not to function as a second coat. Fold and embed tape properly in all interior angles to provide a true angle. The tape or embedding coat must be thoroughly dry prior to application of second coat. (Exception: DURABOND Setting-Type and EASY SAND Lightweight Setting-Type Joint Compounds need only have hardened prior to application of next coat.)

e Apply second coat of joint compound over embedding coat, filling panel taper flush with surface; cover tape and feather out at least 2" beyond first coat. On joints with no taper, cover the tape and feather out at least 4" on either side of tape. Allow second coat to dry thoroughly prior to application of finish coat. (Exception: DURABOND Setting-Type and EASY SAND Lightweight Setting-Type Joint Compounds need only have hardened prior to second coat application.)

f Spread finish coat evenly over and extend at least 2" beyond second coat on all joints and feather to a smooth uniform finish. Do not allow finished joint to protrude beyond plane of the surface. Where necessary, sand lightly between coats and following the final application of compound to provide a smooth surface ready for decoration. When sanding, take care not to roughen face paper.

SHEETROCK Brand Fiberglass Drywall Tape

a. Mix joint compound in strict accordance with manufacturer's recommendations.
b. Center and apply SHEETROCK Brand Fiberglass Drywall Tape directly over joint, pressing tape firmly so that it adheres evenly to surface. To eliminate wrinkles and ensure maximum bond, press entire length of taper with drywall knife. Avoid overlapping tape at intersections. Cut tape with drywall knife.
c. Cover with a layer of SHEETROCK Brand Setting-Type (DURABOND) or Lightweight Setting-Type (EASY SAND) Joint Compound, forcing compound through the tape with a drywall knife/trowel to completely fill and level the joint. Failure to completely fill the joint may result in cracking. Let dry and sand lightly as required.
d. Apply second coat of SHEETROCK Brand Setting-Type (DURABOND) or Lightweight Setting-Type (EASY SAND) Joint Compound or SHEETROCK Brand Drying-Type Joint Compound (powder or ready mixed), feathering approximately 2" beyond first coat. Let dry and sand lightly as required.

Finishing Fasteners

a. Apply a setting-type, all-purpose, or lightweight all-purpose compound to fastener depressions as the first coat. Follow with a minimum of two additional coats of topping or all-purpose compound, leaving all depressions level with the surface. (Exception: Setting-type and lightweight all-purpose joint compounds need only one additional coat.)

F. SHEETROCK Brand Paper Faced Drywall Metal Bead and Trim
Application and Finishing

a. Apply compound to both sides of corner, extending 2" on each side for outer corners, 1-1/2" for inside corners. Cut bead to desired length; align tightly to ceiling and press firmly with fingers along length of corner to set. Do not bend bead. Run taping knife over corner at a 45° angle with even pressure. Remove excess compound using knife to eliminate air bubbles under paper. Allow to dry.

b. For outer corners, apply another coat of compound to both sides, feathering out 5”-6”on each side. Let dry; sand lightly as necessary. For inner corners, apply fill coat to one side, feathering out 1”. Let dry. Apply fill coat to other side using same procedure. Let dry. Sand lightly where necessary.

c. For outer corner, apply finishing coat, feathering 8” from nose of bead. Draw knife along one side of bead with one edge resting on nose of bead and other on surface of wallboard. Repeat for other side. Let dry. Sand and prime. For inner corners, apply finishing coat to one side, feathering 1” past previous coat. Let dry. Apply finishing coat to other side. Let dry. Sand and prime.

G. Other Bead and Trim

Installation

a. Reinforce all vertical and horizontal exterior corners with corner bead fastened with nails or 9/16” galvanized staples 9” o.c. on both flanges along entire length of bead.

b. Where partition or ceiling terminates against masonry or other dissimilar material, apply metal trim over gypsum panel edge and fasten with nails or galvanized staples 9” o.c.

Finishing

a. Apply first coat to all bead and trim and properly feather out from ground to plane of surface. Compound must thoroughly dry prior to application of second coat (exception: SHEETROCK Brand Setting-Type [DURABOND] and Lightweight Setting-Type [EASY SAND] Joint Compounds need only have hardened prior to application of next coat.)

b. Apply second coat in same manner as first coat, extending compound slightly beyond face of panel. Compound must be thoroughly dry prior to application of finish coat (exception: Setting-Type joint compounds need only have hardened prior to application of next coat.)

c. Apply finish coat to all bead and trim, extending compound slightly beyond the second coat and properly feathering from ground to plane or surface (exception: Only two coats of SHEETROCK Brand Setting-Type [DURABOND] or Lightweight Setting-Type [EASY SAND] Joint Compound or SHEETROCK Brand Lightweight All Purpose Joint Compound Ready Mixed [PLUS 3] are needed.) When dry, sand finish as necessary to provide a flat smooth surface ready for decoration. When sanding, take care not to roughen face paper.

Note1: Gypsum board to be installed behind all tubs and shower units which results in double gypsum board on some bathroom walls. See bathroom drawing sheet.

Note 2: Fire rated gypsum board ceiling in concealed spaces. IE: Under acoustic tile ceiling in corridors tape to be set in compound and several coats of compound applied over tape, no exposed tape will be accepted.

H. Ceiling suspension system:

1. Space hangers not over 48 in. o.c. in direction of main runner channels, and within 6 in. of ends of main runner runs and of boundary walls, structural steel, partitions, and similar interruptions of ceiling continuity. Install additional hangers at ends of each suspension member and at ceiling equipment not separately suspended, 6 in. from vertical surfaces. Do not splay wires more than 5 in. in a 4 ft. vertical drop. Wrap wire a minimum of three times horizontally, turning ends upward.
2. Attach hangers directly to ceiling structure, or to supplementary framing members supplied and installed under this section. Hangers may not be suspended from mechanical or electrical equipment such as ductwork, conduit or piping.

3. Install 1-1/2 in. main runner channels spaced not over 48 in. o.c. within 6 in. of wall. Position channels for proper ceiling height, level and secure, with hanger wire saddle-tied along channel. Provide 1 in. clearance between runners and abutting walls and partitions. At channel splices, interlock flanges, overlap ends 12 in., and secure each end with double-strand 18 ga. tie wire.
4. Erect ¾ in. metal furring channels at right angles to main runner channels or main support members. Space furring not over 16 in. o.c., and within 6 in. of wall. Provide 1 in. clearance between furring ends and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to supports with double strand 18 ga. tie wire. At splices, next furring channels at least 8 double-strand 18 ga. tie wire.
5. At openings interrupting main or furring channels, install additional cross-reinforcing as required, to restore lateral stability of ceiling framing system.
6. Finished installations shall be level to within ¼ in. in 10 ft.

3.3 ON SURFACES TO BE PAINTED: tape and cement all joints and screw locations with three coats of compound, then sand to smooth finish, acceptable to paint.

3.4 DURING WORK PROGRESS, remove all excess materials and debris resulting from operations, which may disrupt the work of other trades and after completion leave the premises broom clean.

END OF SECTION

SECTION 09 90 00

PAINTING AND WALL COVERING

1. GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet the requirements of these Specifications. The work covered by this section of Specifications consists of the following:

1. Painting or staining all interior as called for in the Finish Schedule on Drawings or in these Specifications.

2. Painting interior walls, door trim, window trim, etc. A minimum of five (5) different colors will be used.

NOTE: All colors to be selected by Architect/Interior Designer.

2. PRODUCTS

2.1 General

A. Acceptable manufacturers, unless specific manufacturer is noted: California Products Corporation, Benjamin Moors, Pratt & Lambert, Sherwin-Williams, Tnemec.

B. All products used shall be manufacturer's top quality product for each type of finish specified.

2.2 MATERIALS

A. Where primer is called for, use primer recommended by manufacturer for particular combination of substrate and finish coat. Where painting over shop-applied primers, verify that finish paint proposed for field application is compatible with shop primers actually used.

B. All Gypsum Walls and Ceilings to be painted: Primer - Benjamin Moore Vinyl Latex Primer Sealer.

C. Finish-Walls - Benjamin Moore Moorcraft Latex Eggshell

D. Interior Rails & Metal Frames: Touch up Shop Primer. Finish - Two coats Alkyd semi-gloss finish.

E. Note: All Field cut edges to be painted. Metal Door & Window frames latex satin finish.

3. EXECUTION

3.1 JOB CONDITIONS

A. Store materials in sealed containers. Provide a fire extinguisher in storage room. Remove flammable rags and waste from building at end of day.

B. Do not perform exterior work in rain or when precipitation is forecast imminently; or in hot, dry, or windy weather which would cause finish to cure too rapidly, or be marred by windstorm dust; or at temperatures below 40 degrees F.

C. Maintain temperature at interior locations between 50 and 75 degrees F, maximum 80 percent relative humidity, while paint is being applied. Provide adequate ventilation, by mechanical means if necessary, for drying of paint and prevention of condensation and mildew. Do not apply finish in areas in which dust is being generated.

D. Protect finished surfaces and equipment not being painted with masking tape, canvas dropcloths, polyethylene sheets, etc. Items such as lighting switch covers, fixture canopies, and door handles shall be temporarily removed, carefully stored, and replaced after painting, or carefully covered during painting operations.

3.2 PREPARATION

A. Preparation of newly-installed materials to receive finish painting is specified under those Sections installing materials. This includes, but is not necessarily limited to: touch-up of damaged shop coats; taping, sealing and sanding of drywall; patching masonry; sanding finish wood; and cleaning off grease, oil, dirt, mildew, factory-applied protective coatings, and other foreign materials.

B. At wood surfaces to be painted, scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

C. Before beginning work under this Section, verify that preparation of substrates under other Sections has been done as specified. Thoroughly remove water, dirt, and dust with clean cloths, brooms, or brushes. Allow masonry mortar joints to cure as long as possible before beginning paint application, 7 days minimum, 28 days preferably.

3.3 APPLICATION

A. Apply all materials in accordance with the manufacturer's recommendations.

B. Apply materials with suitable brushes, rollers, and spraying equipment. Keep application equipment clean, dry, and free from contaminants. Thoroughly stir materials before applying, and periodically during application.

C. Rate and method of application and drying time between coats shall be strictly in accordance with manufacturer's recommendations.

D. Prepare field test panels in accordance with paragraph 1.4-B.3 of this Section for each type and color of finish specified. Request review of first completed room, color scheme, special items, etc., which shall serve as project standard after approval.

E. Touch-up shop applied primers before field painting.

F. Do not apply first coat until surface is dry to touch. Moisture content of surface shall be within limitations recommended by paint manufacturer.

G. Leave all parts of moldings and ornaments clean and true to detail, without excessive paint in corners and depressions. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping. Paint surfaces visible through grilles one coat flat black.

H. Finish coats shall be smooth, free of brush marks, streaks, laps or pile-up of paint, and skipped or missed areas. Refinish whole wall if unacceptable finish is extensive or of such a nature that it cannot be repaired by normal touch-up.

I. After completion of painting work, remove spilled or spattered paint. Touch-up and repair finishes damaged in any way by work under this Section. Protect finished surfaces.

3.4 Interior

A. Interior Painting: Paint shall be applied in the following number of coats, primer and finish. Tint all primers to match finish color.

1. One (1) fully applied finish coat of even coverage. NOTE: Contractor to adequately cover M.R. (Blueboard) or other colored drywall by primer or finish coat as necessary to eliminate any visible "bleed through".

2. Drywall: All interior gyp board walls and ceilings to receive paint: one (1) coat latex base primer-sealer, two (2) finish coat’s latex eggshell.

B. Interior Glass & Door Frames - one (1) coat primer and two (2) coats finish, semigloss.

C. All hardwood to receive three (3) coats urethane.

END OF SECTION

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to design, install and test a pressurized, fully supervised, wet or dry pipe fire protection system for full building protection in accordance with NFPA, IBC, the City of Portland Fire Department and the Owner's insurance underwriter. Areas subject to freezing shall have a dry pipe system, dry pendent or sidewall heads, per NFPA. Provide a 4" standpipe in each stairwell with a 2½" valve at each floor. Provide multiple risers, as required.

B. The sprinkler systems design shall be based on NFPA13 requirements.

1.2 RELATED DOCUMENTS

A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.

1.3 QUALIFICATIONS

A. The Fire Protection Work shall be performed by a qualified Contractor primarily engaged in the design and installation of Fire Protection Systems. The fire protection system design shall be performed under the direction of, and sealed by, a professional engineer registered in the State of Maine or NICET III certification.

B. Welding qualifications of individuals installing welded piping shall be certified by the National Certified Welding Bureau for the type(s) of weld(s) proposed for use in piping assembly.

1.4 SUBMITTALS

A. Items for which the submittal requirements of section 23 05 00 Common Work Results for HVAC, apply are as Follows:

1. Hydrant flow test.
2. System components.
3. Hydraulic calculations.
4. Piping layout, details and control diagram.
5. Flushing and testing records.
6. Certificate of installation.
7. Copy of Fire Protection Contractors License.
8. Welding certificates of individual welding technicians.
9. Sprinkler heads.
10. Alarm valve(s).
11. Fire department connection(s).
12. Firestopping materials and methods.

Submit hydrant flow test, equipment descriptive data, hydraulic calculations and system layout for review by the Owner's Insurance Underwriter. Submit the system layout to the Architect for review. The Architect's review will be limited to checking for conformance with the design concept of the project and general compliance with the contract documents and will in no way assume liability for review for compliance with codes, standards and laws.

1.5 SPRINKLER COVERAGE

A. Sprinkler head coverage shall conform with NFPA requirements for the use of the building. Coverage shall be increased accordingly where required by the Authority having jurisdiction.

B. If the requirements of the inspection agency or the Owner's insuring agent are more rigorous than those stated herein, then the more rigorous requirements shall govern.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS AND HARDWARE

A. Pipe, Fittings, Joints, Hangers, Valves, Fire Department Connections, Alarms: Conform to NFPA-13, Installation of Sprinkler Systems.

B. Sprinkler Heads:

1. Interior Heated Spaces: Conform to NFPA-13, commercial quick response type. Provide semi-recessed type with white finish for acoustical tile ceilings. Sprinkler heads in GWB ceilings shall be “concealed” type. Dry pendent or sidewall heads, where required, may be standard response type.

2. Provide a spare head cabinet with wrenches, the amount of spare heads for each orifice size, finish, temperature classification, pattern and length furnished in the project shall be in accordance with the following schedule:

Sprinkler Heads on Project	Number of Spare heads of each type.
Less than 300	6
300-999	12
1000 or more	24

3. Provide head protection guards where required.

4. Sprinkler heads in unheated areas shall be dry pendent or sidewall type, or served by a glycol and water loop or separate dry-pipe system.

C. Fire Department Connection: Provide a 4" Storz connection or siamese connection (as verified with the local fire department) at a location coordinated with the local fire department and the Architect.

2.2 WATER SUPPLIES

A. Conform to the requirements of NFPA-13, Installation of Sprinkler Systems.

2.3 DEVICES

A. Detection devices and associated low voltage and line voltage wiring both within the fire protection system and to the building Fire Alarm System shall be the responsibility of the Sprinkler Contractor.

2.4 BACKFLOW PREVENTER

A. Provide AMES MODEL 2000.

2.5 PIPING SYSTEM IDENTIFICATION

A. Piping system and valve identification and color coding shall be in accordance with ANSI.

2.6 ELEVATOR SHAFTS AND MACHINE ROOM

A. Sprinkler elevator shafts and elevator machine room per NFPA and the Maine State Elevator Code.

2.7 CEILING CAVITIES

A. Ceiling cavities above all suspended acoustical tile ceilings in corridor areas and certain other areas contain bundled electrical cables and individual wires and shall be sprinklered. Coordinate sprinkler requirements with the Electrical Drawings.

2.8 FLEXIBLE SPRINKLER HOSE FITTINGS

A. Manufacturer: FlexHead Industries, Inc., Viking or Victaulic “Aquaflex”.

1. Contact: 56 Lowland Street, Holliston, MA 01746; Telephone: (800) 829-6975; Fax: (508) 893-6020; Email: sales1@flexhead.com; website: www.flexhead.com

B. Description: Flexible Sprinkler Hose Fittings for use in commercial suspended ceilings and sheetrock ceilings.

1. Regulatory Requirements:

a. In accordance with NFPA 13.

C. Product Performance Criteria:

1. FM Approved for its intended use pursuant to FM 1637 Approval Standard for Flexible Sprinkler Hose with Threaded End Fittings.
2. UL Listed for its intended use pursuant to UL 2443 Standard for Flexible Sprinkler Hose with Fittings for Fire Protection Service.
3. Seismically qualified for use pursuant to ICC-ES AC-156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

D. Materials: FlexHead Commercial Sprinkler Connections.

1. FlexHead Flexible Hose Assemblies and End Fittings:

    a. Composition: 100% Type 304 Stainless Steel.
    b. Straight Hose Assembly Lengths: 2ft length, Model #2024 or 3ft length, Model #2036.
        1. ¾ inch outlet.
        2. 175 psi maximum rated pressure.
        3. Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter.
    c. Elbow Hose Assembly Lengths(For use in confined spaces): 2ft length, Model #2024E or 3ft length, Model #2036E.
        1. ¾ inch outlet.
        2. 175 psi maximum rated pressure.
        3. Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter.

2. FlexHead Ceiling Bracket:

    a. Composition: Type G90 Galvanized Steel.
    b. Type: Direct attachment type, having integrated snap-on clip ends positively attached to the ceiling using tamper-resistant screws.
    c. Flexible Hose Attachment: Removable hub type with set screw.

3. Do not use product where exposed, concealed only.

2.9 SPRINKLER SYSTEM ZONING

A. The building shall have area zone alarms to connect to the building fire alarm panel (six (6) total zones). Each floor shall be a separate sprinkler system zone. Each zone alarm shall consist of a flow switch, isolation valve with tamper switch and other components per NFPA. See Architectural Drawings for additional information. Coordinate with the Portland Fire Department. Coordinate with the Electrical Contractor and Fire Alarm Contractor.

PART 3 - EXECUTION

3.1 PIPING LAYOUT AND DESIGN

A. System requirements, installation requirements, design, plans, and calculations: Conform to NFPA-13, Installation of Sprinkler Systems.

B. Sprinkler piping shall be run concealed above ceilings in occupied areas where possible. Piping in other areas may be run exposed. Piping shall not be exposed in occupied spaces unless indicated on the drawings or accepted by the Architect.

C. Pipe penetrations through walls and floors shall be in accordance with Section 23 05 00 – Common Work Results for HVAC. Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy. Penetrations through walls shall be sleeved in accordance with Section 23 05 00. Sleeves shall be provided by the Fire Protection Contractor.

D. Coordinate design and layout with building structure and building systems. The work shown in the contract documents has precedence for space requirements. Work of other trades may be modified or moved only with permission of the trade involved. Costs associated with modifications or relocations shall be the same as for "Substitutions" Section 23 05 00.

