PROJECT MANUAL

Hyatt Place, Portland - Old Port

433 Fore Street
Portland, Maine

Project No: 12013

Volume 1
Site, Civil and Structural
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SECTION 024113 - SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Demolition includes modification, removal, resetting, relocation, and/or disposal of items as shown on Drawings or as specified. This includes, but is not limited to, the following:

1. Removal of utilities as required accommodating new construction, including utility mains, structures, services, and appurtenances for storm sewers, sanitary sewers, water piping, gas piping, and other utilities, as identified on the Drawings.
2. Installation of masonry plugs for abandoned utility piping and structures, as identified on the Drawings.
3. Removal and relocation of the existing exterior lighting as identified on the Drawings.
4. Removal and disposal of hot bituminous pavement and fill materials as required accommodating new grades and construction.
5. Removal of brick sidewalk and curbing within project area. Deliver removed bricks and granite curbing to the City of Portland's Material Stockyard. Dispose of removed bricks and granite curbing only at the direction of the City of Portland and the OWNER.
6. Removal of parking meters as identified on the Drawings. Deliver removed parking meters to the City of Portland's Material Stockyard. Dispose of parking meters only at the direction of the City of Portland and the OWNER.
7. Coring of holes of diameter required and at locations required to accommodate utilities and piping as necessary for new construction.
8. Removal of existing concrete retaining wall as identified on the Drawings.
9. Removal of existing vegetation as indicated on the Drawings.
10. All other demolition work required to allow complete installation of the Project.

1.2 RELATED REFERENCES

A. Earth Moving: Section 31 20 00

B. Utilities: Division 33

1.3 SUBMITTALS

A. Submit proposed methods and disposal plans for demolition to OWNER and PROJECT ARCHITECT for review prior to start of work as specified.

B. Submit schedule indicating proposed sequence of demolition to OWNER and PROJECT ARCHITECT for review prior to start of work. Include coordination for shutoff, capping and continuation of utility services as required, together with details for dust and noise control protection.

1.4 JOB CONDITIONS

A. Occupancy: Areas adjacent to areas of selective demolition may be continuously occupied during the project. Conduct selective demolition work in manner that will minimize need for disruption of normal operations.

B. Permits: CONTRACTOR shall obtain all required permits for demolition.

C. Condition of Structures: The OWNER assumes no responsibility for actual condition of structures to be demolished.

1. Conditions existing at time of inspection for bidding purposes will be maintained by OWNER as far as practicable. However, variations within structure may occur by OWNER's removal and salvage operations prior to start of demolition work.

D. Partial Removal: Items must be removed from structure as work progresses. Salvaged items must be transported from site as they are removed.

1. Items property of OWNER: Coordinate with OWNER before removing any items. OWNER reserves right to retain demolished items or portions thereof at designated location on site. Allow OWNER to remove components from demolished items. Items OWNER does not retain become property of CONTRACTOR and must be removed and disposed of properly.

E. Explosives: Use of explosives will not be permitted.

F. Traffic: Conduct demolition operations and removal of debris to ensure no interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways.

G. Protections: Provide temporary barricades and other forms of protection to ensure safe passage of personnel around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

1. Provide protective measures as required to provide free and safe passage of people.
2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to the demolished and adjacent facilities or work to remain.
3. Remove protections at completion of Work.

H. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to OWNER.

I. Environmental Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations, permits, laws, ordinances, etc. pertaining to environmental protection.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.

B. Stop demolition operations and notify PROJECT ARCHITECT immediately if safety appears to be endangered. Take precautions to support until determination is made for continuing operations.

C. Call Dig Safe prior to beginning construction and locate, identify, stub-off and disconnect utility services that are not indicated to remain in accordance with plans.

3.2 DEMOLITION

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings or as specified in accordance with the approved demolition schedule and applicable regulations.

B. Provide services for effective air and water pollution controls (water sprinkling, temporary enclosures, and other suitable methods) to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations, permits, laws, and ordinances pertaining to environmental protection.

C. Completely fill below grade areas and voids resulting from demolition work. Provide fill materials as shown on the Drawings or as specified in section 31 00 00, Earthwork.

D. Saw-cut asphalt and concrete paved surfaces before removal. Joint cut should be neat and straight.

E. Do not disturb existing utilities that are identified to remain in place.

3.3 SALVAGED MATERIALS

A. General: Where shown on the Drawings or specified as Salvage, Property of OWNER, or Deliver to OWNER, carefully remove indicated items, clean, store, and turn over to OWNER in area designated by PROJECT ARCHITECT or OWNER.