E. For areas with acoustical tile ceilings, sprinkler heads shall be located in the center of acoustical tiles. Coordinate with the Reflected Ceiling Plans. The Architect shall review the proposed system layout and reserve the right to relocate heads, substitute head system and in general review final layout for components visible in occupied spaces.

3.2 SYSTEM ACCEPTANCE

A. Approval, flushing, hydrostatic testing, instructions, and certificates of installation: Conform to NFPA-13, Installation of Sprinkler Systems.

B. Disinfect the water piping in accordance with AWWA C601. Fill the piping systems with solution containing a minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Repeat disinfection if chlorine residual is less than 10 parts per million after 24 hours. Flush the solution from the systems with clean water until maximum residual chlorine contents is not greater than 0.2 parts per million.

C. Closing in Work:

1. General: Cover up or enclose work after it has been properly and completely reviewed.

2. No additional cost to the Owner will be allowed for uncovering and recovering, work that is covered or enclosed prior to required review and acceptance.

D. Cleanup and Corrosion Prevention:

1. Upon completion of the work thoroughly clean and flush piping systems to the sewer with water.

2. Piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.

3. Before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

E. Instructions: On completion of the project, provide a technician familiar with the system to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner.

F. Warranty: For a period of one (1) year after completion of the installation repair or replace any defective materials or workmanship. Upon completion of the installation, the system shall be turned over to the Owner fully inspected and tested, and in operational condition.

3.3 FIRESTOPPING

A. Firestopping shall be performed in accordance with Specification Section 07 84 00 “Firestopping”. All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *

SECTION 26 00 20

SITE ELECTRICAL & COMMUNICATIONS WORK

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. All work of this section shall be completed by an electrical subcontractor to the site contractor except where the site contractor elects to perform the work. The site contractor is responsible for assuring that the bid price includes all work of this section.

B. Description: Provide all necessary site electrical work in connection with the following:

1. Provision of a new 3-phase primary underground electrical line from existing underground facilities in Fore Street to a new concrete pad for a service transformer.
    a. Wiring by Central Maine Power (CMP).
    b. Conduit, hand holes, and manholes by the Electrical Sub-Contractor of Site Work Contractor.
2. Provision of a new concrete transformer pad for an electrical service.
    a. Concrete transformer pad by the Site Contractor.
    b. Service transformer by Central Maine Power.
3. Provision of empty electrical conduit from the service transformer to the concrete splice box.
4. Provision of a post or building mounted, utility service meter located adjacent to the service transformer.
    a. Meter by Central Maine Power.
    b. Meter post, conduit, and meter back box by the Electrical Sub-Contractor.
5. Provision of service grounding at the concrete transformer vault for the CMP service transformer.
6. Provision of relocated light poles.
    a. Secondary underground electric control boxes, photocells, and related equipment as required by the City of Portland to connect light poles.
7. Provision of an empty telephone conduits from the existing utility pole on Fore Street to a point one foot inside the proposed building.
    a. Conduit by the Electrical Sub-Contractor for Site Work Contractor.
    b. Telephone service cable by Fairpoint Communications (to be provided under separate contract for the proposed building), conduit by Site Work Contractor.

8. Provision of an empty telecommunications conduit(s) from the terminal utility pole on Fore Street to a point one foot inside of the proposed building.
    a. Conduit by the Electrical Sub-Contractor of Site Work Contractor.
    b. Cable TV service cable by telecommunications provider (to be provided under separate contract for the proposed building), conduit by Site Work Contractor.
9. Provision of site lighting poles with luminaries, lamps, and anchor bolts.
    a. Concrete foundation bases by the Site Contractor using anchor bolts provided by the pole supplier.
    b. New poles, luminaries, lamps, anchor bolts to be supplied.
    c. Underground conduit and wiring by electrical subcontractor.
10. Provision of empty underground conduit(s) with pull string from site lighting junction box to be extended through the foundation wall of the proposed building perimeter.
    a. Conduit by the Electrical Sub-Contractor for Site Work Contractor.
    b. Wiring to be provided under separate contract for the proposed building.

C. The Contractor for this work is referred to in Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work that is a part of this Contract as contained in Division 1. The following General Provisions amplify and supplement these sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 1 supersede and must be satisfied by the Contractor.

1.2 REFERENCES

A NEMA TC-2 – Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

B. NEMA TC-3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

C. ANSI/NFPA 70 – National Electrical Code.

D. ANSI C80.1 – Rigid Galvanized Steel Conduit.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide for each product specified herein. Indicate overall equipment dimensions and electrical characteristics including voltage, frame and trip ratings and short circuit withstand ratings where applicable. Provide submittals for all light fixture poles and concrete bases.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Record the installed location of all electrical equipment and underground services.

1.5 REGULATORY REQUIREMENTS

A. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances, included but not limited to latest approved editions of the following:

1. National Electrical Safety Code (ANSI C2).
2. National Electrical Code (NFPA 70).
3. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
4. All applicable State and Local Codes.
5. City of Portland Street Lighting Technical Standards.
6. Central Maine Power – Handbook of Requirements for Electrical Service and Meter Installation.

B. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes, and ordinances, and they are thereby included in these specifications.

C. Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim will be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.

D. Furnish products listed and classified by Underwriters Laboratories, Inc.

E. Obtain permits and request inspections from all authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. It is recognized that minor adjustments to locations may be required to coordinate with existing site conditions and underground utilities. Where equipment and/or conduit cannot be installed at the location shown on the plans, notify the Engineer to receive direction. Prior to installation of any site light pole or foundation, verify the minimum clearance requirements will be met with other overhead utilities, as required by utility company or other regulatory codes.

PART 2 – PRODUCTS

2.1 CONDUIT AND FITTINGS

A. PVC Schedule 40 Plastic Conduit: NEMA TC 2.

B. Plastic Conduit Fittings: NEMA TC-3.

C. Rigid Galvanized Steel Conduit: ANSI C80.1.

2.2 UNDERGROUND WARNING TAPE

A. Underground Warning Tape: 6” wide plastic tape, colored red with suitable legend describing buried electrical lines: Model UT27737-6 as manufactured by Emedco, or equal.

2.3 SITE LIGHTING

A. Provide site lighting poles/luminaries as described on the landscape and site lighting plans contained in the contract documents.

B. Provide all necessary pole hardware including anchor bolts as required.

C. Foundations, poles and anchor bolts shall be rated for the given EPA to withstand 90 mph wind with a 1.3 gust factor.

D. Site lighting poles shall be provided with all necessary internal wiring conductors.

E. Provide all site lighting poles with internal ground lugs.

PART 3 – EXECUTION

3.1 EXISTING UNDERGROUND UTILITIES IDENTIFICATION

A. The Contractor shall utilize the services of Dig-Safe to identify locations of existing underground utilities within the vicinity of all new excavation work.

3.2 CONDUIT INSTALLATION

A. Cut conduit square using a saw or pipe cutter; de-burr cut ends.

B. Bring conduit to the shoulder of fittings and couplings and fasten securely.

C. Install no more than the equivalent of three 90-degree bends between poles.

D. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

E. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

F. Install electrical warning tape for all underground conduits 6 inches below the finished grade.

G. Cap empty conduits for future use by others. Mark locations where ends of conduits are buried.

3.3 CONDUIT INSTALLATION SCHEDULE

A. Underground Locations - PVC, Schedule 40.

B. Above ground Locations - Rigid galvanized steel conduit.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing site utilities.
7. Temporary erosion and sedimentation control measures.

1.2 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner’s premises. Coordinate storage locations with Owner.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing. Note that a private utility detection service will be required to identify utilities on the school property. The Contractor shall be responsible for the cost of private utility detection.

D. Do not commence site clearing operations until temporary erosion and sedimentation control and plant protection measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.

3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 “Earth Moving”.

1. Obtain approved granular borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation control Drawings and requirements for the project.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Section 32 93 00 “Landscaping”.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner’s Rep and Engineer.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner’s Rep and Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner’s Rep and Engineer’s written permission.

C. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 02 41 19 “Selective Demolition” (NIC).

3.5 CLEARING AND GRUBBING

A. Clearing and grubbing shall include the removal of all trees, shrubs, vegetation, roots, and organic measures to permit installation of new construction. The Contractor may elect to remove some of the roots during loam stripping operations. Any area that will be regraded must be cleared and grubbed.

B. Fill depressions caused by clearing and grubbing operations with satisfactory granular soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil. All removals/excavation shall be completed in accordance with the Soil Management Plan.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.7 SITE IMPROVEMENTS

A. Remove existing above and below grade improvements as indicated and necessary to facilitate new construction. Unforeseen conditions such as remnant foundations or other remnant site improvements shall be removed to at least 1’ below subgrade at no extra expense to the Owner.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, stumps and cleared material, and legally dispose of them off Owner's property at no extra expense to the Owner.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

2. All topsoil shall be screened. Excess topsoil, if any, shall remain the property of the Owner. The location for stockpile material shall be agreed upon with the Owner.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, play surfaces, and all other subgrade surfaces required for this project.
2. Excavating and backfilling for site improvements and structures.
3. Moisture condition and/or chemically treat excavated soils as necessary to provide workable fill material that will meet the compaction specifications and maximize reuse of existing soils.
4. Subbase course for walks and pavements.
5. Subbase and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

B. Related Requirements

1. See Section 02 32 00 Geotechnical Investigation
2. See Section 31 10 00 Site Clearing
3. See Soil Management Plan

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from on or off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade in areas where underslab drainage is required that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

G. Fill: Granular soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, curbs, electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or material placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

L. Zone of Influence (ZOI): The area below footings and below imaginary lines that extend 2 ft laterally beyond the footing outer bottom edges and down on a 1H:1V slope to suitable bearing material.

M. Pipe Zone: The pipe zone is considered to be the area from the invert of the pipe to 6 inches above the crown of the pipe.

N. Pipe Bedding: Pipe bedding is the material placed between the bottom of the trench and the invert of the pipe.

1.3 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated. A private utility detection service will be required to identify utilities within the school property.

1.4 SUBMITTALS

A. General

1. Unless otherwise noted, Contractor shall forward submittals to the Engineer a minimum of two weeks prior to any planned work related to the Contractor's submittals.
2. The time period(s) for submittals are the minimum required by the Engineer to review, comment and respond to the Contractor. The Engineer may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.

3. The Contractor's submittals shall be reviewed and accepted by the Engineer prior to conducting any work.

4. Acceptance of the Contractor's submittals by the Engineer does not relieve the Contractor of responsibility for the adequacy, safety and performance of the work.

B. Excavation and Backfilling

1. A narrative describing the schedule and means and methods for placement/compaction of fill soils based on the material requirements provided in Part 2 of this Section.

2. Proposed type(s) and source(s) of chemicals to treat borrow soils to be reused beneath building or pavement areas if site work activities are to be performed outside of summer months.

3. A plan showing delineated site "haul roads" for heavy construction equipment such as articulated trucks and scrapers.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. In general, the Owner's intent is to encourage the use of onsite excavated materials for subgrade fills subject to the material requirements provided herein.

B. Satisfactory Soils: The existing soils will not meet the gradation specifications for Structural Fill, Base Course or Subbase Material. The native soils are acceptable for common subgrade fill if moisture conditioned and placed to meet the density and other requirements of the Contract Documents. The native soil may require segregation by type, blending with offsite borrow, filling with choke stone, must be free of organics, and moisture conditioned during winter construction or wet weather or extreme dry conditions. In no case should frozen soils be used beneath the building footprint, parking areas, or driveways.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, OL, CH, MH, OH, and PT or a combination of these groups and satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Course: Maine DOT 703.06 Type D. (Maximum Particle Size of 4 inches)

E. Base Course: Maine DOT 703.06 Type A. (Maximum Particle size of 2 inches)

F. Gravel Borrow: Maine DOT 703.19 with a maximum particle size of 6 inches. Note that existing subgrade soils may meet the definition of Gravel Borrow and may be used in place of imported materials if the Contractor can provide third party testing confirming conformance with this specification.

G. Crushed Stone: Maine DOT 703.22 Backfill for Underdrain Type C.

H. Pipe Bedding: Maine DOT 703.22 Backfill for Underdrain Type C.

I. Foundation Backfill: Foundations shall be backfilled with foundation backfill. The portion of foundation backfill passing the 3" sieve size should meet the following gradation requirements:

FOUNDATION BACKFILL	
Sieve Size	**Percent Passing By Weight**
3-inch	100
¼-inch	25 to 100
No. 40	0 to 50
No. 200	0 to 6**

*The maximum particle size should be limited to 3-inches.
**Reduced from 7% to 6% from Type E Structural.

J. Structural Fill: Structural fill shall be used as fill below ground floor slabs. Structural fill shall be a well graded sand and gravel mixture free of roots, topsoil, loam, organic material, and any other deleterious materials, as well as clods of silt or clay, and meet the following gradation requirements:

STRUCTURAL FILL	
Sieve Size	**Percent Passing By Weight**
3-inch	100
½-inch	38 to 80
¼-inch	25 to 65
No. 40	0 to 30
No. 200	0 to 7

*The maximum particle size should be limited to 3-inches.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility with a separate metallic "tracer". <u>This is required for all non-metallic utility lines except "straight runs" of sewer lines and storm drains between manholes.</u>

PART 3 - EXECUTION

3.1 PREPARATION

A. The earthwork shall be conducted in accordance with the more stringent of the Maine DOT Specifications, and these specifications. All cost for moisture conditioning and complying with the Contract Documents is part of the base bid.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

C. Designated haul roads shall be established by the Contractor at the beginning of earthwork operations to minimize damage to soil subgrades resulting from construction vehicle traffic. The use of geotextile fabric and/or geogrid to stabilize haul road subgrades shall be included by the Contractor as part of the base bid.

D. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

E. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing." during earthwork operations.

F. Due to the previously developed nature of the site, the Project Contractor and their Subcontractors should be sensitive to the potential of encountering obstructions such as remnants from prior structures and buildings, associated foundations, and underground utilities (note: both active and abandoned) during site and earthwork activities. It is anticipated that obstructions may include, but not limited to, conduits, electrical and communications lines, and old foundations. Where such items are encountered beneath the proposed construction limits, they should be excavated to their full extent, removed, and replaced with compacted structural fill. The ends of underground pipes and utility conduits that will be abandoned in-place should be filled with concrete and capped to prevent erosion of material into the conduit or pipe. Removals of obstructions and replacement with structural fill shall be performed at no extra expense to the Owner.

3.2 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

B. Remove all organic soils within the ZOI of footings or slabs to expose naturally deposited soils or bedrock.

C. Excavation of bearing surfaces in soil or fill should be performed by earthwork equipment fitted with smooth-edged buckets. Final subgrade preparation should include compaction of fill or naturally deposited soil subgrades with vibratory compaction equipment. Following compaction and prior to placement of imported materials, care should be taken to limit disturbance of the bearing surfaces. Any loose, softened, or disturbed material due to construction traffic should be removed prior to placement of imported materials, and backfilled with compacted structural fill.

D. The integrity of natural soils and fill must be maintained during cold weather conditions. Footing and slab subgrades should not be allowed to freeze. The naturally deposited soils are considered moderately. Freezing of subgrade soils beneath improvements might result in heaving and post-construction settlement. The Contractor should make every effort to prevent freezing of subgrade soils. In the event frost penetration occurs, all frozen and previously frozen soils should be removed and replaced with compacted structural fill. At no time should frozen material be placed as fill.

E. Excavation measurement and pay dimensions shall extend 12” beyond the footing or slab.

3.3 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

B. Remove all man placed fill, topsoil, organic matter, and debris encountered within the footprint of site improvements and structures.

C. Proof-rolling should be performed using a fully loaded, tandem axle dump truck weighing not less than 25 tons or 2 passes in each of two perpendicular directions with a 5-ton min. vibratory roller. Proof-rolling should not be performed over culverts, pipes, conduits, or other underground construction that might be damaged by the proof-roller. Soft areas or areas that yield excessively during proof-rolling should be over excavated and replaced with ¾" crushed stone or structural fill. Soft areas or areas that yield excessively are characterized by weaving or rutting more than one-inch deep.

3.4 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following trench width. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

C. A minimum and pay width of 2'-6" for conduits up to 6" diameter.

D. A minimum of 3'-0" or 4/3 the pipe inside diameter plus 1'-6" for conduits over 18".

E. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

F. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

3.5 SUBGRADE INSPECTION

A. Proof-roll subgrade consisting of granular soils below slabs and under pavement as outlined in paragraph 3.3.C above. Any soft pockets, areas of excess yielding, or areas disturbed during excavation and construction shall be over excavated and replaced with structural fill. Do not proof-roll wet or saturated subgrades or subgrades consisting of silt/clay soils (marine deposits).

B. The exposed subgrade will be examined in the field by the Geotechnical Engineer to observe the strength and bearing capacity of the soils. Disturbed or soft soils, as judged by the Engineer, shall be excavated and replaced with suitable material without additional compensation.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, or accumulated water, as directed by Engineer, without additional compensation.

D. Overexcavate subgrades disturbed/damaged by construction vehicle traffic to the depth and plan limits directed by the Engineer. Replace disturbed soil with suitable material without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.

B. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion.

B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

C. Stockpiles must be contained within permissible work and staging areas in accordance with the detail shown on the Drawings.

3.8 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches with Engineered Fill, Gravel Borrow, or granular backfill, or crushed stone.

D. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact pipe zone backfill to a height of 6 inches over the utility pipe or conduit.

F. Carefully compact pipe zone backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Place and compact trench granular backfill of satisfactory soil to final subgrade elevation.

H. Install warning tape directly above utilities as noted in Section 2.2, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.9 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

1. Place and compact fill material in layers to required elevations as follows:
2. Under grass and planted areas, use satisfactory soil material.
3. Under walks and pavements, use Granular Fill below base and subbase gravels.

B. In open areas, structural fill should be placed in level, uniform lifts not exceeding 12 inches in uncompacted thickness and be compacted with self-propelled compaction equipment. In confined areas and within 4 feet of foundation walls, structural fill should be placed in lifts not exceeding 6 inches in uncompacted thickness and be compacted with hand-operated compaction equipment. All fill placed for footing and slab support should be structural fill compacted to at least 95 percent of the maximum dry density as determined by *ASTM Standard D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).*

3.10 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, aerate or chemically treat otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Gravel Borrow: Place in layers not more than 6 to 12 inches in loose depth for material compacted by heavy compaction equipment and not more than 6 inches for material compacted with hand-guided equipment.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

Location	**Minimum Compaction Requirements**	**Testing Frequency 1 Lift per:**
Structures and Walkways	95 Percent	5,000 square feet
Trenches	95 Percent Bedding and 92 Percent Trench Zone	100 linear feet
Pavement Base and Subbase Areas	95 Percent	5,000 square feet
Pavement Areas (Below Base & Subbase)	92 Percent	5,000 square feet
Landscaped Areas	90 Percent Nominal Compaction	5,000 square feet

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus ¼" with no "bird baths".
3. Pavements: Plus or minus ¼" with no "bird baths".

3.13 SUBBASE AND BASE COURSES

A. Place subbase and base course on stable, firm subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Shape subbase and base course to required crown elevations and cross-slope grades.

C. Compact subbase and base course in maximum 8-inch lifts in uncompacted thickness at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.14 DRAINAGE COURSE (N.I.C.)

A. Place drainage course on stable, firm subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade or filter fabric as shown on the Drawings, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

C. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades consisting of engineered fill materials, tests will be performed to verify that the compaction requirements are achieved. Bearing capacities will be verified visually in natural soils (glacial till), weathered rock or bedrock.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions without additional compensation.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

E. The in-situ sandy soils and gradation makes them susceptible to “loosening” if allowed to dry out. The contractor shall keep the soils moist and cover with a 12” layer of sand/soil mix approved to the geotechnical engineer of record.

F. All areas where soil is placed shall not have standing water. The contractor shall keep water out of the work areas until backfill is complete or adequate provisions to protect the work have been taken by the Contractor.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil except loam and materials otherwise shown on the contract drawings, waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property at no extra expense to the Owner.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

B. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control groundwater 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. Discharge all pumped water through a Dirtbag® or equal. Dewatering water may <u>not</u> be discharged directly to nearby City drainage systems.

C. Comply with all OSHA and other safety regulations.

PART 2 - PRODUCTS (VACANT)

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, sumps, 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 groundwater 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, Dirtbag® 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

SECTION 31 25 13

EROSION CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary and permanent erosion control systems.

B. Slope Protection Systems.

1.2 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing

B. Section 31 20 00 – Earth Moving

C. Construction Requirements

D. Construction Management Plan

1.3 ENVIRONMENTAL REQUIREMENTS

A. The Site Contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the construction contract in accordance with the Erosion and Sediment Control plan, details and notes prepared for this project and in accordance with the requirements of the City of Portland's Permit and conditions of approval. The Erosion and Sediment Control plan, notes and details and Site Permits have specific restrictions on work which must be completed prior to the start of other construction, seasonal work limits, the amount of area which can be exposed at a given time, the general sequence of construction, and Site Contractor monitoring responsibilities for documenting compliance with the erosion control plan for this project. These affect the scheduling of the work.

Protected resources as referred to in this document include wetlands, streams or water bodies, and trees or vegetation outside of the work limit.

Prior to grubbing, orange safety fence shall be installed between the limit of grading and any protected resource. When the protected resource is a tree, the safety fence shall be installed at the drip line of the tree. If disturbance of the root system occurs, the Site Contractor shall have an Arborist or Nurseryman inspect the root system and provide recommendations to preserve the tree. This information shall be included in the logs for the Erosion Control Plan maintained by the Site Contractor.

B. The Site Contractor will be required to designate, by name, a suitably qualified individual, responsible for implementation of all erosion control measures as required by current local, State and federal regulations and this specification.

Specific responsibilities will include:

1. Assuring and certifying the Site 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 plan, details and notes.

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. The erosion and sediment measures shown on the contract documents are minimum provisions. Any additional measures required to comply with the permit or intent of the Erosion and Sedimentation Control plan shall be incidental to the contract.

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 90 percent is required prior to removal of erosion control measures.

5. Maintaining precipitation records and monitoring forecast activity.

C. It shall be the responsibility of the Site Contractor to implement, maintain, monitor and document compliance with the erosion and sediment control plan for the project and to avoid turbid discharges from the site, to avoid fugitive dust emissions, to avoid sediment from leaving the site, or affecting areas outside of the project work limits.

The work includes the submission of logs and photographic evidence of compliance with the plan at the time each pay requisition is submitted. These records shall be certified as complying with the Erosion Control Plan and this specification. Deficiencies in the logs or photographic records identified by the Owner or Engineer shall be corrected before the pay requisition is processed.

The photographic documentation must include:

1. A minimum of 10 digital photos per week showing the appropriate erosion control measures in place.

2. Evidence of stabilization of areas that are not being actively worked.

3. Documentation of any observed releases of turbid runoff or failure of any erosion control measure.

D. The erosion control measures specified are required to be installed in accordance with the details provided with the construction plans and manufacturer's recommendations. The method and details of the installation of these erosion control methods are of vital importance to insure the effectiveness of the erosion control measures. While precipitation amounts cannot be predicted, the Erosion Control Plan is designed to minimize erosion by restricting the amount of the site that can be open at a given time, limiting the period that an area can be open without stabilization, and requiring weather forecasts to be monitored. It is a requirement of the contract documents that these methods be incorporated on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quick growing grasses for temporary seeding (see seed mixes contained in Erosion and Sedimentation Notes).

B. Hay or straw bales.

C. Fencing for siltation control as specified on the plans. Mirafi prefabricated silt fence, straw wattles or approved equal.

D. Curlex blankets by American Excelsior Company or approved equal. Curlex single net except Curlex double net in winter months.

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 Sediment Barriers or SiltSacksTM, or approved equal for inlet protection.

I. A stabilized construction entrance to be constructed of the materials identified on the contract drawings.

J. Calcium chloride and water for dust control.

K. DIRTBAG® as outlined on the contract drawings and specified in Section 31.

L. Catch basin inserts. SiltSacks™ or approved equal.

M. Sorbent booms. Ecotech "Hula" Bug or equal (N.I.C.).

N. DirtGlue™ Polymar Emulsion Mixes. DirtGlue™ emulsion formulation must be approved by Owner prior to installation (NIC).

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 and Owner and a remedial action prepared and implemented by the Contractor.

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 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 any time by clearing and grubbing, excavation, borrow and embankment operations. The Owner has the authority to direct the Site Contractor to provide immediate permanent or temporary pollution control measures. The Site 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 necessary to comply with the erosion control plan.

E. The temporary erosion control systems installed by the Site Contractor shall be maintained to control siltation at all times during the life of the Contract. The Site Contractor must respond to any maintenance or additional work to comply with this specification within a 48-hour period.

F. DIRTBAGS® are required for the discharge of <u>any</u> construction dewatering or pumping, and the DIRTBAG® shall be operational before any trenching.

G. Certain erosion control measures require staged restoration. For example, reinforced cuts must be completed in 5-foot vertical increments.

H. Fugitive dust shall be controlled through construction.

I. Sorbent booms must be installed in the catch basin before paving. These shall be replaced prior to requesting substantial completion (N.I.C.).

J. DirtGlue™ may be substituted to the Engineer for approval when DirtGlue™ is to be substituted for mulch, dust control, and other erosion controls of the emulsion mix, application rate, and weather condition that exist at the time of proposed installation must be approved by the Engineer (NIC).

3.3 CONSTRUCTION OF TEMPORARY EROSION CONTROL MEASURES

A. Perimeter Dike/Swale Construction

1. All perimeter dike/swale shall have uninterrupted positive grade to an outlet.

2. Diverted runoff from a disturbed area shall be conveyed to a sediment trapping device.
3. Diverted runoff from an undisturbed area shall outlet into an undisturbed stabilized area at non-erosion velocity.
4. The swale shall be excavated or shaped to line grade and cross section as required to meet the criteria specified in the standard.
5. Stabilization of the area disturbed by the dike and swale shall be done in accordance with the standard and specifications for temporary seeding and mulching, and shall be done within 10 days.
6. Periodic inspection and required maintenance must be provided after each rain event.

   Max. Drainage Area Limit: 2 Acres.

B. Silt Fence Construction

1. Woven wire fence to be fastened securely to fence posts with wire ties or staples. Posts shall be steel either 'T' or 'U' type or hardwood.
2. Filter cloth to be fastened securely to woven wire fence with ties spaced every 24" at top and mid section. Fence shall be woven wire, 12 ½ gauge, 6" maximum mesh opening.
3. When two sections of filter cloth adjoin each other, they shall be overlapped by six inches and folded. Filter cloth shall be either Filter X, Mirafi 100X, Stabilinka T140N, or approved equivalent.
4. Prefabricated units shall be Geofab, EnviroFence, or approved equivalent.
5. Maintenance shall be performed as needed and material removed when 'bulges' develop in the silt fence.

C. Stabilized Construction Entrance

1. Stone Size – Use 2" stone, or reclaimed or recycled concrete equivalent.
2. Length – Not less than 50 feet (except on a single residence lot where a 30-foot minimum length would apply).
3. Thickness – Not less than six (6) inches.
4. Width – Twelve (12) foot minimum, but not less than the full width at points where ingress or egress occurs. Twenty-four (24) foot if single entrance to site.
5. Filter Cloth – Will be placed over the entire area prior to placing of stone.
6. Surface Water – All surface water flowing or diverted toward construction entrances shall be piped across the entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.
7. Maintenance – The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way, all sediment spilled, dropped, washed or tracted onto public rights-of-way must be removed immediately.
8. When washing is required, it shall be done on an area stabilized with stone and which drains into an approved sediment trapping device.

9. Periodic inspection and needed maintenance shall be provided after each rain.

D. Sump Pit Construction

1. Pit dimensions are optional.
2. The standpipe should be constructed by perforating a 12-24" diameter corrugated or PVC pipe.
3. A base of 2" aggregate should be placed in the pit to a depth of 12" after installing the standpipe, the pit surrounding the standpipe should be backfilled with 2" aggregate.
4. The standpipe should extend 12-18" above the lip of the pit.
5. If discharge will be pumped directly to a storm drainage system, the standpipe should be wrapped with filter cloth before installation. If desired, ¼" – ½" hardware cloth may be placed around the standpipe, prior to attaching the filter cloth.

1.4 MULCH ANCHORING REQUIREMENTS

Anchoring Method or Material	Kind of Mulch to be Anchored	How to Apply
Peg and Twine	Hay or straw	After mulching, divide areas into blocks approximately 1 sq. yd. in size. Drive 4-6 pegs per block to within 2" to 3" of soil surface. Secure mulch to surface by stretching twine between pegs in crisscross pattern on each block. Secure twine around each peg with 2 or more tight turns. Drive pegs flush with soil. Driving stakes into ground tightens the twine.
Mulch Netting	Hall or straw	Staple the light-weight paper, jute, wood fiber, or plastic nettings to soil surface according to manufacturer's recommendations. Should be biodegradable. Most products are not suitable for foot traffic.
Wood Cellulose Fiber	Hay or Straw	Apply with hydro seeder immediately after mulching. Use 500 lbs. Wood fiber per acre. Some products contain an adhesive material, possible advantageous.
Mulch Anchoring Tool	Hay or Straw	Apply mulch and pull a mulch anchoring tool (blunt, straight discs) over mulch as near to the contour as possible. Mulch material should be "tucked" into soil surface about 3".
Chemical	Hay or Straw	Apply Terra Tack AR 120 lbs./ac. in 480 gal. of water (#156/ac.) or Aerospray 70 (60 gal/ac.) according to manufacturer's instructions. Avoid application during rain. A 24-hour curing period and a soil temperature higher than 45º Fahrenheit are required.

END OF SECTION

SECTION 31 25 73

DIRTBAG® SPECIFICATIONS FOR CONTROL OF SEDIMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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

B. Four (4) DIRTBAGS® shall be included as part of the base bid.

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.

D. The geotextile fabric shall be non-woven fabric with the following properties:

Properties	Test Method	Units	Non-Woven	
			53	55
Weight	ASTM D-3776	Oz/yd	8	10
Grab Tensile	ASTM D-4632	Lbs.	203	250
Puncture	ASTM D-4833	Lbs.	130	165
Flow Rate	ASTM D-4491	Gal/Min/Ft2	80	70
Permittivity	ASTM D-4491	Sec.[1]	1.5	1.3

Properties	Test Method	Units	Non-Woven	
			53	**55**
Mullen Burst	ASTM D-3786	Lbs.^{in2}	400	550
UV Resistant	ASTM D-4355	%	70	70
AOS % Retained	ASTM D-4751	%	100	100

All properties are minimum average roll value except the weight of the fabric which is given for information only.

PART 3 – CONSTRUCTION SEQUENCE

3.1 Install DIRTBAG® on a prepared crushed stone pad overlying Mirafi 600X as shown on the contract drawings. Strap the neck of the DIRTBAG® tightly to the discharge hose. The preparation of a DIRTBAG® area is required before any trenching. Any water pumped from the construction site must be discharged through a DIRTBAG®.

3.2 It may be necessary to use hay/poly or other measures to keep the DIRTBAG® from freezing during winter months.

3.3 The DIRTBAG® is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of the DIRTBAG®, the type and amount of sediment discharged into the DIRTBAG®, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most circumstances, the vendor claims DIRTBAGS® will accommodate flow rates of 1,500 gallons per minute. Use of excessive flow rates or overfilling DIRTBAG® with sediment will cause ruptures of the bags or failure of the hose attachment straps.

3.4 Dispose of DIRTBAG® in accordance with Local, State, and Federal regulations. If allowed, the DIRTBAG® may be cut open and the contents seeded after removing visible fabric. DIRTBAG® is strong enough to be lifted with added straps if it must be hauled away (extra option). Off-site disposal may be facilitated by placing the DIRTBAG® in the back of the dump truck or flatbed prior to use and allowing the water to drain from the bag in place, thereby dismissing the need to lift the DIRTBAG®.

END OF SECTION

SECTION 32 11 00

BASE COURSES

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 31 10 00 – Site Clearing

B. Section 31 20 00 – Earth Moving

C. Section 32 12 16 – Asphaltic Paving

D. Section 32 16 15 – Curbs and Sidewalks

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 D1557 - 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

A. 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 31 20 00, Earth Moving.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.

3.3 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 5,000 square feet in-place base material area.

5. Base and subbase material compaction: Perform one test in each lift for each 5,000 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 Engineer, 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

SECTION 32 12 16

ASPHALTIC PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide all material and labor for the placement of surface course and binder course on roads, access drives, parking lots, sidewalks, and walkways. All pavement shall be produced, supplied, placed and conform to the requirements of Section 401 of the MaineDOT Standard Specifications.

1.2 REFERENCES

A. November 2014 State of MaineDOT Standard Specifications, including relevant updates, except as modified herein.

B. November 2014 State of MaineDOT Standard Details.

C. MS-2 - Mix design methods for asphalt concrete and other hot mix types - The Asphalt Institute (AI).

D. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).

E. Hot Mix Asphalt Paving Handbook - US Army Corp of Engineers, UN-13 (CE MP-ET).

F. MS-19 - Basic Asphalt Emulsion Manual - The Asphaltic Institute (AI).

G. ASTM D946 - Penetration - Graded Asphalt Cement for use in Pavement Construction.

H. AASHTO M-226/ASTM D3381 Asphalt Cement

I. AASHTO M-140/ASTM D997 or AASHTO M-208/ASTM D-2397 Tack Coat

J. AASHTO M-117/ASTM D242 Mineral Filler

K. AASHTO T-245/ASTM D1559 Marshall Mix Design

L. Approved and released for construction plans (for State Highway work, there may be a difference between “Released for Bid” and “Approved and Released for Construction” drawings. Any substantive changes shall be addressed by approved change order before commencing the work).

M. City of Portland Technical Manual – Section 1: Transportation Systems and Street Design Standards.

1.3 RELATED SECTIONS

A. Section 31 20 00 – Earth Moving
B. Section 32 11 00 – Base Courses
C. Section 32 16 15 – Curbs and Sidewalks

1.4 SUBMITTALS

A. Design Mix: Before any asphaltic concrete paving is constructed, the Contractor shall submit the proposed actual design mix to the Owner for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, asphalt cement grade used, Marshall Stability (lbs), flow, effective asphalt content (percent), and direct references to the applicable highway department specifications sections for each material. Design shall be for a mixture listed in the most recent edition of roadway specifications of the state in which the project is to be constructed. In no case shall a mix design over three years old be submitted.

B. Material Certificates: Submit materials certificate to an independent testing laboratory retained by the Owner. The certificates shall be signed by the material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

C. Field density test results, minimum 1 per 100 tons of bituminous pavement placed including station/offset of test.

D. Plant inspection reports to verify pavement batch plant and paving equipment meets or exceeds MDOT Specification 401. The inspections shall be conducted by an independent testing firm retained by the Owner.

1.5 JOB CONDITIONS

A. Weather Limitations:

1. Apply tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application.

2. Construct asphaltic concrete paving when atmospheric temperature is above 40 degrees F base, 50 degrees F surface.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide asphaltic concrete mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet State Department of Transportation specifications and exhibit satisfactory record on previous installations.

B. Asphalt Cement: Comply with AASHTO M-226/ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, AR-80, viscosity grade, depending on local mean annual air temperature. (See following chart):

Temperature Condition	Asphalt Grades
Cold, mean annual air temperature < 7° C (45° F)	AC-10 85/100 pen.
Warm, mean annual air temperature between 7° C (45° F) and 24° C (75° F)	AC-20 60/70 pen.
Hot, mean annual air temperature > 24° C (57° F)	AC-30

Final acceptance of the proper grade of A.C. shall be made by the Owner's Engineer.

C. Tack Coat: Emulsified asphalt; AASHTO M-140/ASTM D 997 or M 208/ASTM D 2397, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.

D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D242, if recommended by applicable state highway standards.

E. Asphalt-Aggregate Mixture: See drawings and details – all materials must meet current Maine DOT Standards and Specifications.

2.2 EQUIPMENT

A. Maintain all batch plant and paving equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose material from compacted base material surface immediately before applying prime coat.

B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.

C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

3.2 APPLICATIONS

A. Tack Coat:

1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.

2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat on the surface of all such bases where asphaltic concrete paving will be constructed.

3. Apply emulsified asphalt tack coat in accordance with APWA Section 2204 and applicable state highway specifications.

4. Apply at minimum rate of 0.05 gallon per square yard of surface.

5. Allow to dry until at proper condition to receive paving.

3.3 ASPHALTIC CONCRETE PLACEMENT

A. Place asphalt concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:

1. When ambient temperature is between 40 degrees F and 50 degrees F: 285 degrees F.
2. When ambient temperature is between 50 degrees F and 60 degrees F: 280 degrees F.
3. When ambient temperature is higher than 60 degrees F: 275 degrees F.

B. Whenever possible, all pavement shall be spread by a finishing machine. Inaccessible or irregular areas, pavement may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated coarse aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10'-0" wide.

D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

3.4 WEATHER AND SEASONAL LIMITATIONS

For weather limitations, the State of Maine will be considered to be divided into two paving zones:

(a) Zone 1: All area north of US Route 2 from Gilead to Brewer and north of Route 9 from Brewer to Calais.

(b) Zone 2: All area south of Zone 1 including the US Route 2 and Route 9 boundaries.