1. Where shown on the Drawings or specified as Deliver to City of Portland’s Material Stockyard, carefully remove indicated items, clean, store and transport to the Material Stockyard upon approval of the City of Portland’s Department of Public Services.

B. Remove all salvaged materials from the site except stockpile items for reuse as indicated on the Drawings and set aside items requested by the OWNER. The OWNER shall remove all such requested materials from the site promptly.

C. Any unanticipated items of significant historic or commercial value discovered in the demolition work shall remain the property of OWNER. CONTRACTOR will have the option to take possession of all other demolition materials or to dispose of them suitably. No materials assigned to CONTRACTOR may remain on site without written authorization from PROJECT ARCHITECT or OWNER.

3.4 PIPE CORING

A. General: Core holes for all pipe protrusions through existing concrete structures to allow watertight installation of pipe and link seal or pipe sleeve as required. Double link seals shall be installed at all pipe protrusions through concrete walls containing liquid or saturated conditions on either side.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove from Project site debris, rubbish, and other materials resulting from demolition operations. Do not remove from Project site without prior permission by OWNER or PROJECT ARCHITECT. Store all demolished materials that OWNER wishes to retain at location designated by OWNER or PROJECT ARCHITECT.

B. Burning of removed materials from demolished structures will not be permitted on site.

C. Dispose of demolition debris in a lawful manner.

D. Management of hazardous materials not specifically identified in this specification shall be extra work. This provision does not relieve CONTRACTOR of his responsibility to respond promptly and appropriately to indications of hazardous material.

E. In the event that unanticipated hazardous materials are discovered or suspected, CONTRACTOR shall carry out suitable measures to minimize hazards and immediately report conditions to PROJECT ARCHITECT.

3.6 CLEAN-UP

A. General: CONTRACTOR shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the Work, all materials, equipment, waste, and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.

3.7 PORTLAND WATER DISTRICT

A. General: CONTRACTOR shall complete all work in accordance with the Portland Water District's Standard Specifications.

3.8 CITY OF PORTLAND SANITARY AND STORM SEWER

A. General: CONTRACTOR shall complete all work in accordance with the City of Portland Maine Technical and Design Standards and Guidelines, latest edition, and all other Ordinances and Requirements of the City of Portland.

3.9 UNITIL NATURAL GAS

A. General: CONTRACTOR shall complete all work in accordance with the requirements of Unitil.

END OF SECTION 024113

SECTION 033000 - CAST -IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other 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.

1.2 DESCRIPTION OF WORK:

A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section and, without limiting the generality thereof, furnish and include the following:

1. The extent of cast-in-place concrete work is shown on drawings and includes (but not by way of limitation) formwork, reinforcing, cast-in-place concrete, accessories, finishing, and casting in of items specified under other Sections of the Specifications or furnished by Owner that are required to be built-in with the concrete.
2. Equipment support pads indicated on mechanical drawings to be installed by the Building Contractor.
3. Cast-in-place retaining walls, exterior slabs on grade and other concrete shown on site drawings.

1.3 RELATED WORK:

A. Metal Fabrications: Section 05 50 00

1. Expansion Anchors - Section 05 12 00
2. Embedded Items - Section 05 50 00

B. Anchor Bolts: Section 05 12 00

C. Joint Sealants: Division 7

D. Underslab Vapor Retarders/Wall Waterproofing: Division 7

1.4 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the latest edition of the following except where more stringent requirements are shown or specified:

1. ACI “Manual of Concrete Practice”.
2. ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials”.
3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."
4. ACI 212.3R "Chemical Admixtures for Concrete."
5. ACI 301 "Specifications for Structural Concrete for Buildings."
6. ACI 302.1R "Guide for Concrete Floor and Slab Construction."
7. ACI 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete."
8. ACI 304.2R "Placing Concrete by Pumping Methods."
9. ACI 306 R "Cold Weather Concreting."
10. ACI 308 “Standard Practice for Curing Concrete."
11. ACI 309R "Guide for Consolidation of Concrete."
12. ACI 315 "ACI Detailing Manual."
13. ACI 318 "Building Code Requirements for Reinforced Concrete."
14. ACI 347R "Guide to Formwork for Concrete."
15. Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars."
16. AISC “Code of Standard Practice for Steel Buildings and Bridges.”
17. “Code of Federal Regulations, Part 1926” per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Materials and installed work may require testing and retesting, as directed by the Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

1.5 SUBMITTALS:

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner’s Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

I. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Reinforcement certified mill reports covering chemical and physical properties and yield strength.
2. Patching products.
3. Non-shrink grout.
4. Curing compounds, where applicable.
5. Admixtures.
6. Expansion/Adhesive Anchors.