Bituminous plant mix for use other than traveled way wearing course may be placed in either zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer placed in the shade at the paving location is 35 degrees F or higher and the area to be paved is not frozen. Plant mix to be placed as traveled way wearing course may be placed in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th provided the air temperature determined above is 50 degrees F or higher.

Any hot bituminous base or binder course that is to be subject to traffic during the winter months shall have its gradation densified or asphalt content (percent of mix) adjusted through a change in the job mix formula as submitted by the Contractor and approved by the Owner.

3.5 ROLLING AND COMPACTION

A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. Mixture shall be compacted to a minimum, of 92% theoretical maximum density. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 FIELD QUALITY CONTROL

A. An Independent Testing Laboratory, shall be retained to perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, density,

composition and surface smoothness. Asphaltic surface and asphaltic base/binder courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. In no event shall less than three cores in light duty areas and three cores in heavy-duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Asphaltic Concrete pavement samples shall be tested for conformance with the mix design. Refer to the general contract conditions for clarification on the cost for the independent laboratory.

B. Grade Control: Establish and maintain required lines and elevations.

C. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" overlay; or shall be removed and replaced to the proper thickness, at the discretion of the Owner's; until specified thickness of the course is met or exceeded at no additional expense to the Owner.

D. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The results of these tests shall be made available to the owner upon request. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

Base Course Surface:	1/4"
Wearing Course Surface:	3/16"

E. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.

F. Compaction: Field density tests for in-place materials shall be performed by examination of field cores in accordance with one of the following standards:

1. Bulk specific gravity of paraffin-coated specimens: ASTM D-1188.

2. Bulk specific gravity using saturated surface-dry specimens: ASTM D-2726.

Rate of testing shall be one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard-duty areas. Cores shall be cut from areas representative of the project.

Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

G. Pavement Plant Inspection: The paving plant shall be inspected a minimum of one week prior to pavement placement to verify the plant meets the requirements outlined in Section 401. Random inspection and sampling during pavement placement shall be conducted and documented by a testing firm hired and paid for by the Owner.

H. After the binder pavement is placed, the Contractor shall retain an independent surveyor to profile the centerline of the access drive at a minimum of 25-foot stations plus survey the elevations at the locations of any pavement spot grades shown on the drawing and all catch basin inlets. This survey information shall be plotted on the drawing access drive profile and a grading plan. The Contractor shall supply this information in triplicate to the Engineer with copies to the Owner, Architect and Construction Manager. A narrative identifying any areas which do not meet the specification tolerances of subsection E of this specification with an outline of corrective measures shall accompany the submission. The Owner shall have four working days upon certified receipt of these data to issue a letter authorizing surface pavement to be placed.

END OF SECTION

SECTION 32 16 15

CURBS AND SIDEWALKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete, Brick or Bituminous Sidewalks

B. Stonedust Walks (N.I.C.)

C. Granite Curb

D. Bituminous Curb (N.I.C.)

E. Slipform Cast in Place Concrete Curb (precast concrete curb is not permitted on this project) - (N.I.C.)

F. Unit Pavers

G. Tactile Warning Strips

H. This specification contains the requirements for multiple types of curbing and sidewalks. Some of these will not be required for this project.

1.2 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing

B. Section 31 20 00 – Earth Moving

C. Section 32 11 00 – Base Courses

D. Section 32 12 16 – Asphaltic Paving

E. State Highway Department Standard Specifications

F. Construction Documents.

G. City of Portland Technical Manual – Section 1: Transportation Systems and Street Design Standards.

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. See Structural Plan for further information.

1.4 REFERENCES

A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

B. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural construction.

C. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

D. ASTM C33 - Concrete Aggregates.

E. ASTM C94 - Ready Mix Concrete.

F. ASTM C150 - Portland Cement.

G. ASTM C260 - Air-Entraining Admixtures for Concrete.

H. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

I. ASTM C494 - Chemical Admixtures for Concrete.

J. FA TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

K. MDOT specifications for Highway and Bridge construction, current edition.

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

1. C33 – Concrete Aggregates
2. C67 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
3. C144 – Aggregate for Masonry Mortar
4. C936 – Standard Specification for Solid Interlocking Concrete Pavers.
5. C979 – Specification for Pigments for Integrally Colored Concrete.

M. Interlocking Concrete Pavement Institute (ICPI).

1. Interlocking Concrete Pavement Manual

1.5 PERFORMANCE REQUIREMENTS

A. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with non-staining type coating that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner.

C. Concrete Materials: Comply with requirements of MaineDOT Specifications Section 502 for concrete materials, admixtures, bonding materials, curing materials, and others as required.

Any concrete outside of the building and not a structural slab shall be part of the site work for the project.

D. Joint Fillers: Resilient pre-molded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A; or AASHTO M 153, Type I.

E. Joint Sealers: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant", Sonneborn "Sonomeric CT 1 Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulken 45", or Woodmont Products "Chem-Caulk".

F. Granite Curb shall be used where required on the Contract Drawings and shall be installed in accordance with the requirements of MDOT Specification 609 or City of Portland Technical Standards or whichever is more stringent. All curb shall be of granite mined and cut in the United States of America. Type 1 granite headstones shall be used at all catch basin inlets along the access drive gutter lines. Granite at all ADA ramps shall be Type 1 with a flush reveal. Type V curb is not permitted for tip downs or to directly abut Type 1 curb in any area.

G. Bituminous Curb shall be used where required on the Contract Drawings and shall be installed in accordance with Section 609 of the MDOT specifications. Fiberglass resin shall be used in all curb. Coatings pursuant to MDOT specifications (seal coat) shall be provided for all bituminous curb (N.I.C.).

H. Slipform Concrete Curb shall be used where required on the Contract Drawings. Concrete materials for Slipform curb will meet the same requirements for concrete curb under 502.05 of the MaineDOT Standard Specifications including 703.0201 associated with ASR Aggregates. This includes a minimum compressive strength of 4000 psi (N.I.C.).

I. Aggregates subbase gravels and base gravels (if appropriate) for sidewalks shall meet the requirements of Section 32 11 00 of these specifications.

J. Asphaltic concrete pavement for sidewalks shall meet the requirements of Section 32 12 16 of these specifications.

K. STONEDUST (N.I.C.)

i. 3/8” sieve material as supplied by R. J. Grondin and Sons, Route 25, Gorham, ME 839.5544 or approved equal conforming to the following gradations:

Sieve Designation	% by Weight Passing Square Mesh Sieves
#6	100
#16	40-63
#40	20-29
#200	0-8

ii. Construct stone dust on prepared base to lines, grades and sections shown on the drawings and details.

iii. Compact to 95% density.

iv. During the final grading of lawn areas, bring loam to stone dust walk edges and grades. Create a smooth line where loam meets stone dust. Keep stone dust and loam from becoming mixed.

L. Aggregate Base: Material for aggregate base course shall be a graded, granular, non-frost susceptible, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.

1. Material shall conform to MaineDOT Specifications Section 703.06, "Aggregate for Base" Type A gravel.

M. Unit Pavers:

1. City sidewalks require pedestrian/light traffic clay Pathway paving bricks as manufactured by Pinehall Brick (www.pinehallbrick.com), or approved equal, and as distributed by Morin Brick (Tel. 207-784-9375 – Jason LaChance).
2. Onsite plazas shall contain Hanover Prest® Pavers or approved equal (12x12 or 24x24) Natural Color with Tudor® finish.
3. Unit specifications:
   a. Unit clay paver shall conform to the requirements of ASTM C902, Class SX, Type 1, Application PX.
   b. Square, wire-cut edges, no lugs.
   c. Minimum average compressive strength of 8,500 psi.
   d. Water absorption less than 5%, without sealer.
   e. Dimensional tolerance: ± 1/8" in any dimension.
   f. Passes CSA-A231.2 freeze thaw test in saline solution without use of sealers or other products applied to the paver.
   g. Refer to details in the drawings and to the following schedule:

Type/Finish	Size	Uses	Color	Pattern
Pinehall Pathway	4x8x2¼	Sidewalks	Full Range	Runningbond
Hanover Prest® Paver	12 x 12 or 24 x 24	Plaza	Natural	Refer to Site Plans

   i. Color selections correspond to manufacturers' designations and City of Portland Technical Standards.
   ii. Refer to Enlarged Site Layout Plans for coursing and pattern direction.
4. Detectable Warning Pavers as manufactured by Pavestone, (www.pavestone.com), Whitacre-Greer (www.wgpaver.com or 1-800-947-2837), or approved equal (N.I.C.).

a. Dry-press solid (uncored) hard-burned, frost-free pavers with chamfered edge.
b. Complies with ADA requirements, 5,000 psi min. compressive strength, 8% maximum absorption.
c. Size: 2 ¼" x 4" x 8".
d. Color: Light Gray.

5. The pavers shall be free of cracks or other imperfections when viewed from a distance of 20 feet (6 meters). The exposed parts of the brick shall be free of chips exceeding 5/16" from the edge and ½" from a corner. All pavers that do not meet these criteria shall be replaced with acceptable units.

N. Cobblestone (N.I.C.):

1. Provide gray granite cobblestones roughly 9"x5"x5" in size.

O. Edge Restraint:

1. Provide injection molded polyethylene edge restraint as manufactured by Snap Edge Corporation or approved equal. Use approved edge restraints where a structure, pavement, or curbing does not abut pavers.

2. Edge restraint spikes shall be 12" x 3/8" diameter galvanized steel.

P. Setting Bed and Joint Filler:

1. Concrete sand conforming to ASTM C33 for bedding sand; ASTM C144 for unit paver joint sand. Bedding sand may be used for unit paver joints, but may require extra sweeping compound and compaction.
   a. Sand to be sharp, washed and free of foreign material.

2. Stone dust may be used instead of sand to fill cobblestone joints.

Q. Bituminous Setting Bed:

1. Refer to Section 02525 – Curbs and Sidewalks

R. Water: Water shall be potable and shall be free of injurious contaminants.

S. Catalog cuts and information on the curb supplier shall be submitted to the Engineer for approval prior to ordering the material.

T. Tactile Warning Strips: Materials shall be selected by the Contractor from the materials shown on the drawings or from materials approved by the City of Portland Technical Standards and shall meet all current ADA standards at the time the materials are ordered.

U. Granite Black (Steps on Thames): Contractor shall provide source, color, and lengths for review and approved by the landscape architect and City Public Works prior to ordering.

2.2 MIX DESIGN AND TESTING

A. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce the following properties:

1. Compressive Strength: 4,500 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
2. Slump Range: 3"-5" for normal concrete at time of placement
3. Air Entrainment: 4% to 6%

PART 3 - EXECUTION

3.1 PREPARATION FOR SIDEWALKS

A. Prepare subgrade to receive sidewalk subbase gravel in accordance with Section 32 11 00.

B. Place and compact subbase and base gravel in accordance with Section 31 20 00 and 32 11 00 of these specifications.

C. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after the unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.

D. Surface Preparation: Remove loose material from compacted base material surface immediately before placing concrete.

3.2 INSTALLATION OF CONCRETE SIDEWALKS

A. Form Construction:

1. Set forms to required grades and lines, rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.
3. Check completed formwork for grade and alignment to following tolerances:

   Top of forms not more than 1/8" in 10'-0".
   Vertical face on longitudinal axis, not more than 1/4" in 10'-0".
4. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Locate, place and support reinforcement per Division 3 specifications.

C. Concrete Placement:

1. Comply with requirements of Division 033000 – Concrete.

2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structure until they are at the required finish elevation and alignment.

3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels and joint devices.

4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hours, place construction joint.

D. Joint Construction:

1. Contraction Joints: If joints are specified, the curb or gutter shall be constructed in uniform sections of the length specified on the plans. The joints between sections shall be formed either by steel templates 1/8 inch in thickness, or a length equal to the width of the gutter or curb, and with a depth which will penetrate at least 2 inches below the surface of the curb and gutter; or with 3/4 inch thick preformed expansion joint filler cut to the exact cross section of the curb or gutter; or by sawing to a depth of at least 2 inches while the concrete is between 4 to 24 hours old. If steel templates are used, they shall be left in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place.

2. Longitudinal Construction Joints: Concrete curb, concrete gutter, combination concrete curb and gutter, where specified on the plans, shall be tied to concrete pavement with 1/2 inch round, reinforcement bars of the length and spacing shown on the plans.

3. Transverse Expansion Joints: Transverse expansion joint in curb, curb and gutter, gutter or sidewalk shall have the filler cut to the exact cross section of the curb, curb and gutter, gutter or sidewalk. The joints shall be similar to the type of expansion joint used in the adjacent pavement.

E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If not joint sealer, place top of joint filler flush with finished concrete surface. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler section together.

F. Joint Sealants: Exterior pavement joint sealants shall be installed per manufacturer's recommendations.

G. Cold Weather Placing:

1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions or low temperatures, in compliance with ACI 306 and as specified herein. All expenses associated with the protective measures, temporary heating, etc. shall be at the expense of the Contractor.

When air temperature has fallen to or is expected to fall below 40° F (4° C) uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50° F (10° C) and not more than 80° F (27° C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete or frozen subgrade or subgrade containing frozen materials.

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical agents, unless otherwise accepted in mix design.

H. Concrete Finishing:

1. After striking off and consolidating concrete, smooth surface by screening and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

2. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius. Eliminate tool marks on concrete surface. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

   a. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.

   b. Paving: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.

3. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.

4. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in the "water-curing" section of ACI 308-81. Apply Saltguard© or approved equal to finished concrete surface.

I. Cleaning and Adjusting:

1. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

2. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.3 GRANITE CURB

A. Granite curbing will be installed and backfilled in accordance with provisions of Paragraph 3.06. If Type 5 sloped curb configuration is used, the curb shall be set on a slope as shown on the plans. All granite curb used to form a radius and any granite curb of any type with stone length of less than 36” shall be backfilled with lean concrete to a level equal to the binder pavement surface in front of the curb and a level equal to 3” below finish grade behind the curb.

B. Protect the granite curb from damage throughout construction and until substantial completion.

3.4 BITUMINOUS CURB

A. Bituminous curb shall be installed on the bituminous pavement base course prior to placement of final bituminous pavement wearing course. The curb shall be backfilled with approved materials. That shall be placed in layers not exceeding 8 inches in depth, loose measure and thoroughly tamped.

B. Bituminous curb shall be seal coated after placement in accordance with MDOT Standard Highway specifications.

3.5 SLIPFORM CONCRETE CURB

A. Installation: Concrete may be placed with an approved Slipform machine that will produce a finished product according to the design specified in the plans and will meet the same standards set for cast-in-place curbing. For cold weather slipforming, the outside temperature must be at least 36 °F (2.2 °C) and rising. The curb shall be placed on a firm, uniform bearing surface, shall conform to the section profile specified in the plans and shall match the appropriate grade. Proper curing shall be insured through the use of a curing compound spray that meets ASTM specifications. Expansion joints will be provided at ends of curve radii or wherever the curb meets rigid structures such as building foundations or fire hydrants. Contraction joints will be placed at 10 foot (3 m) intervals using sawing methods, which cut 1-3" into the concrete. Joints shall be constructed perpendicular to the subgrade and match other joints in roadways, sidewalks or other structures when applicable. If the concrete is placed on bituminous pavement, an approved epoxy or adhesive shall be used to bond the curb to the pavement. The contractor shall form tip downs and transitions to conform to the requirements of the construction documents and details.

B. Backfilling: Same as Section 609.05 (B) of the Maine Department of Transportation Standard Specifications.

C. Protection: Slipform curbing must be adequately protected after placement. The concrete shall be allowed to cure for at least 72 hours. During cold weather conditions, when temperatures drop below the required temperature of 36 °F (2.2 °C) after placement, curbing shall be protected by concrete blankets or a combination of plastic sheeting and straw. After any placement of Slipform curbing, regardless of weather conditions, the placed curbing shall be adequately protected by traffic control devices and flagging as necessary

3.6 HOT BITUMINOUS CONCRETE SIDEWALKS

A. Bituminous concrete pavement for sidewalks shall be placed in two lifts to provide the total thickness specified on the drawings.

B. Compaction shall be by a paver roller having a minimum total weight of 2,000 lb. with a minimum of 65 lbs. per inch of drive roll or by satisfactory vibratory equipment.

C. Placement and quality control shall comply with Section 32 12 16 of these specifications.

3.7 BRICK SIDEWALKS

A. Preparation: Provide and compact base gravel where required as surface to place stone dust or bituminous concrete as shown on the detail.

B. Stone Dust: A layer of sand cement base material one (1") inch thick shall be spread upon the properly prepared bituminous concrete base. This course of stone dust shall be firm but not compacted.

C. Brick Placement: Perform all masonry work with skilled workmen under adequate supervision. A journeyman brick mason shall supervise all brick placement. Lay all masonry true to lines and grade with all surfaces true, and corners straight and plumb. Lay exposed-to-view bricks smooth side up, with an individual unit-to-unit level tolerance not to exceed 1/8-inch and an overall tolerance from the grade not to exceed ¼-inch in 10 feet in any direction. Lay no unit having chipped edges of face, in exposed-to-view locations. Remove any such unit, if installed and replace with a new undamaged unit.

1. Brick Laying: The brick shall be laid in patterns shown on the drawings. The joints shall be hand tight, leaving only as much space between bricks as occurs naturally from rough surface or slight irregularities. When necessary, the brick shall be cut with a masonry saw. The Owner will require replacement of improperly broken bricks. No struck brick shall be less than two (2') inches in length.

D. Compaction: After the bricks are carefully laid upon the properly prepared sand cement base, a 2" x 4" board shall be placed upon the bricks and shall be tapped with a hammer until the bricks reach a firm, unyielding bed and present a surface of the proper grade and slope. Any divergence from line and grade is to be corrected by taking up and relaying the bricks. After setting the bricks, a sufficient amount of sand cement shall be spread over the surface and thoroughly swept or raked so as to fill the joints. All surplus sand cement remaining on the brick paved areas after the joints have been properly filled shall be removed by sweeping. Avoid raking out the joints during the removal of excess sand cement.

E. Moisture: Sufficient moisture shall be applied by sprinkling to permit the sand cement to achieve and set.

F. After 3 days, the surface of the walk shall be cleaned with a solution of muriatic acid to remove any cement film.

3.8 INSTALLATION OF UNIT PAVERS

A. Base:

1. Contractor shall inspect and verify that aggregate base and sand leveling 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 02511 – Asphaltic Concrete 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 owner's representative 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. Top edge should not be visible from surface.
4. Notify Owner's representative 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. Keep cuts to a minimum. Small pieces less than 2" in any dimension, or pieced together to create a larger "whole" will not be accepted.
3. A typical spacing of 1/16" is to be maintained between pavers; maximum joint width 1/8".
4. Gaps between pavers and adjoining objects of greater than 3/8" shall 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. Expansion and Control Joints:

1. Provide for sealant-filled joints at building foundation and against concrete slabs or foundations.
2. Provide compressible form filler as backing for sealant-filled joints as necessary.
3. Install joint filler before setting pavers.
4. Make top of joint filler flush with top of pavers.