J. Shop Drawings:

1. Shop Drawing Preparation: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings is prohibited. Shop drawings created from reproduced Construction Documents will be returned without review. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315, showing bar schedules, stirrup and tie spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete elements. Include supplemental reinforcing and bar supports necessary to support reinforcing steel at proper location within forms or slabs.

   a. Review of the shop drawings will be made for the size and arrangement of reinforcement. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
   b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided all items listed prior. Incomplete submittals will not be reviewed.

K. Mix designs: Submit all laboratory test reports and materials for each mix design listed within. Prepare mixes by the field experience method and/or trial mixtures per the requirements of chapter 5 of ACI 318. Include the calculation of average strength and standard deviation. Proportioning by water cement ratio method will not be permitted.

L. Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.

M. Curing Methods: Submit documentation of curing methods to be used for review. Account for anticipated project temperature ranges and conditions in curing methods.

N. Contraction/Construction Joints: Submit plan indicating proposed location of contraction and construction joints in walls and slabs.

O. Test Reports: Test reports shall be submitted to the Owner, Architect and Engineer within 48 hour after completion of each test.

PART 2 - PRODUCTS

2.1 FORM MATERIALS:

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system

shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.2 REINFORCING MATERIALS:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. Provide welded wire fabric in flat sheets.

C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use plastic, wire bar type supports or concrete block supports complying with CRSI recommendations, unless otherwise specified. Wood, clay brick and other unspecified devices are not acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2).

2.3 CONCRETE MATERIALS:

A. Single-Source Supplier: Ready-mix concrete shall be from one supplier unless specific written approval is received from the Structural Engineer.

B. Portland Cement: ASTM C 150, Type I or Type II, unless otherwise approved Use one brand of cement throughout project, unless otherwise acceptable to Architect.

C. Normal Weight Aggregates: ASTM C 33. Provide from a single source for exposed concrete. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, or ochre which can cause stains on exposed concrete surfaces.

D. Light Weight Aggregates: ASTM C 330.

E. Water: Potable.

F. Air-Entraining Admixture: ASTM C 260.

G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G containing not more than 1% chloride ions.

H. Fiber reinforcement shall be Type III Synthetic Virgin Homopolymer Polypropylene Fibers conforming to ASTM C1116. Fiber reinforcing shall be added and distributed prior to incorporation of Super Plasticizer.

I. Normal range water reducing admixture: ASTM C 494 Type A containing no calcium chloride.

J. Accelerating Admixture: ASTM C 494, Type C or E.

K. Concrete water proofing admixture: Waterproofing admixture shall be used in walls where grade is above slab level at habitable spaces only. Admixture shall be BASF Rheomac 300D or Xypex C Series.

L. Blast Furnace Slag: ASTM C989

M. Fly Ash: ASTM C618, Class C or F

N. Calcium Chloride is not permitted.

2.4 RELATED MATERIALS:

A. Underslab Vapor Retarder: Provide vapor retarder over prepared sub base. Refer to architectural drawings, geotechnical report and/or division 7 specifications for additional requirements and vapor retarder location.

B. Non-Shrink Cement-based Grout: Provide grout consisting of pre-measured, prepackaged materials supplied by the manufacturer requiring only the addition of water. Manufacturer's instructions must be printed on the outside of each bag.

1. Non-shrink: No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827. No shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with CRD-C-621.
2. Compressive strength: A minimum 28 day compressive strength of 5000 psi when tested in accordance with ASTM C-109.
3. Setting time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C-191.
4. Composition: Shall not contain metallic particles or expansive cement.

C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

E. Liquid Membrane-Forming Curing Compound: Liquid type membrane forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Curing compound shall not impair bonding of any material, including floor finishes, to be applied directly to the concrete. Demonstrate the non-impairment prior to use.

F. Preformed Expansion Joint Formers:

1. Bituminous Fiber Type, ASTM D 1751.
2. Felt Void, Poly-Styrene Cap with removable top as manufactured by SUPERIOR.

G. Slab Joint Filler: Multi-component polyurethane sealant (self-leveling type).

H. Waterstops shall be Bentonite/Butyl Rubberbased product. Use in conjunction with manufacturer's approved mastic. Acceptable products include:

1. "Waterstop Rx," by American Colloid Co.
2. "Adeka Ultra Seal MC-2010," by Asahi Denka Koeyo, Kik MN.

2.5 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 318. Use material, including all admixtures, proposed for use on the project. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

B. Submit written reports to Architect of each proposed mix for each class of concrete. Do not begin concrete production until mixes have been reviewed by Architect.

C. Proportion design mixes to provide concrete with the following properties:

1. Footings at rock anchors, grade beams, and drilled piers:

a. Strength: 5,000 psi at 28 days.
b. Aggregate: 3/4"
c. W/C Ratio: 0.54 maximum
d. Entrained Air: 6% +/- 1.5%

e. Slump: 4" maximum

2. All other foundation elements:

a. Strength: 3,000 psi at 28 days.
b. Aggregate: 3/4"
c. W/C Ratio: 0.54 maximum
d. Entrained Air: 6% +/- 1.5%
e. Slump: 4" maximum

3. Interior Slabs on grade and elevated slabs:

a. Strength: 3,000 psi at 28 days
b. Aggregate: 3/4" minimum, 1 1/2" maximum.
c. W/C Ratio: 0.54 maximum
d. Entrapped Air only (no entrainment), 2.5% +/- 1%
e. Slump: 4" maximum

4. Exterior Slabs and all other exposed Site Concrete not specified elsewhere:

a. Strength: 4,500 psi at 28 days
b. Aggregate: 3/4"
c. W/C Ratio: 0.45 maximum
d. Entrained Air: 6% +/- 1.5%
e. Slump: 4" maximum

5. Add air entraining admixture at manufacturers prescribed rate to result in concrete at point of placement having the above noted air contents.
6. Additional slump may be achieved by the addition of a mid-range or high-range water reducing admixture. Maximum slump after the addition of admixture shall be 6 or 8 inches for mid-range or high range water reducing admixtures, respectively.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor, when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Structural Engineer before using in work.

1. Water may be added at the project only if the maximum specified slump and design mix maximum water/cement ratio is not exceeded.
2. Additional dosages of superplastisizer should be used when delays occur and required slump has not been maintained. A maximum of two additional dosages will be permitted per ACI 212.3R recommendations.

2.6 CONCRETE MIXING:

A. Job-Site Mixing will not be permitted.

B. Ready-Mix Concrete: Must comply with the requirements of ASTM C 94, and as herein specified. Provide batch ticket for each batch discharged and used in work, indicating project name, mix type, mix time and quantity.

1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required by Structural Engineer.
2. When the air temperature is between 85 degrees F. and 90 degrees F., reduce the mixing and delivery time from 1 1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F., reduce the mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMS:

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design, construct, erect, maintain, and remove forms for cast-in-place concrete work in compliance with ACI 347.

C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

D. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

E. Vertical dovetail slots may be required for masonry tie installation. Coordinate dovetail slot spacing and location with division 4 specifications and Architectural drawings.

F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, dovetail slots, reglets, recesses, and the like to prevent swelling and for easy removal.

G. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

H. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

I. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

1. Unless otherwise indicated, provide ties for concrete surfaces to be exposed to view in the final condition so portion remaining within concrete after removal is 1" (minimum) inside concrete.
2. Form ties shall not leave holes larger than 1" diameter in concrete surface. Repair holes left by form ties after removal of formwork.

J. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

K. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

3.2 PLACING REINFORCEMENT:

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

1. Subgrade tolerance shall conform to a tolerance of +0/-1 1/2". Base tolerance (fine grading) for slabs shall conform to a tolerance of +0”/-3/4” in. Confirm compliance of above tolerances with surveyed measurements taken at 20 ft. intervals in each direction.
2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
3. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
4. Place reinforcement to obtain specified coverage for concrete protection within tolerances of ACI-318. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
5. Install welded wire fabric in flat sheets in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.3 JOINTS:

A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Architect. Submit plan indicating proposed location of construction joints for review prior to beginning work.