F. Tolerances:

1. Do not exceed 1/16-inch (1.6 mm) unit–to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and ¼ inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface paving.
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.

G. Repair, Protection, Cleanup:

1. Replace units that are chipped, broken, stained, or in any other way do not conform to or may adversely affect the adjoining work.
2. Work area to be left in a neat and orderly manner upon completion of work, free from debris and swept clean.
3. 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.

H. Inspection and Acceptance:

1. When paver installation is complete, the owner’s representative will, upon request, inspect work to determine acceptability.
2. 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.
3. The owner’s representative will, upon completion and request, inspect replaced areas to determine acceptability.

END OF SECTION

SECTION 32 17 23.13

PAINTED PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. The work shall consist of furnishing and placing permanent reflectorized pavement markings as shown on the plans or as designated by the Engineer or City Public Works Representatives.

B. When it is necessary to remove existing pavement lines or markings, it shall be done by grinding, sand blasting, or other acceptable method. The method chosen must be capable of completely eradicating the existing lines or markings without damage to the existing pavement.

1.2 RELATED REQUIREMENTS:

A. Section 31 20 00 – Earth Moving

B. Section 32 11 00 – Base Courses

C. Section 32 12 16 – Asphaltic Paving

D. Construction Drawings

E. City of Portland Technical Manual

1.3 PROJECT CONDITIONS

A. 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

A. 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 Portland Public Works, the Engineer, Contractor, Pavement Marking Subcontractor, and the Owner shall be conducted prior to conducting the work. Marking locations, colors for the markup, and dates of application shall be confirmed at this meeting. The Owner reserves the right to alter or modify said locations 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. Install during calm (low wind) conditions in order that spray or unintended paint does not affect adjacent areas. Where necessary, apply during periods of the day when traffic can be controlled and barricaded from area where markings are being installed. Use proper barricades, traffic and safety officers. 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:

1. Pedestrian Crosswalks: White
2. Lane Striping where separating traffic in opposite directions: Yellow
3. Lane Striping where separating traffic in same direction: White
4. Handicap Symbols: Conforming to the modified symbol for International Barrier Free as shown on drawings
5. Parking Stall Striping: White
6. Parking space numbering (if required by plans): White
7. Stop Bars: Provide painted stop bars where shown on the plan
8. Directional Arrows: White
9. Fire Lane: Per Fire Department and Portland Public Works selection
10. Chevrons: Yellow

END OF SECTION

SECTION 32 30 00

SITE IMPROVEMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Documents affecting Work of this Section include, but are not necessarily limited to, The CONDITIONS OF THE CONTRACT General Conditions, Supplementary Conditions, Addenda and all Sections of Division 1, which are hereby made a part of this Section.

B. Coordinate Work with that of other trades affecting or affected by Work of this Section. Cooperate with such trades to assure the steady progress of the Work.

C. The Standard Specifications referred to herein is the book entitled *"Standard Specifications, Highways and Bridges"* published by the State of Maine Department of Transportation dated April, 1995, as supplemented, excluding the following portions thereof:

DIVISION 100, SECTIONS l02 THROUGH l09 NUMERICAL INDEX OF PAYMENT ITEMS INCLUDED IN EACH SECTION.

Those Sections of the aforementioned Standard Specifications which are cited herein are applicable to the Work of this Contract as they may be modified, amplified or added to by this Section.

1.2 DESCRIPTION

A. Provide all labor, materials, equipment and services necessary for proper and complete installation of the following as indicated on the Drawings and herein specified:

1. Site Lighting
2. Granite slab steps
3. Granite block wall with tempered glass Windscreen
4. Granite tree wells with tree grate
5. Raised granite tree planters
6. Green Vegetated Fence
7. Benches
8. Rooftop Tree Planters
9. Pre-vegetated green roof modules

B. Related Work specified elsewhere:

Excavation, Backfill and Compaction	- Section 31 23 00
Gravel Base Courses	- Section 32 11 00
Paving Walks and Curbs	- Section 32 12 16
Subdrainage	- Section 33 46 00
Structural Concrete	- Division 03

Painting and Finishing	- Division 09
Electrical	- Division 26

1.3 QUALITY ASSURANCE; SUBMITTALS

A. General: Comply with requirements of SECTION 01 33 00 – SUBMITTALS, 01 40 00 QUALITY REQUIREMENTS.

B. Shop Drawings: Submit product specification literature and/or shop drawings for:

1. Granite for walls, steps, tree wells and raised planters.
2. Low LED Guardrail for rooftop terrace.
3. Green Vegetated Fence.

C. Samples:

1. Granite to be used for walls, steps, tree wells & raised planters.

PART 2 – PRODUCTS

2.1 CONCRETE

A. 4000 psi air entrained concrete. Conform to requirements of Division 03.

2.2 Site Lighting and Accessories

A. Existing City Street Lights (Hancock (X-5D) & Thames (X-6B) Sec. 10 -Municipal Street Lighting Standards)

1. Existing street lights within the right of way will be removed and stored during construction. Some of the existing light pole bases will need to be re-located as part of this project. It is intended that the existing lights, light poles and light pole bases will be re-used.

B. Area Lights - Mounted at 12 feet

1. New concrete light pole bases shall be 16” round as manufactured by Pre-Cast of Maine, Topsham, ME, as detailed on plans.
2. Light poles shall be Beacon Model #SSS-B with steel circle base plate, standard black powder coated polyester paint.
3. Light fixture shall be Beacon Viper S (Small Viper), 136-watt 60NB-136 LED array, 3K, T2, BLC, RA mount

C. Bollard Lights

1. 8-inch diameter concrete tube to a depth of 4 feet below finish grade.
2. 5-inch bolt circle template.
3. Light fixture shall be Kim Lighting B30 LED, 15 LED, 3K, Universal Voltage

D. Wall Mounted Lights

1. Wall lights to be B-K Lighting Core Drill Step Star CD-SS, Aluminum, finish to be Bronze, B-K LED bulb # 362, 2700K, 36-degree flood with 90 degree cutoff.

E. Tree Mounted Lights

1. Tree Mounted lights to be Hunza NPS spot, D3-12v/350mA, 60-degree, 2700K with Glare Guard and SSP/T, Finish Black.
2. Tree Mount – HK Lighting- TM125-HB, Color black, with 1" nylon adjustable straps.

F. Rooftop Terrace Tree Planters and Perimeter LED Rope

1. LED rope lighting to be Infina by Jesco, 2700K, installed in anodized aluminum channel, 120V with a max. length of 150 feet per circuit.

2.3 Granite (Steps, Wall blocks, tree wells)

A. Color:

a. Salt & Pepper (Concord Gray) as supplied by Swenson Granite in Westbrook, Maine. Telephone number 207-797-4500 or approved equivalent.

B. Finish: (Varies per application)

a. Granite Steps along Thames Street, 14" tall x 14" deep x 8 ft lengths. Steps to have sawn and thermal top and front face and sawn back and bottom.

b. Granite tree wells along Thames Street, 24" tall x 5" deep x varying lengths. Stones to have sawn and thermal top and rockface on the outside. Inside and bottom surface to be sawn.

c. Raised Granite tree planters along Hancock Street to be 5" wide x 12" tall x varying lengths. Corners pieces to be curved with a 12" radius to the outside edge of stone. Stones to have sawn and thermal top and rockface on outside. Inside and bottom surface to be sawn.

d. Granite Block wall at Plaza stones to be 18" wide x 24" tall x 5'-0" in length. Top of stones to be sawn and thermal, both sides to be rockface, bottom and ends to be sawn. Exposed ends to have rockface.

2.4 Green Vegetated Fence:

A. Material:

a. Vegetated fence to be constructed out of steel both tubular and solid rod.

b. Posts to be 3" square tubular steel with solid caps on top.

c. Panels to be 4ft x 8ft in size with 2" square tubular steel frame with ½" diameter steel rods welded at 6" on center vertically.

d. All posts and panels to be primed and painted (x2 coats) Finish color to be Black.

e. All hardware to be stainless steel.

2.5 Benches w/ LED light strip underneath:

A. Benches to be Manufactured by DuMor, Inc., model# 472-60-2AR/S-2, 6ft in length with armrests on each end, backrest and seat to be 'Ipe' and surface mountable or approved equal.

B. Mounting hardware: Simpson Strong-Tie Anchor Bolts or approved equivalent.

C. 48” long anodized aluminum channel to be installed on the underside of the seat for the installation of a LED Light Rope. See section 2.3 Site Lighting and Accessories above.

2.7 Rooftop Tree Planter

A. Wood framing: Pressure treated Southern Yellow Pine

B. Surface: Metal Sheeting (T.B.D.) Coordinate with Architect, to match metal siding used on building.

C. Bench Frame: 2” square steel tubing, primed and painted black.

D. Seat: Teak or Ipe, minimum of 2” in thickness, space seat boards ½ inch.

E. Hardware: Stainless Steel

F. Insulation: 2” Rigid Extruded Polystyrene

G. Drainage Plate: (T.B.D.) coordinate with Architect for drainage plate used for rooftop terrace

H. Filter Fabric: Mirafi 140N or approved equal

I. Waterproofing: See architectural drawings and specifications

2.8 Pre-vegetated Green Roof

A. LiveRoof: Standard: 1’ x 2’ x 3-¼” (soil height approx. 4-1/4”)

B. LiverRoof RoofEdge Standard Aluminum Edge Restraint: Color Gray.

C. Pre-vegetated modules as manufactured by LiveRoof, LLC, Spring Lake, MI

D. Sedum Mix to be provided by LiveRoof licensed grower Prides Corner Farms Wholesale Nursery, Lebanon CT.

PART 3 - EXECUTION

3.1 SITE LIGHTING

A. Install precast and cast-in-place concrete bases plumb and true to grades as shown on Plans for area lights and bollards.

B. Install all conduits, wires, and photocells necessary. (Refer to Electrical Specifications)

C. Wire core drilled wall lights at both sides of ramp up to plaza.

D. Install tree mounted lights, two fixtures per tree, using nylon tree straps.

E. Coordinate with timers and building electrical as needed. Refer to Electrical Specifications for site lighting specifications.

3.2 GRANITE STEPS & GRANITE BLOCK WALL

A. Excavate existing soil and install crushed stone base in 6” lifts.

B. Compact crushed stone layer using vibratory compactor until final grades are achieved.

C. Place granite to finish elevations as shown on plans.

D. Joints between step slabs shall be friction joints.

E. Joints for steps should be staggered so that joints are offset a minimum of 18 inches.

3.3 BENCHES

A. Place benches on concrete pads as shown on plans.

B. Coordinate electrical feed for LED rope light mounted to underside of bench seats in anodized aluminum channel.

C. Mark location for installation of anchor Bolts, drill and install bolts per manufacturer's instructions.

D. Place bench over bolts and tighten nuts per manufacturer's instructions.

E. Install 48" anodized aluminum channel on the underside of the seat.

F. Install 48" LED light rope on underside of the seat.

3.4 GREEN VEGETATED FENCE

A. Excavate and install 10" Sonotube at equal spacing approximately 12 inches from the property line as shown on plans. Sonotube should be set at 8'-4" on center.

B. Install 3" square steel posts in Sonotube so that top of post is at a minimum of 6 feet above finish grade. Post heights to step in 3" or 6" increments along the length of the fence as necessary.

C. Fill Sonotubes with concrete and shape concrete surface to shed water.

D. Install steel trellis panels so that the bottom of the trellis panel are approximately 24 inches above finish grade.

E. All mounting hardware to be stainless steel.

F. Plant vines in plant bed along bottom of trellis panels.

3.5 ROOFTOP TREE PLANTER

A. Construct frame of tree planter box using pressure treated southern yellow pine and stainless-steel hardware.

B. Install 2" rigid insulation on the floor of the planter and around the perimeter of the planter box.

C. Place drainage plates over the entire floor of the planter box.

D. Install four anchor bolts to the bottom of the PT planter box frame.

E. Attach galvanized guy wires to the anchor bolts for tying down the tree root balls.

F. Cover the entire interior with the filter fabric, overlap joints a minimum of 6 inches.

G. Place 3-inch layer of soil in the planter box, install tree and backfill with specified lightweight soil medium.

H. Exterior metal covering to be coordinated with the building architecture. Final material to be approved by Owner Representative prior to installation.

I. Metal seat frame to be continuous around the entire perimeter of the planter box.

J. Provisions should be made for electrical connections to the planters for an outlet and for lighting the underside of the bench with a LED rope light.

K. Anodized Aluminum Channel to be mounted to the underside of the wood seat.

L. Wood Seat to be Teak or Ipe and minimum of 2 inches in thickness.

M. All mounting hardware to be Stainless Steel.

N. Drill and plug all holes.

END OF SECTION

SECTION 32 40 00

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.

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.

C. Posts to be 2" diameter galvanized steel tube.

2.2 MATERIALS

1. 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:
2. "STOP" Signs: (R1-1) 24"x24", Octagon, reflectorized copy and border.
3. "MODIFIED HANDICAPPED SYMBOL" Signs 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. "DO NOT ENTER" Signs: (R5-1) Highway Dept. standard red and white sign except 24"x24" size.
5. 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 2" diameter galvanized steel tube with galvanized steel weather tight closure cap.

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.

END OF SECTION

SECTION 32 93 00

LANDSCAPING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Documents affecting Work of this Section include, but are not necessarily limited to, THE CONDITIONS OF THE CONTRACT, General Conditions, Supplementary Conditions, Addenda and all Sections of Division 1, which are hereby made a part of this Section.

B. Reference is made to the latest Erosion and Sedimentation Control Report and Plan included in the Plan set for this project. Strict adherence to this Plan is required in order to prevent adverse downstream impacts from erosion and sedimentation, originating from on-site construction activity. Reference is also made to SECTION 31 25 13 - Erosion Controls.

1.2 DESCRIPTION OF WORK

A. Provide all labor, material, equipment and service required to complete the following, in accordance with the American Association of Nurserymen Standards:

1. Preparation of final subgrades in Lawn and Planting areas.
2. Topsoil and soil amendment preparation.
3. Installation of Loam over all seed and planting areas.
4. Harrowing, raking and fine grading.
5. Lawn construction and related items.
6. Watering from on-site sources.
7. Interim watering, fertilization and maintenance.
8. Planting and plant maintenance.
9. Installation of river stone.

B. Related Work specified elsewhere:

Site Special Conditions	- Section 02 00 00
Site Preparation	- Section 31 11 00
Grading	- Section 31 22 00
Excavation, Backfill and Compaction	- Section 31 23 00
Erosion Control & Slope Protection	- Section 31 25 13
Paving, Walks and Curbs	- Section 32 12 16
Storm Drainage Systems	- Section 33 41 00
Site Improvements	- Section 32 30 00

C. All existing topsoil on this site shall be removed from the site and become the property of the Contractor.

1.3 QUALITY ASSURANCE; SUBMITTALS

A. General: Comply with requirements of SECTIONS 01 33 00 – SUBMITTALS and 01 40 00 QUALITY REQUIREMENTS.

B. Materials Testing: All loam and soil amendments shall be tested by an approved soils testing laboratory which normally provides testing of agricultural soils.

1. Loam:
   a. The soils testing laboratory shall analyze the Contractor's sample(s) and shall identify the materials and the rates of distribution required to meet the Specifications for loam. The laboratory shall also recommend the addition of fertilizer and limestone to meet Specifications for pH and nutrient levels.

   b. All laboratory testing of loam shall be at the Owner's expense. All sampling and related costs shall be at the Contractor's expense. Test reports shall be forwarded to the Owner, Architect/Engineer, and Contractor.

2. Soil Amendment:
   a. An independent laboratory shall test the materials, mechanical analysis (ASTM D421).

   b. Test the material for PH and acidity.

   c. Test the material for organic content.

   d. Determine that the amendment is inert.

C. Submittals required:

1. Loam and soil amendment samples for testing, as specified above.

2. Certificate from vendor that the seed being supplied complies with the Specifications.

3. Certificate from vendor stating mulch for the hydro-seeding conforms to that which is specified.

4. Test results and recommendations from the certified laboratory for topsoil and soil amendments.

5. Plant maintenance program.

6. Sod: Certificate of grass and seed mixture by grower.

7. Sedum Pre-planted modules at green roof (See Site Improvements)

1.4 PLANTING SEASON

A. Plant Lawn and Plant materials during season or seasons normal for such Work. More specifically, construct lawns between April 30 and June 30 and between August l5 and October l5.

B. Contractor may do Planting during unseasonable conditions if desired by the subcontractor. No additional compensation will be allowed, and Work is subject to review as to time and methods of operation.

1.5 PLANT MAINTENANCE

A. The Landscape Contractor shall, in his or her price, include the cost for 1 (one) year of full maintenance service for all trees, shrubs and groundcovers. This will include all necessary watering, fertilizing, insect protection, pruning and plant care on a routine basis.

PART 2 - PRODUCTS

2.1 LAWN MATERIALS

A. Topsoil:

1. Topsoil shall be a good grade of topsoil from a site approved by the Architect/Engineer.

    a. It shall be loose and friable and shall be free from admixture of subsoil, refuse, large stones, clods or roots or other undesirable foreign matter.

    b. It shall be free of weeds, roots or rhizomes of 'Witch Grass' 'Chinese Bamboo' or other undesirable plant materials.

    c. Mulch, peat or other excessively acid soil containing excessive proportions of either clay or sand will not be accepted.

    d. It shall have a ph range of 5.5 to 7.

    e. The organic content of loam shall be not less than 4% or more than 20% as determined by the wet combustion method (chromic acid reduction).

    f. There shall be not more than 20% - 25% of loam passing the 200-mesh sieve, as determined by the wash test made in accordance with the standard test ASTM D1140.

    g. There shall be no stones larger than ½" in any dimension.

2. Samples of proposed topsoil shall be taken and tested by an approved laboratory as specified above, and the results sent to the Architect/Engineer for review and approval.

3. Amend topsoil with soil amendment material as required by the Architect/Engineer, based on laboratory testing, prior to spreading. No topsoil shall be amended or spread if it is in a frozen or muddy condition.

4. Screen topsoil after amendments have been incorporated. Remove all stones and other debris greater than ½" in any direction.