1. Provide keyways at least 1-1/2" deep in construction joints in walls, and slabs; bulkheads reviewed by the Engineer, designed for this purpose may be used for slabs.
2. Roughened surfaces shall be used between walls and footings unless shown otherwise on the drawings. The footing surface shall be roughened to at least an amplitude of 1/4" for the width of the wall before placing the wall concrete.
3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
4. Joints in slabs on grade shall be located and detailed as indicated on the drawings. If saw-cut joints are required, the early-entry dry-cut process shall be used. Refer to ACI 302, section 8.3.12.

3.4 INSTALLATION OF EMBEDDED ITEMS:

A. General: Set, securely anchor and build into work prior to concrete placement all anchorage devices and all other embedded items, including but not by limitation reinforcement, reinforcing dowels, embedded plates, anchor rods, anchor inserts, sleeves, load transfer plates, diamond dowels and shelf bulk heads required for other work that is attached to, bear upon, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto. Notify other trades to permit installation of their work. Templates to be utilized for setting of anchorage devices shall be constructed in a manner to allow mechanical consolidation of concrete without disturbance. Embedments shall be placed in a timely fashion to permit the inspection of embedments prior to concrete placement. “Wet Setting” of embedded items into plastic concrete is strictly prohibited.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface.

C. Provide PVC sleeves where pipes and/or conduit pass through exterior concrete or slabs. Sleeves or penetrations shall not be placed through footings, piers, pedestals, drop caps, columns or pilasters unless specifically noted.

D. Tolerances: Tolerances for Anchor Bolts/Rods, other embedded items and bearing surfaces shall meet the requirement set forth in the latest edition of the American Institute of Steel Construction “Code of Standard Practice for Steel Buildings and Bridges,” and ACI 117. The more stringent criteria from these documents shall apply.

3.5 INSTALLATION OF GROUT

A. Place grout for base plates in accordance with manufacturer's recommendations.

B. Grout below setting plates as soon as practicable to facilitate erection of steel and prior to removal of temporary bracing and guys. If leveling bolts or shims are used for erection grout shall be installed prior to addition of any column load.

C. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

3.6 PREPARATION OF FORM SURFACES:

A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating material manufacturer's directions. Do not allow excess form coating to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.7 CONCRETE PLACEMENT:

A. Preplacement Review: Footing bottoms are subject to review by the Geotechnical Engineer. Reinforcement and all concrete preparation work shall be subject to review by the Structural Engineer. Verify that reinforcing, ducts, anchors, seats, plates and other items cast into concrete are placed and securely held. Notify Engineer/Project Special Inspector 48 hours prior to scheduled placement and obtain approval or waiver of review prior to placement. Be sure that all debris and foreign matter is removed from forms.

B. Concrete shall be placed in the presence of an approved testing agency.

C. General: Comply with ACI 304, and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.
2. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.
3. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:

    a. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An arrangement shall be used at the discharge end to

prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.

b. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long, and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

c. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete.

d. Concrete shall not be conveyed through pipe made of aluminum alloy. Standby equipment shall be provided on the site.

e. Tined rakes are prohibited as a means of conveying fiber reinforced concrete.

4. Do not use reinforcement as bases for runways for concrete conveying equipment or other construction loads.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment. Hand-spading, rodding or tamping as the sole means for the consolidation of concrete will only be permitted with special permission from the Engineer. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
2. Use vibrators designed to operate with vibratory equipment submerged in concrete, maintaining a speed of not less than 8000 impulses per minute and of sufficient amplitude to consolidate the concrete effectively. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine, generally at points 18 inches maximum apart. Place vibrators to rapidly penetrate placed layer and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion maintain the duration of vibration for the time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix, generally from 5 to 15 seconds. A spare vibrator shall be kept on the job site during all concrete placing operation.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete using internal vibrators during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Do not sprinkle water on plastic surface.
3. Maintain reinforcing in proper position during concrete placement operations.
4. Slab thicknesses indicated on the drawings are minimums. Provide sufficient concrete to account for structure deflection, subgrade fluctuations, and to obtain the specified slab elevation at the flatness and levelness indicated here within.

5. Finish: See “Monolithic Slab Finishes” in this specification for slab finish requirements.

F. Cold Weather Placing: 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 herein specified.

1. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27degrees 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 and other materials containing antifreeze agents or chemical accelerators.
4. All temporary heat, form insulation, insulated blankets, coverings, hay or other equipment and materials necessary to protect the concrete work from physical damage caused by frost, freezing action, or low temperature shall be provided prior to start of placing operations.
5. When the air temperature has fallen to or is expected to fall below 40 degrees F, provide adequate means to maintain the temperature in the area where concrete is being placed between 50 and 70 degrees F.