5. Topsoil will be provided from off-site sources. Topsoil shall be:

   a) Provide new screened topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than ½" in any dimension, and other extraneous or toxic matter harmful to plant growth. It shall contain at least 4% of decayed organic matter (humus). Topsoil shall not be excessively acid or alkaline nor contain toxic substances, which may be harmful to plant growth. Loam shall meet the specifications of sandy loam as defined by the USDA NRCS with no more than 20% passing the number 200 sieve.

   b) The amended loam, unless otherwise specified or approved, shall have an acidity range of approximately 5.5 pH to 7.6 pH.

   c). The organic content of loam shall be not less than 4% or more than 20% as determined by the wet combustion method (chromic acid reduction).

   d) There shall be not less than 20% loam passing the 200-mesh sieve, as determined by the wash test made in accordance with the standard test ASTM D1140.

   e) All laboratory testing of loam shall be at the Owner's expense. All sampling and related costs shall be at the Contractor's expense. Test reports shall be forwarded to the Owner, Architect/Engineer, and Contractor.

B. Soil Amendment:

1. Provide a commercially produced, aged, soil compost material containing inert organic matter or material of a generally humus nature capable of sustaining growth of vegetation.

2. The material shall be free of stones, lumps or similar objects larger than 1/2" in diameter. It shall be derived from organic waste material such as agricultural waste, animal manure and sewage sludge, approved for land application use by the State of Maine Department of Environment Protection (DEP).

3. The composting process of the material shall be 95% to 98% complete prior to its use on-site.

4. Prior to any soil amendment material being delivered to the site, the Contractor shall supply a certificate from an independent laboratory, certified by the state, stating that the material meets the specifications.

C. Fertilizer:

1. Provide commercial brand fertilizer of neutral character, the elements of which are delivered from organic sources. Fertilizer shall be a standard product complying with state and federal fertilizer laws.

2. Actual percentages of nitrogen, phosphorous, and potash shall be based on laboratory test recommendations, as approved by the Architect/Engineer.

   For purposes of bidding: Provide fertilizer with percentage of nitrogen required to provide not less than 1 lb. of actual nitrogen per 1,000 sq. ft. of lawn area and not less than 4% phosphoric acid and 2% potassium. Provide nitrogen in a form that will be available to lawns during initial period of growth; at least 50% of nitrogen shall contain no less than 3% water-insoluble nitrogen.

3. Fertilizer shall be delivered to the site, mixed as specified, in the original, unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's guarantee statement of analysis, or a manufacturer's certificate of compliance covering analysis, which shall be furnished to the Architect/ Engineer. Fertilizer shall be stored in a weatherproof location and in a manner, such that it will be kept dry and its effectiveness will not be impaired.

D. Lime:

1. Provide natural dolomitic limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates, ground so that not less than 90% passes a 20-mesh sieve and not less than 50% passes a 100-mesh sieve. Coarser material will be accepted, provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve. For the purposes of bidding: provide 2,000 lbs of lime per acre to be seeded for lawn areas and 1,000 lbs. of lime per acre for all conservation mix areas.

E. Water:

1. Potable water, unless otherwise directed by the Architect/Engineer.

F. Crabgrass Preventative:

1. "Tupersan" or approved equivalent.

G. Broad Leaf Weed Control:

1. 2-4-D material.

H. Grass Seed Mixtures:

1. Fine lawn seed mixture –with fresh, clean, new crop seed composed of the following varieties

Use 'Estate Green' mix as blended by Allen, Sterling & Lothrop.

Seed mixture -	% by Weight	Germination
VNS Chewing Fescue	35%	85%
Improved Perennial Ryegrass	20%	90%
Improved Turf Type Perennial Ryegrass	15 %	90%
Kentucky Bluegrass	15%	80%
Improved Kentucky Bluegrass	15 %	80%

Rate – 3.3 lbs/1,000 sq. ft. (145 lbs. per acre)
Maximum percentage of inert or weed seed =1.75%

2. Seed shall be delivered pre-mixed to the site in standard size sealed containers, bearing the vendor's guaranteed statement attesting to the composition of the mixture and to the percentages of purity and germination of each variety. Seed shall be stored in such a manner that its effectiveness is not impaired. Samples of seed shall be taken as directed by the Architect/Engineer and shall be submitted to the State Agricultural Station for analysis.

I. Mulch:

1. Clean straw free of weed seed.

J. Sod:

1. Sod shall be bluegrass blend as grown by Down East Turf Farm, Inc., Kennebunk, ME. Certificate of blend to be provided by grower prior to delivery.

2.2 PLANT MATERIALS

A. Quality: Provide Trees, Shrubs, and other Plants of size, genus, species and variety as shown and scheduled for Landscape Work, and complying with recommendations and requirements of ANSI Z60.1, "American Standard for Nursery Stock". Plant names shall conform to "Standardized Plant Names" by the American Joint Committee on Horticultural Nomenclature. All Plants shall be nursery grown. All Plants shall be hardy under climate conditions similar to those in the locality of the project.

B. Trees: Provide Trees of height and caliper scheduled or shown, and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed.

1. Provide balled and burlapped (B&B) deciduous trees.

2. Provide balled and burlapped (B&B) evergreen trees.

C. Shrubs: Provide shrubs of the height shown or listed, and with not less than minimum number of canes required by ANSI Z60.1 for type and height of shrub required.

1. Provide balled and burlapped (B&B) or container-grown deciduous shrubs.

2. Provide balled and burlapped (B&B) evergreens.

D. All Plants shall be freshly dug. No heeled-in Plants or Plants from cold storage shall be used. All Plants shall by typical of their species or variety and shall have a normal habit of growth. Plants shall be sound, healthy, and vigorous, well-branched, and densely foliated when in leaf; shall be free of disease, insect pests, eggs or larvae; and shall have healthy, well-developed root systems.

E. Container-grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together, firm and whole. No Plants shall be loose in the container.

F. Do necessary pruning at time of Planting.

G. No substitutions will be acceptable, except upon submission of proof that any Plant called for is unavailable. In such cases substitutions shall be equal in size to current originally Planted species, or size to which species would have grown to over elapsed time since original Planted time. All substitutions shall be approved by the Architect/Engineer.

H. Plants larger than those specified in the Plant list may be used if approved by the Landscape Architect, but use of such Plants shall not increase the Contract Price. If the use of larger Plants is approved, the spread of roots or ball of earth shall be increased in proportion to the size of the Plant. If there is a time delay from original time of Planting, size of substituted Plants shall be equal in size to current size of originally Planted species, or size to which species would have grown to over elapsed time since original Planting time.

I. Root protection:

J. Plants designated "B&B" on Plant list to be dug with firm, natural ball of earth large enough to encompass fibrous and feed root system necessary for full Plant recovery. Wrap with natural burlap and bind with twine or cord. When necessary to prevent ball from cracking, ball shall be secured on a platform.

K. Protect "B&B" material, which cannot be planted immediately on delivery from drying wind and sun, by covering ball with moist soil or mulch. Water as necessary until Planted.

L. Loam: Same as that used for lawn materials (See SS 2.01 A).

M. Fertilizer:

1. Commercially bagged dehydrated cow manure such as Bovung, Dri-Conure, or equal.

2. Chemical Planting Tablets such as Agriform Planting Tablets by Leslie Agriform Corp., Newark, California, or equal. Follow manufacturer's recommendations for application.

N. Water: Clean and potable.

O. Peat Moss: Commercially packaged natural, shredded, low-in-wood content, with pH of 4 to 5 and maximum moisture of 30%.

P. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.

Q. Sand: Clean, washed sand, free of toxic materials.

R. Manure: Well rotted, unbleached stable or cattle manure containing not more than 25% by volume of straw, sawdust or other bedding materials, and containing no chemicals or ingredients harmful to Plants. Manure shall not be more than two years or less than 9 months old.

S. Mulch: Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs or plants, and consisting of one of the following: shredded hardwood or ground or shredded bark.

T. Anti-Desiccant: Emulsion type film-forming agent, designed to permit transpiration but retard excessive loss of moisture from Plants. Deliver in manufacturer's fully identified containers, and mix in accordance with manufacturer's instructions.

U. Wrapping: Tree-wrap tape, not less than 6" nor more than 10" wide, designed to prevent bore damage and winter freezing, shall be first-quality burlap or paper material, manufactured for this purpose.

V. Stakes: Wood or metal; as shown on Drawings.

W. Hose Friction Guards: New, ½" diameter rubber or PVC, as shown on Drawings.

X. Wire: New, 12-gauge braided wire; as shown on Drawings.

Y. Turnbuckles: New aluminum; as shown on Drawings.

PART 3 - EXECUTION

3.1 TOPSOIL AND SOIL AMENDMENT PREPARATION

A. Based on the test results of the topsoil and the inclusion of the soil amendment material. The Contractor shall mix the existing soil and compost material at a rate determined by the soil-testing lab and review by the Architect/Engineer.

B. The Contractor shall mix the topsoil and soil amendment in a screening operation on-site.

C. Once mixed by screening, the material shall be mixed again by mechanical means, such as a front-end loader, prior to spreading.

3.2 FINE AND ROUGH LAWN CONSTRUCTION

A. Subgrade Preparation: Subsoil shall be graded and uniformly compacted to a true smooth slope six (6) inches below, and parallel to, the proposed finish grade for areas to be sodded or seeded. Subgrade shall be loosened to a depth of two (2) inches. Subsoil shall be kept in a loosened condition until the loam is spread. Subgrade shall be inspected and approved by the Architect/Engineer before placing of loam.

B. Topsoil Placement: Topsoil shall be placed and spread, compacted and otherwise manipulated, over approved areas to a sufficient depth so that after natural settlement and light rolling, the completed Work shall conform to the lines, grades, and elevations shown on the Drawings

C. Topsoil Preparation: After topsoil has been spread, it shall be carefully prepared by scarifying or harrowing and hand raking. The whole surface shall then be rolled with a hand roller weighing not more than one hundred (100) pounds per foot of width. All depressions caused by settlement as a result of rolling shall be filled with additional loam, and the surface regraded and re-rolled until it presents a smooth, even finish to the required grades.

D. Lime Application: Prior to completion of topsoil preparation, and if recommended as a result of soil analysis, lime shall be evenly distributed and thoroughly worked into the top three (3) inches of topsoil, at the rate recommended by the soil analysis laboratory. Limestone shall be applied at least seven (7) days before applying fertilizer. The pH content of the loam shall be 6.5 to 7.0 before sod or seed is placed. Fine grade the topsoil to a smooth, friable, fine texture surface, free of hollows, bumps or depressions. Remove all stones over ½" in diameter, stocks, roots or other extraneous matter. Avoid over compaction of topsoil. If any area is over-compacted it shall be re-scarified, re-raked, and re-rolled.

E. Fertilizer Application: Commercial fertilizers shall be uniformly applied in all new grass areas. The application shall be within one week prior to placement of sod or seed, at the rate recommended by the soil analysis laboratory, and worked lightly into the top two (2) inches of loam. Grass areas shall be watered thoroughly after the application of fertilizers.

F. Hydroseeding: Upon completion of topsoil preparation and fine grading, hydro-seed all lawn areas with a seed, lime and mulch slurry. Rates of mix as follows:

Seed: 145 lbs/acre (grass) 100 lbs per acre (conservation mix)
Lime: 2,000 lbs. per acre (1 ton per acre)
Mulch: 1,200 lbs. per acre

1. Hydroseeding equipment shall maintain the slurry in an agitated condition and distribution shall be uniform in all areas. Furnish a certified statement prior to this Work, as to the number of pounds of lime, seed and mulch per 100 gallons of water. This statement should specify the number of square yards of seeding that can be covered with the solution.

2. Hydroseeding shall be done with suitable standard equipment capable of spreading at the above rates. Exercise care in hydroseeding. Do not carry on operations on a windy day; keep mixture off all equipment, structures, vehicles, pedestrians and pavement. Protect newly seeded areas from erosion, traffic, etc.

G. Mechanical Seeding: Mechanical seeding shall be done on dry or moderately dry soil, and at a time when wind does not exceed a velocity of five (5) miles per hour. Seeding shall be done in two directions, at right angles, in such a manner that a uniform stand shall result. Seed shall be sown evenly by hand, or with an approved mechanical spreader, to a depth not exceeding one-fourth (1/4) inch, at the rate of three point three (3.3) pounds per one thousand (1000) square feet of area.

1. After seeding, the surface shall be evenly and lightly raked with a fine wood-toothed rake or other approved method, and rolled in both directions with a hand roller weighing not more than one hundred (100) pounds per foot of width, and then watered thoroughly with a fine spray.

2. Maintain a moist seedbed until a thick stand of grass is produced. Furnish sufficient watering equipment to apply water to a minimum 2 in. depth in a 24-hour period, to assure continued growth of germinated grass. Watering shall be done to provide uniform coverage, prevent erosion, and prevent damage from watering equipment to the finished surface.

H. Sodding: Sod to be installed on drip edge and as shown on plan.

1. After fine grading of topsoil, roll sod into place. Carefully match pieces together, tightly.

2. Immediate after all sod is installed begin watering.

I. Mulching of Seeded Areas: Mulch to be installed in seeded areas at rates specified in the Erosion Control Plan.

3.3 FINE AND ROUGH LAWN MAINTENANCE

A. Upon completion of seeding and prior to acceptance, remove from the site excess soil and debris, and repair all damage resulting from seeding operations.

B. Maintenance shall begin immediately after each area of lawn is planted. Lawns shall be watered, mowed, weeded, replanted, fertilized, cultivated, and otherwise maintained and protected as necessary to establish a uniform stand of the specified grasses, until acceptance. (see Section 3.04)

C. At the time of first cutting, keep mower blades not less than 2-1/2 inches high. After the grass has started, all areas and parts of areas which fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded or resodded, and such areas and parts of areas shall be reseeded or resodded repeatedly until all areas are covered with a satisfactory growth of grass.

D. Protect lawn areas against trespassing by fencing from grade to a height of four (4) feet, using steel drive posts and 2 inch by 4 inch welded wire mesh, or by other approved means. Damage resulting from erosion, gullies, washouts, vehicle traffic, or other causes shall be

repaired by filling with approved topsoil, tamping, refertilizing and reseeding by the Contractor at his expense, if such damage occurs prior to acceptance of the lawn area.

E. Watering: Lawns shall be watered in a satisfactory manner during and immediately after planting, and not less than twice per week, until acceptance.

F. Suitable water for planting and maintenance of lawns shall be provided by the Contractor. Contractor shall furnish his own hose and hose connections from the outlets where water is furnished, and shall provide all necessary watering equipment.

G. Guarantee: All seeded areas shall be guaranteed for three (3) mowings by the Landscape Contractor, with notification to the Architect/Engineer between each mowing.

3.4 FINE AND ROUGH LAWN INSPECTION AND ACCEPTANCE

A. The Architect/Engineer will review all Work upon the written request of the Contractor, received at least 10 days before the anticipated date of lawn inspection.

B. To be acceptable, a stand of grass shall consist of a uniform stand of at least 90 percent established permanent grass species, with a uniform count of at least 100 plants per square foot.

C. Architect/Engineer's field review shall provide an opinion to whether maintenance shall continue in any part.

D. Furnish full and complete written instructions for maintenance of the lawns to the Owner, at the time of acceptance.

E. After all necessary corrective Work and clean-up has been completed, and maintenance instructions have been received by the Owner, the Architect/Engineer will provide an opinion to the Owner for acceptance or non-acceptance of the lawns. The Contractor's responsibility for maintenance of lawns or parts of lawns shall cease on receipt of acceptance by the Owner.

3.5 SOD INSTALLATION

A. Lightly scarify topsoil and check finish grade all surfaces to receive sod.

B. Lightly mist soil surface prior to installing sod. Lay sod with tightly fitted joints, offsetting joints in adjacent courses.

C. Fill minor cracks between sod pieces with sod or topsoil.

D. Tamp and roll (dry, empty roller) lightly to form smooth surface.

3.6 PLANTING

A. Installation and Workmanship:

1. Layout: Take necessary field measurements to locate trees where shown. Should obstructions above or below ground dictate, alternate locations will be designated by the Project Representative.

2. Planting Pits: Dig pits and prepare soil prior to moving Plants to respective locations. Excavate circular pits with vertical sides unless plants are designated to be planted in beds. Diameter of pit to be 2 ft. greater than size of ball or spread of roots. Depth of pit to allow 6" of prepared topsoil in bottom of tree pits.

3. Soil Preparation: Mix topsoil to be used as follows: Five parts topsoil, one part peat humus, one part manure fertilizer; except that for ericaceous Plants, very acid soils (pH less than 6) are to be mixed with sufficient lime to produce a pH of 6 to 6.5.

4. Setting Plants: Plant vertically, faced to give best appearance or relationship to adjacent areas. Leave burlap in place, untie from crown and bury edges of burlap to expose a minimum of 1/3 of the root ball. Cut off all frayed or broken roots cleanly. Place prepared soil and carefully compact, avoiding injury to roots and filling all voids. Add water when hole is 3/4 full and allow to drain away. Fill hole to finished grade and form a shallow saucer around each Plant. Later, add additional soil as needed.

5. Guying, Staking and Wrapping: Support trees immediately after Planting. Guy trees 3 in. and over in trunk diameter. Stake trees up to 3" diameter.

    a) Guying - use 4 guy wires, spaced equally at an angle of 60 degrees with the ground surface, attached at 2/5 of tree height. Drive notched stakes at angle away from tree so tops are below finished grade. Use turnbuckles to adjust wire tension. Attach wood or metal flag to each guy 6" to 12" above ground.

    b) Staking - drive 3 stakes per tree vertically into ground at least 3 feet deep, at l8 inches from tree trunk. Attach stakes to tree as detailed at approximately 5 ft. height using 2 strands of wire and hose.

    c) Wrapping - wrap trees immediately after guying, spirally from ground to height of second branching. Wrapping to be neat and snug and held in place by suitable natural cord.

6. Mulching: Mulch all Plants within 2 days after Planting. A 3-in. layer shall entirely cover Plant pit, bed or saucer and to edge of paving or grass, as appropriate. Mulch beds shall have smooth edges. Mulched tree pits shall be uniform in size and appearance.

7. Anti-Desiccant: Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving, and again 2 weeks after planting.

8. Pruning: Thin out and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Project Representative, do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any. Prune shrubs to retain natural character. Remove and replace excessively pruned or misformed stock resulting from improper pruning.

B. Maintenance:

1. Repair any damage to lawn areas resulting from Planting operations. Maintain all Plantings throughout the guarantee period by cultivating, spraying, weeding, watering and other necessary operations.

2. Landscape Contractor shall complete a weekly watering inventory to assure that all plants are receiving proper amounts of irrigation/water.

C. Guarantee:

1. All Plant materials are to be true to name and size, and in vigorous growing condition. Guarantee healthy materials for one (1) year from time of acceptance. Final acceptance will be given after material has been in place one (1) year and is in vigorous, healthy growing condition. Replace any dead, unhealthy or unsightly Plants as soon as weather permits. Contractor's responsibility ends with final acceptance, except any replaced material to be guaranteed one (1) year from replacement date.

D. Cleanup:

1. Properly dispose of excess materials, branches, paper and rubbish off-site. Leave site in orderly condition, satisfactory to the Architect/Engineer, upon completion of Work.

3.7 EXTENDED MAINTENANCE

A. All trees, shrubs, ground covers and grass or sod will be cared for, and maintained, by the Contractor for one full calendar year from the date of installation.

B. Services to be provided by the Contractor shall include all requisite maintenance activities required by each species planted. These activities include, but are not limited to:

1. Regular, weekly watering of plant material.

2. Regular watering of grass/sod until substantial completion.

3. Seasonal watering.

4. Fertilization by species, by season.

5. Pruning by species.

6. Treatment for insects.

7. Treatment for diseases.

C. The Contractor will provide the Owner with a written maintenance program prior to beginning any work activities.

END OF SECTION

SECTION 33 05 00

COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Sleeves.
3. Identification devices.
4. Grout.
5. Piping system common requirements.
6. Equipment installation common requirements.
7. Concrete bases.
8. Supports and anchorages.
9. Utility testing.

1.2 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Storm drain, underdrain, water, sewer, pipe and fittings.
2. Appurtenances including manholes, catch basins, grease traps, cleanouts, backflow preventers, pipe manifolds, pipe insulation, flared inlets, rain guards, roof drain treatment devices, and manhole bases.
3. Submittals for appurtenances shall show the angle for any pipe entrances as well as the height or elevation of the penetration.

1.4 QUALITY ASSURANCE

A. Testing of Sanitary Sewer System (Gravity Main):

1. Sanitary Sewer Testing: Testing of a section of sewer between manholes shall be performed using the below stated equipment according to stated procedures and under the observation of the Owner's representative. The Contractor shall notify the City of Portland

Public Works Department, Division of Stormwater and Sewer (PPW) at least 72 hours in advance of the date and time of the testing in order for PPW to have an opportunity to have a representative on site during the tests.

a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

c. All air used shall pass through a single control panel.

d. Three (3) individual hoses shall be used for the following connections:

1) From control panel to pneumatic plugs for inflation.
2) From control panel to sealed line for introducing the low pressure air.
3) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

2. 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.

a. 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

3. 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.)

4. If installation fails to meet the above requirements for the air test, the Contractor shall locate and repair the pipeline until an acceptable test is achieved.

5. 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.

6. Where ground water is confirmed to be high, the Engineer at his option may elect to accept infiltration measurements in lieu of air testing.

7. These tests shall be conducted at all times in the presence of the Owner's representatives. Should a line which has previously been tested indicate any water infiltration, or otherwise appear suspect to the representatives, the Contractor shall conduct confirmation air tests on the line at no additional costs.

1.5 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.

1.6 MANHOLE AND APPURTENANCE TESTING

A. All sanitary manholes, wet wells, septic tanks, holding tanks, and other appurtenant structures shall be tested as to water tightness. If the initial test fails, a retest shall be required. The Contractor has the option of either of the following methods:

1. 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.

2. 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.

1.7 WATER MAIN TESTING:

A. Test water distribution system installed below grade and into the building to the base of the riser in accordance with following procedures:

1. The Contractor shall notify Portland Water District (PWD) at least 72 hours in advance of any testing on new water mains, in order for PWD to have an opportunity to have a representative on site during the tests.

2. 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 Owner.

3. If fire hydrants are installed on the new water main, the test shall be conducted against a closed hydrant valve.

4. 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.

5. 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.

6. Water, only, shall be used to bring the main to the required test pressure. The type of pump shall be approved by the Mechanical Engineer.

7. The test shall be of at least two hours in duration. A leakage test shall be conducted immediately after the pressure test.

8. 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.

9. The pressure and leakage tests shall be witnessed by the Owner's representative.

10. New hydrants shall be flowed with the static and residual pressures measured in accordance with NFPA 291.

B. Utility Grade/Alignment Check of the Design Alignment. Survey checks, mirrors, or lasers may be employed to verify conformance with these standards.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.

2. CPVC Piping: ASTM F 493.

3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

4. PVC to ABS Piping Transition: ASTM D 3138.

E. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 SLEEVES

A. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.3 IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

2. Location: Accessible and visible.

B. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.

1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.

2. Color: Comply with ASME A13.1, unless otherwise indicated.

C. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.

1. Material: Valve manufacturer's standard solid plastic.

2. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.

3. Shape: As indicated for each piping system.

D. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

E. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.

2. Thickness: 1/8 inch (3 mm), unless otherwise indicated.

3. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.

4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

F. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.

2. Yellow: Heating equipment and components.

3. Brown: Energy reclamation equipment and components.

4. Blue: Equipment and components that do not meet criteria above.

5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.

6. Terminology: Match schedules as closely as possible. Include the following:

a. Name and plan number.

b. Equipment service.

c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

2.4 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. PVC Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.

3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.

6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

K. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.

2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

L. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Install dielectric fittings at connections of dissimilar metal pipes.

3.4 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.5 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.

2. Locate pipe markers on exposed piping according to the following:

   a. Near each valve and control device.
   b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
   c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
   d. At manholes and similar access points that permit view of concealed piping.
   e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.

2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in "Cast-in-Place Concrete" Section of the specifications.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.8 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

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 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. 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 onsite and offsite water line including domestic water line and fire water line, valves, set lines, elevations, and grades for water distribution systems. **Also, supply all tapping sleeves, tees, and valves for connection to the existing water main.** Provide rigid insulation where cover is designated to be less than 4'-0".

B. Related Sections:

1. Section 32 11 00 – Base Courses.
2. Section 31 20 00 – Earth Moving.
3. Local Governing Authority and Code Requirements.
4. Portland Water District Specifications and Procedures.
5. All Necessary Construction Permits.

C. The public water supply is owned and operated by the Portland Water District. All materials, installation, and workmanship shall comply with the requirements of the local water department, the Public Utilities Commission, the Maine State Plumbing Code, and these specifications. Where a more stringent standard exists, the more stringent standard shall apply.

1.2 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.

1.3 QUALITY ASSURANCE

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/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.

C. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe Fittings for Water.

D. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquid.

E. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

F. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

G. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.

H. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.

I. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

J. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.

K. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.

L. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

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

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

O. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

P. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, ½ inch through 3 inch, for water.

Q. UL 246 - Hydrants for Fire - Protection Service.

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, and invert elevations. Record a minimum of two (2) lateral measurement “swing ties”, as close to 90 degrees opposed as practical, prior to backfilling pipeline from permanent fixtures such as building corners, telephone poles, fire hydrants, catch basins, manholes etc. to all valves, fittings, couplings, tees etc. for purposes of future location. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. These ties must be legibly recorded in sketch form and submitted to the Owner prior to final project acceptance. Record the same information with coordinates on the Maine State coordinate grid system for the record drawings.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 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 and seal coated in accordance with AWWA C104. Joints shall meet requirements of AWWA C111. Push-on joint pipe to be supplied with gaskets and gasket lubricants. Mechanical joint pipe to be furnished with gland, gaskets, Cor-Ten bolts, and nuts. Pipe shall be 62-42-10 strength; 60,000 psi minimum tensile strength; 42,000 psi minimum yield strength; 4”-12”, but not including 16”, shall have a Class 52 wall thickness. Size 16" and over shall be approved by Portland Water District. 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 North American manufactured by 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 (AWWA C550 and C116). 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 (60o) to fit slip-joint fitting and shall be long body design.

D. Retainer Glands: Glands shall be heavy duty ductile iron body as manufactured be 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” – 350 psi
   12” – 350 psi

Set screws shall be:

1. cupped syle 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 nomial 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 water way 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, American Flow Control or U.S. Pipe 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 North American and 1.0" (in.) I.D. steel size (SCHEDULE 40) black iron with top having N.P.I. threads for 1.0" screw-on cover.

Shall be Erie style with 6' (ft.) slide-type riser.

2. Service Box Cover Specifications:

Shall be North American, 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 North American, 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) 1/2" diameter minimum #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 Portland Water District. Options include the following:

The tapping sleeve shall be; 304 Stainless Steel Tapping Sleeves with ductile iron flange. Flange bolts shall be Type 304 stainless steel. 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. 1" shall be a ball valve design with a brass ball that is Teflon (or equal) coated. 1-1/2" - 2" shall be ball corporation 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 1”-2”, the valve shall be a brass ball that is Teflon (or equal) coated.

2. The bass 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°) 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: Hydrants shall be either American Flow Control’s B-62-B, Mueller Centurion or U.S. Pipe’s Metropolitan 250 all with stainless steel nuts and bolts below grade. The hydrant shall have an epoxy-coated base, and open right. 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 2" 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. Utilize materials as approved by Portland Water District.

Q. Polyethylene Encasement:

1. Tube type polyethylene encasement shall be installed on all ductile iron pipe and fittings in accordance with AWWA Standard C105 – latest revision, Method A.

2. Polyethylene encasement shall be either linear low-density polyethylene (LLDPE) film with a minimum thickness of 8-mil or high-density, cross-laminated polyethylene (HDCLPE) film with a minimum thickness of 4-mil.

3. Circumferential wraps of tape or plastic tie straps shall be placed at 2-ft. intervals along the barrel of the pipe.

4. The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely airtight or watertight enclosure. All lumps of clay, mud, cinders, and so forth, on the pipe surface shall be removed prior to installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or embankment material from becoming trapped between the pipe and the polyethylene.

5. The polyethylene film shall be fitted to the contour of the pipe to effect a snug, but not tight, encasement with minimum space between the polyethylene and the pipe.

Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to the polyethylene due to backfilling operations. Overlaps and ends shall be secured with adhesive tape, string, plastic tie straps, or any other material capable of holding the polyethylene encasement in place until backfilling operations are complete.

6. Three layers of polyethylene adhesive tape shall be wrapped around any polywrapped pipe where a tapping machine will be placed. All copper services connected to a pipe wrapped in polyethylene encasement shall be wrapped within three feet of the pipe.

R. Valve Boxes:

1. The valve box bottom section shall be slide-type with bell-type base with bottom lip. Manufacturer: North American Manufacture

2. The valve box top section shall be slide-type, 36 inches long (minimum). No top flange and no “bead” or bottom flange. Manufacturer: North American Manufacture

3. The valve box cover shall be a 2” drop-type cover to fit the 7-1/4” opening of the top section. Manufacturer: Bibby St-Croix (no substitute)

4. The valve box intermediate (mid) section shall be slide-type with a minimum 3” belled bottom. Base section No. 645 may be used as an alternate. Manufacturer: North American Manufacture

5. Material shall be cast iron or ductile iron free from defects.

6. Interior and exterior of all components shall be bituminous coated with a minimum of 4 mils dry film thickness.

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. 4 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 33 41 00).

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 four (4) 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 Portland Water District will install the domestic water meter.

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 50 mg/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 25 mg/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 District.

6. The pressure test shall be of at least 15 minutes 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 District's supervision.

END OF SECTION

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 33 39 00

APPURTENANCES FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage and accessories.
2. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage and accessories.
3. Masonry manholes sections with masonry transition to lid frame, covers, anchorage and accessories.
4. Precast septic tank, holding tank, grease traps, and SEWER SYSTEM accessories when required on the contract drawings.

B. Related Sections:

1. Section 33 05 00 – Common Work Results for Utilities
2. Section 33 31 00 – Sanitary Utility Sewerage Piping
3. Local Governing Authority and Code Requirements
4. Construction Drawings
5. City of Portland Technical Manual

1.2 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 C1227-13 – Standard Specification for Precast Concrete Septic Tanks

F. ASTM D1248 - Precast Polyethylene Manholes.

G. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.3 SUBMITTALS

A. Shop Drawings: For all precast structures indicate manhole locations, rim elevation, piping, sizes and elevations of proposed penetrations. For all other precast appurtenances, provide dimensional data, ASTM compliance certificates, and load capacity where applicable.

B. Product Data: Provide manhole covers, component construction, features, configuration and dimensions. Each precast structure shall have a diagram showing the dimensions and location of all openings or penetrations.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE ITEMS

A. Precast Manhole and Sections: Manhole and 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 vertical 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 Bases: Manhole 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. 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 "o" rings. 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.

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. Sanitary sewer covers shall have the name "Sewer" cast therein. The grease tank covers shall have the name “GREASE” cast therein.

D. The manhole castings shall be a non-perforated manhole frame and cover, 24” clear opening as manufactured by the East Jordan Works Foundry or approved equal.

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

A. 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 SITE CONCRETE

A. Site concrete shall meet the requirements set forth below:

1. 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.

2. 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.

3. 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 4000 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.

2.6 REINFORCEMENT

A. 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.

2.7 TREATMENT OF INTERIOR SURFACES

A. 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 concrete items shall be treated with a waterproof coating (18 mil. film thickness).

2.8 TREATMENT OF EXPOSED SURFACES

A. 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. All light pole bases shall have an epoxy finish colored to match the pole color. One coat shall be applied in the factory, a second coat shall be applied in the field.

2.9 TREATMENT OF ALL OTHER EXTERIOR SURFACES

A. All buried surfaces shall be double coated with a concrete hardener to achieve a minimum dry film thickness of 18 mils.

2.10 RAIN GUARD MANHOLE INSET

A. A self sealing removable insert shall be provided and installed in the frame of each manhole casting. The purpose of this device is to collect and store illicit water that may enter the manhole casting. The units shall be “RAINGUARD™” or approved equal.

PART 3 - EXECUTION

3.1 MANHOLES

A. General: All appurtenant structures shall be set level on compacted material as shown on the Plans.

B. Manhole Channels: Channels shall be constructed in all sanitary sewer manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the Engineer or a channel of reinforced concrete cast with the manhole base. 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.

E. Infiltration Seal: Install rain guard or approved equal manhole inserts.

3.2 ALTERATIONS TO EXISTING MANHOLES

A. Existing manholes 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.

B. 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

A. Existing manholes 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.

B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.

C. 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 super structure 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.

D. 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 MANHOLES

A. Existing 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 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.

3.5 MANHOLE ADAPTERS

A. 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

A. These precast items shall be set in a dry excavation, proof-rolled, 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.

B. The anti-flotation slab 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.

C. 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.

D. 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.

E. 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.

F. 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.

G. Any voids created by removal of sheeting, bracing or shielding shall be filled and recompacted.

3.7 TESTING

A. Testing shall meet the requirements of Section 33 05 00 “Common Work Results for Utilities”.

END OF SECTION

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, non-pressure storm drainage outside the building, with the following components:

1. Cleanouts.
2. Precast concrete manholes.
3. Flared inlets/outlets.
4. Catch basins.

B. Related Sections:

1. City of Portland Technical Manual.

1.2 PERFORMANCE REQUIREMENTS

A. Perimeter building underdrains are required and shall be installed as part of the site work. Refer to Section 33 46 00 (N.I.C.).

B. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: Watertight when installed below groundwater, silt tight in other areas.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For manholes and catch basins. Include plans, elevations, sections, details, and manhole frames and covers and catch basin frames and grates.

C. Coordination Drawings: Show pipe sizes, locations, and elevations for all manholes and appurtenances.

D. Field quality-control test reports. Product Data: For each type of product indicated.

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 and including as shown on the plumbing 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. Provide fittings to raise grade to accept roof drain 5’-0” outside of building where necessary.

C. All building underdrains shall be connected to the storm drainage system. Refer to Section 33 46 00 (NIC).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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: 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. Piping below the water table, subject to surcharge, or which could affect a pond level, shall be watertight. All other piping shall be silt tight.

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: (N.I.C.)

- Rip rapped aprons.
- Concrete flared inlets/outlets for pipes larger than 18" in diameter.
- Bar racks for pipes larger than 18" diameter.
- HDPE flares for pipe smaller than 18" in diameter. High density polyethylene flares with added carbon black for exposure to sunlight.

F. Manholes and Catch Basins Outlet Control Structures, Stilling, Basins, Water Quality Unit, and Water Quality Control Structures shall be provided where shown on the contract drawings.

2.2 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Manufacturers:

   a. Josam Company.
   b. MIFAB Manufacturing Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Wade Div.; Tyler Pipe.
   e. Watts Industries, Inc.
   f. Watts Industries, Inc.; Enpoco, Inc. Div.
   g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): Heavy duty.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.3 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

4. Riser Sections: 4-inch (100-mm) minimum thickness, and of length to provide depth indicated.

5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.

7. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.

8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches (900 mm).

9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.

11. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 8-inch (203-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

    a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

2.4 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

2.5 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.

3. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) by 8-inch (203-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with bicycle proof drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2. The location of catch basins shall be accurately located by a registered land surveyor. Catch basins shall be located as follows:

- Edge of frame 6" off face of curb where shown near slopes granite or bit concrete curblines.
- The center of aisle or parking modules when shown on plans.
- In other cases, verify with Engineer.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use non-pressure type flexible couplings where required to join gravity-flow, non-pressure sewer piping, unless otherwise indicated.

a. Flexible couplings for same or minor difference OD pipes.

b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves,

and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, non-pressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at the slope provided on the contract drawing.

2. 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 therefore. 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.

3. No pipe laying will be allowed to begin at any point other than a manhole or other appurtenance without the expressed 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.

4. 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.

5. 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.

6. All joints shall be made in a dry trench in accordance with the manufacturer's recommendations.

7. A minimum of two (2) pipe lengths or pipe stubs shall be used between any two (2) appurtenances.

8. 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.

9. Install piping below frost line or with rigid insulation where required by profiles and details.

10. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

11. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.3 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, non-pressure drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
3. Join dissimilar pipe materials with non-pressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.

3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

4. Use extra-heavy-duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch (25 mm) above surrounding grade in lawn areas.

C. Set cleanout frames and covers in pavement with tops flush with pavement surface.

3.5 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 0-1" (0-25 mm) above finished surface elsewhere, unless otherwise indicated.

3.6 CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

B. Outlet Control Structure: Provide precast concrete unit, covers, weirs, orifices and appurtenances as shown on the drawings. Provide information on the method, materials, installation, and quality control measures which will be used to seal the wall between the inlet and outlet side of the manhole.

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.

3.7 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.

3.8 ALTERATIONS TO EXISTING MANHOLES AND CATCH BASINS

A. 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.

B. 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.

3.9 ADJUSTING EXISTING MANHOLES AND CATCH BASINS

A. 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.

B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.

C. 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 super structure 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.

D. Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.

3.10 ABANDONING EXISTING CATCH BASINS AND MANHOLES

A. 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 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.

3.11 MANHOLE ADAPTERS

A. 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.

3.12 PRECAST TANKS, VAULTS, AND APPURTENANCES

A. These precast items shall be set in a dry excavation, proof-rolled, 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.

B. The anti-flotation slab 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.

C. Tanks shall be set on the anti-flotation slab when required to resist floatation. Where necessary for plumbness and level, the tank shall be shimmed with a strong slurry grout installed to fill the void space.

D. 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.

E. The tank shall be anchored to the anti-flotation slab with approved stainless steel masonry anchors when the anti-floatation slab is required. All anchors shall be inspected by the Contractor to assure the anchor is secure and will provide the required resistance.

F. 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. The

dewatering shall continue until the finish grade around the tank has been reached with the backfill.

G. Any voids created by removal of sheeting, bracing or shielding shall be filled and recompacted.

3.13 CONNECTIONS

A. Connect non-pressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

2. Insulation, when required by the Drawings, shall be Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.

3. 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.

4. The Contractor shall coat the insulation material in accordance with the manufacturer’s instructions.

3.14 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

a. Horizontal Alignment: Less than full diameter of inside of pipe is visible between structures or ½” off design alignment.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

f. Vertical Alignment: Within ¼” of design grade.

2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

3. Re-inspect and repeat procedure until results are satisfactory.

B. Test new watertight piping systems that have been installed below the elevation of the permanent pool in the wet pond.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

PILE FOUNDATIONS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. RELATED DOCUMENTS: Drawings and general provisions of the contract, including General and Supplementary Conditions.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK

A. The work covered by this Section, without limiting the generality thereof, consists of all labor, equipment, and material and performing all operations in connection with the furnishing and installing 80-ton capacity piles at the locations and to the lines and grades shown on the drawings. The piles will be driven to end bearing on the naturally deposited dense silty sand and/or bedrock. Based on the borings and probe results,

B. Suitable pile shall be steel H-section piles or steel pipe piles with concrete fill, ASTM A36/A36M, ASTM A572/572M, ASTM A992, or ASTM A252 Grade 2 or Grade 3, driven to an ultimate capacity of 360 kips.

C. Related Work Specified Elsewhere

1. Section 03300: Concrete

1.03 DEFINITIONS AND REFERENCE STANDARDS

A. ASTM: Specifications of the American Society for Testing and Materials.

B. AWS: Standard Code for Welding in Building Construction, of the American Welding Society,

C. AISC: Specification of the American Institute of Steel Construction.

D. CODE: International Building Code, 2009 Edition.

1.04 QUALITY ASSURANCE

A. Comply with all rules, regulations, laws and ordinances of the City of Portland, and of all other authorities having jurisdiction, Including State and Federal laws including OSHA. All labor, materials, equipment and services necessary to make work comply with such requirements shall be provided without additional cost to Owner.

B. All welding shall be performed by operators who have been previously qualified by tests as prescribed in the AWS D1.1 “Standard Code for Welding in Building Construction". Evidence that welders meet qualification requirements shall be submitted to the Owner's Representative before welding has begun. The Owner's Representative may require a. weld test for each operator.

C. Field Monitoring and Testing

1. Periodic monitoring of pile driving operations will be provided by the Owner's Representative. The Contractor shall fully cooperate with the agency to facilitate inspection, notifying it in advance when welding operations are to be performed.

2. From time to time, monitoring of welding and welds will be performed by an independent testing agency employed by the owner. The Contractor shall fully cooperate with the agency to facilitate inspection, notifying it in advance when welding operations are to be performed. Welds which do not conform to applicable specifications shall be repaired as directed by the Owner's Representative.

3. Certification of quality of pile materials to be used in the work shall be furnished, in a form acceptable to the owner's Representative at the time of delivery of materials to the site. Pile materials shall also be subject to on-site observation for conformance with specifications.

4. Approvals given by the Owner's Representative or by testing agencies shall not relieve the Contractor of his responsibility for performing the work in accordance with the Contract Documents.

5. Instrumentation for Pile Installation

    a. Diesel Hammers: Open-type diesel hammers shall be equipped with a gauge for measuring ram height at the top of the stroke. Closed-type diesel hammers shall be equipped with an output energy gauge, calibrated for measurement of the total hammer energy. One spare output gauge shall be maintained at the site.

6. Where the design compressive loads exceed those allowed by the 2009 IBC Code (Section 1810), controlled test elements shall be tested in accordance with ASTM D1143 or ASTM D4595. At least two elements shall be load tested following the guidelines in Section 1810 of the 2009 IBC and the applicable ASTM Specification.

1.05 SUBMITTALS

A. General

1. The Contractor shall submit the information specified herein to the Engineer for review. Unless otherwise specified, submittals shall be received by the Engineer not less than two weeks before the start of the work to provide adequate review time.

2. The Contractor shall have received and approved all submittals prior to review by the Engineer. All review by the Architect, Engineer, and Contractor of submittals shall be completed prior to fabrication and installation of any material or product.

B. Shop Drawings

1. Shop Drawings showing sizes, tip details, and details for splice and shear connections, and other items pertinent to pile design.

2. Information on proposed pile driving system for review by the owner's representative prior to equipment mobilization. The system should be capable of installing the piles to the specified minimum ultimate geotechnical capacity without exceeding the allowable driving stresses.

3. Details of equipment and procedures.

C. Manufacturer's literature, including technical and performance literature for pile driving hammer, cushions, driving tips and other equipment for piles.

D. Mill certificates stating the chemical composition, yield point and ultimate strength of the steel.

E. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS D1.1 “Standard Qualification Procedure.”

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.

2. If re-certification of welders is required, retesting will be the Contractor’s responsibility.

F. Submit a Wave Equation Analysis which indicates the selected pile hammer can drive the piles to the required minimum ultimate capacity without overstressing or damaging piles.

G. As-Driven Pile Location Data:

1. Submit pile location two days after individual pile or pile cluster is completed.

2. At the completion of pile driving, submit final as-driven pile location plan with tabulated lengths, certified by a Registered Land Surveyor or Registered Professional Engineer.

1.06 JOB CONDITIONS

A. Site and Subsurface Conditions

1. Subsurface investigation data are available from the Owner in the report “Geotechnical Report Addendum, Proposed Wex Building, Corner of Hancock and Thames Street, Portland Maine,” prepared by summit Geoengineering Services, Inc. dated September 5, 2017. Prior to submitting a bid, the Contractor shall review and understand the information contained in the report. The geotechnical investigation report is made available to the Contractor for information on factual data only and shall not be interpreted as a warranty for subsurface conditions whether interpreted from written text, boring logs, or other data.

2. The contractor shall protect adjacent property, public utilities and structures, and completed work, from damage associated with the pile driving operation. All damage due to any pile driving operations shall be repaired by the Contractor at the Contractor's own expense.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall deliver piles at times and in sequence to assure continuity of pile driving.

B. Piles shall be handled, transported, stacked and protected to prevent damage to piles.

1.08 LINES AND GRADES

A. The-Contractor shall stake the pile locations and establish all elevations required. A baseline and benchmark located on or close to the site will be provided by the Owner. The Contractor shall be responsibe for the maintenance and protection of the baseline and benchmark, and all pile location stakes.

B. The Contractor shall employ a licensed Registered Land Surveyor or a Registered Civil Engineer familiar with pile installation, who shall establish lines and levels. Contractor shall be responsible for the correct location of piles, as well as keeping up-to-date records of the amount of uplift of individual piles, and establishing actual pile locations. Locations of the centers of as-driven piles shall be shown on a drawing in relation to the design location and submitted to the Owner within two days after the individual pile or pile group is completed. Drawings shall include the following:

1. Base line and north arrow.

2. Each pile identified by a separate number.

3. Elevation of each top of pile prior to cutting, to nearest 0.1 foot.

4. Deviation in inches, to the nearest one-fourth inch, from plan location at cutoff elevation.

C. Within two weeks after the completion of all pile driving, the Contractor shall provide to the Architect a plan, certified by said Surveyor or Engineer, showing the as-driven location of all piles. Plan shall be distributed to Structural Engineer and Owner.

PART 2 PRODUCTS

2.01 STEEL H-SECTION

A. Steel H-piles shall be new rolled H-sections of structural steel conforming to the ASTM A572 or ASTM A992 specifications for structural steel.

B. Steel H-pile sections shall be a HP 8X36 shape and weight as a minimum.

C. Deformations, defects, camber, sweep of piles placed in the leads of pile driving rigs shall be no more than allowed by ASTM A 572 or ASTM A992.

D. Steel H-Pile sections shall be fitted with APF HP 77600 "Hard-Bite" points, as manufactured by Associated Pile and Fitting Corporation or approved equal, prior to installation. APF HP 77600 points, or equal, shall be installed per manufacturer's recommendations.

E. Piles shall be furnished in sufficient lengths to meet specified driving requirements.

2.02 STEEL PIPE SECTION

A. Steel pipe piles shall consist of steel pipe conforming to the following Standard Specification of the American Society for Testing and Materials:

B. ASTM A252 Grade 2 or Grade 3 – Standard Specification for Welded and Seamless Steel Pipe Piles

C. Minimum Dimensions:

1. Pipes shall have an outside diameter of 8 inches or 10 inches and a minimum nominal wall thickness as required to meet the driving stresses and ultimate loads.

2. Ends of closed-ended pipe piles shall be closed with a flat plate or a forged or cast steel conical point, or other end closure of approved design. End plates shall have a minimum thickness of 0.75 inch.

D. Concrete Fill:

1. Prior to the placing of concrete in a closed end pipe pile, the pile shall be inspected by an acceptable method to confirm the full pile length and dry bottom condition. If accumulations of water in pipes are present for either closed end or open end pipes, the water shall be removed before the concrete is placed.

2. The concrete for concrete filled pipe piles shall have a minimum compressive strength of 2.5 ksi and a slump of not less than 6 inches andnot more than 10 inches.

PART 3 EXECUTION

3.01 SEQUENCE OF OPERATIONS AND EQUIPMENT REQUIREMENTS

A. The pile contractor shall provide equipment to maintain the schedule as developed by the Contractor, and shall mobilize additional equipment, if necessary, to complete the work on schedule.

B. Where the design compressive loads exceed those allowed by the 2009 IBC Code (Section 1810), controlled test elements shall be tested in accordance with ASTM D1143 or ASTM D4595. At least element shall be load tested following the guidelines in Section 1810 of the 2009 IBC.

C. When piles are located in an area where excavation is to be made, the piles shall not be driven until the excavation has been completed.

D. The Contractor shall coordinate his pile driving operations with other work on the project.

3.02 EQUIPMENT

A. Piles shall be installed with modern equipment as approved by the Owner's Representative. Approval shall be obtained from the Owner's Representative by the contractor a minimum of one week prior to commencement of pile driving.

B. The leads of the pile driving rig shall be fixed at two points; the points shall be at least half the length of the leads apart in order to maintain the pile and hammer in axial alignment at the correct plan location during the entire driving operation. The leads shall extend down to the lowest point at which the hammer must operate.

C. Piles may be driven with a single acting, double acting, or differential acting hammer capable of delivering the rated energy as necessary to drive the piles to the resistance required to meet the ultimate design capacity.

D. In the case of diesel hammers, the Contractor will be required to provide an apparatus, approved by the the Owner's Representative, to measure gas pressures inside the hammer for closed hammers or ram bounce height in the case of open hammers.

E. An aluminum micarta cushion block, or other cushion material approved by the Owner's Representative, shall be used in the hammer for driving piles. The cushion shall be replaced when, burned or otherwise worn.

F. Hammers used to drive permanent piles shall be of the same type and have the same rated energy as the hammer used to drive test piles for the pile load test program.

G. The use of followers will not be permitted unless authorized in writing by the Owner’s Representative.

3.03 OBSTRUCTIONS

A. The Contractor shall make reference to the test boring and test pit logs and available plans showing the site conditions.

B. Piles abandoned because of obstructions encountered shall be cut off or pulled out at the discretion of the Owner's Representative and the hole filled with sand.

C. Removal of obstructions by spudding, augering, drilling, etc. is not recommended, however, may be allowed in certain conditions with the approval of the Owner's Representative.

3.04 INSTALLATION

A. Driving

1. As part of the preparation for driving, each pile shall be marked at one-foot intervals along the upper 30 percent of the pile length. In addition, the footage shall be marked and designated at five-foot intervals, starting from the tip of the pile.

2. All Piles shall be driven at the locations and orientations shown on the drawings. Pile location shall be checked during driving and appropriate measures taken, as necessary, to maintain the correct pile position.

3. Each pile shall be driven to refusal to a minimum ultimate design capacity of 200 tons (SF=2.5) in compression. Pile driving shall be continuous and without interruption for the final 20 feet of penetration. If an abrupt increase in driving resistance is encountered, the driving shall be terminated when the pile penetration is less than 1/2 inch in eight successive blows. These driving criteria may be revised by the Geotechnical Engineer based on the hammer proposed by the contractor and their associated wave equation analysis.

4. Piles in a group shall be driven commencing in the center of the group and working toward the edge. All piles in any one group shall be driven before moving to other locations.

5. Immediately after a pile in a pile group is driven, the Contractor shall establish a reference point and its elevation on the pile for the purpose of checking uplift of the pile tip.

6. After all piles within the radius of uplift have been driven, the Contractor shall determine the elevation of the reference points on each of the piles in the group. If uplift of 0.04 feet or more has occurred, the pile shall be re-driven to its original elevation, and deeper if necessary to the specified final driving resistance. After re-driving each pile, the Contractor shall re-establish the elevation of the reference point. Re-driving shall be repeated as often as necessary until the measured uplift on any pile is less than 0.04 feet.

7. The radius of uplift is defined as the maximum distance between piles such that pile driving causes uplift of 0.04 feet or more in the affected pile. Survey instruments used to establish the reference elevations shall be carefully checked and adjusted as necessary to insure accurate readings. Uplift measurements shall be submitted to the Engineer.

B. Splicing

1. A maximum of 1 pile splices shall be allowed for all piles.

2. No splices will be permitted in the upper 10 feet of the embedded portion of the pile.

3. The strength of all splices, in compression, tension, and bending, shall be equal to or greater than the ultimate capacities of the pile section.

4. Piles may be spliced in the leads. The sections of piles to be spliced shall be secured in alignment such that there is no eccentricity between the axes of the two spliced lengths, or angle between them, after the splice has been completed.

5. Steel pile sections shall be spliced by continuous, butt-joint, 45 degree bevel; or vee, complete penetration, arc welding around the entire circumference, to produce joints developing 100 percent of the pile section strength.

    a. Electrodes conforming to ASTM A233, E-70 series, shall be used.

    b. Welds which do not conform to specifications shall be gouged and repaired as directed by the inspector.

    c. Mechanical drive-fit splices shall not be used.

C. Cutting off Piles

1. Pile tops shall be cut off square within one inch of the elevations shown on the drawings. The pile cut-offs shall become the property of the Contractor and shall be removed from the site.

2.. When piles are driven below the design cut-off grade, due to unexpected penetration, a limited number of build-ups will be permitted in accordance with designs provided by the Contractor and approved by the Engineer. Build up costs shall be the responsibility of the Contractor.

D. Concrete Fill for Pipe Piles

1. Concrete shall be placed in each pile in a continuous operation. No concrete shall be placed until all driving within a radius of 15 feet of the pile has been completed, or all driving wihin the above limits shall be discontinued until the concrete in the last pile cast has set for at least two days.

3.05 TOLERANCES AND CRITERIA FOR ACCEPTANCE

A. Piles shall be driven as close as practicable to the plan location. Allowable maximum deviations shall be as follows:

1. Lateral deviation from column centerline and centroid of pile or pile group for single piles and groups of two piles: 1 inches.

2. Lateral deviations from column centerline and centroid of pile group for groups of three or more piles: 3 inches.

3. Design cut off elevations: 1 inch.

4. Plumbness of a driven pile measured on the projection above ground : 6 inches in 10 feet.

B. Piles that are damaged below cutoff elevation during driving will be rejected. The engineer will determine if a pile has been unacceptably damaged based on his knowledge of the subsurface conditions and comparison of the subject piles driving performance with that of other driven piles.

C. Piles indicating sudden or peculiar decrease in penetration resistance during driving will be assumed to be broken and will be rejected unless Engineer's review of available data indicates that sudden decrease in driving resistance is due to natural, subsurface conditions and continued acceptable driving behavior is observed.

D. Except as specified under "Obstructions". piles that are rejected because of damage, mis-location or misalignment, or failure to meet the driving criteria, shall be cut off below the limits of the structure and abandoned, and additional piles shall be driven as directed by the Engineer.

E. When otherwise acceptable, the Contractor shall provide an accurate survey to the Engineer of installed piles exceeding the specified tolerances as specified. The maximum compressive load on any pile due to mis-location shall not exceed 110 percent of the allowable design load. If the load on any pile exceeds 110 percent of the specified load capacity, corrections shall be made in accordance with a design provided by the Engineer.

F. The installation of replacement piles and other corrective measures shall in all cases be in accordance with designs provided by the Engineer.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Piles will be measured for payment on the basis of length along the axis of the pile in place below the design cutoff elevation.

4.02 BASIS OF PAYMENT

A, Work included under this contract shall include installation of the end bearing piles. The amount of such work shall include furnishing and driving the piles, splicing, pile tips, concrete fill and all work incidental thereto, and mobilization and demobilization which shall include job set-up, moving, equipment including pile driving rigs on and off the project, establishing and dismantling the Contractor's field administration forces and equipment, and all other work incidental thereto.

B. The footage of foundation piles for payment shall be the sum of the lengths of the piles below design cutoff grade actually driven and accepted.

C. Piles rejected in accordance with the provisions of these Specifications and which result in the judgment of the Engineer, from the Contractor's violation of the Specifications or his other error, will not be paid for. If one or more replacement piles are required by the Owner's Representative to compensate for a rejected pile, the Contractor will be paid at the Contract unit price per foot for only the longer of the replacement piles. Additional piles required to compensate for production piles or replacement piles driven out of design location due to Contractor error will be installed at no additional cost to the Owner.

D. Piles rejected, in the judgment of the Owner's Representative due to causes other than the Contractor's violation of the Specifications or his other error, will be measured and included in the aggregate footage of piles for payment.

E. Whenever, in the judgement of the Owner's Representative, misalignment or rejection of a pile or piles caused by the Contractor's violation of the specifications or his other error necessitates structural redesign of the pile cap, and the redesigned pile cap requires greater quantities of concrete and reinforcing steel, the quantities required shall be compared with quantities required for the pile cap for the design pile group configuration, and the additional cost for pile cap concrete, reinforcing steel and form work shall be deducted from the contract price, in addition to redesign cost. Whenever, in the judgement of the Owner's Representative, misalignment or rejection of a pile or piles caused by the Contractor's violation of the specifications or his other error necessitates structural redesign, the cost of such redesign shall be deducted from sums otherwise due to the Contractor under the contract.

F. No payment will be made for pile cut-offs, splices and pile buildups.

G. Payment for the two load tests and additional tests, should they be required, shall be made as a lump sum per test. The pile load test unit price shall include constructing and supporting the test load or reaction system, driving and removing temporary piles and supports, furnishing and operating jacks and gauges and related equipment, tools, personnel, and incidentals necessary for the proper execution of the pile load test as specified. If a load test is unacceptable due to the contractor's lack of conformance with the specification, an additional load test shall be made and the expense of the additional load test shall be borne by the Contractor.

END OF SECTION