G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Wet forms thoroughly before placing concrete.
4. Do not use retarding admixtures without the written acceptance by the Architect.

3.8 FINISH OF FORMED SURFACES:

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This concrete surface shall have texture imparted by form facing material, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 in. in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This as-cast concrete surface shall be obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment. Combine one part Portland cement to 1-1/2 parts fine sand by volume and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

1. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

D. Related Unformed Surfaces: At tops of walls and grade beams, horizontal offset surfaces occurring adjacent to formed surfaces, strike-off, smooth and finish with a texture matching adjacent unformed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FLOOR FLATNESS AND LEVELNESS

A. Floor flatness/levelness tolerances: Tolerances for various floor uses shall conform to the requirements set forth in ACI 117 and ACI 302 for “flat” floor profile.

1. Minimum Test Area Flatness/Levelness: F_F35/F_L25
2. Minimum Local F Number: F_F25/F_L15

B. Levelness criteria shall be applied to slabs-on-grade only.

C. Contractor shall measure floor finish within 72 hours after slab finishing and provide corrective measures for finishes not within tolerance. Corrective procedures shall be reviewed by the Architect prior to implementation.

3.10 MONOLITHIC SLAB FINISHES:

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds, and as otherwise indicated.

1. After placing slabs, plane surface to a tolerance not exceeding 1/2 in. in 10 ft. when tested with a 10-ft. straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, and as otherwise indicated.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces indicated, including slab surfaces to be covered with carpet, resilient flooring, paint or other thin-film finish coating system.

D. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

E. Slab finishes for floor coverings not indicated or exposed to view in the final condition shall be coordinated with the Architect prior to slab placement.

F. Slab Joints: Where indicated, sawn slab contraction joints shall be “soft cut”, immediately after concrete surface is firm enough not to be torn or damaged by the blade.

3.11 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 308 as herein specified.

B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified unless noted otherwise. Curing shall commence as soon as concrete surfaces are sufficiently hard as to withstand surface damage. Slabs-on-grade shall be cured by “wet” curing methods unless otherwise noted; Slabs-on-grade to receive floor coverings with moisture sensitive adhesives shall be cured by means of a moisture retaining covering. Coordinate curing with flooring adhesive manufacturer and flooring installer. Submit curing methods to Architect for review and approval.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Protection From Mechanical Injury: During the curing period and duration of construction, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

3.12 REMOVAL OF FORMS:

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as joints, slabs and other structural elements, may not be removed in fewer than 14 days or until concrete has attained design minimum

compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and support.

3.13 REUSE OF FORMS:

A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and latency, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.14 MISCELLANEOUS CONCRETE ITEMS:

A. Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

3.15 CONCRETE SURFACE REPAIRS:

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Architect.

1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush coat the area to be patched with approved bonding agent. Place patching mortar after bonding compound has dried.
2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, form tie holes, cracks, spalls, air bubbles, honeycomb, rock pockets, fins, and other projections on surface and stains and other discolorations that cannot be removed by cleaning.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. Testing Agency/Project Special Inspector shall verify reinforcement, including foundation reinforcement and slab reinforcement (WWF or reinforcing bar). Agent shall verify WWF or reinforcement has been chair/placed with proper clearances.

B. The Owner shall employ a Testing Laboratory to inspect, sample and test the materials and the production of concrete and to submit test reports. Concrete testing shall be performed by technicians certified by the Maine Concrete Technician Certification Board and/or ACI Concrete Field Testing Technician Grade I.

C. Concrete shall be sampled and tested for quality control during placement. Quality control testing shall include the following, unless otherwise directed by the Architect.

D. See Submittals section for report requirements.

E. Sampling Fresh Concrete: ASTM C 172.

1. Slump: ASTM C143; One test for each set of compressive strength test specimens. Sample shall be taken from middle third of the load per ASTM C172. A slump test must be run prior to the incorporation of the CFP fibers per recommendations of ACI 544. A slump test must be run prior to and following the addition of a water reducer (superplasticizer) per recommendations of ACI 301.
2. Air Content: ASTM C231 "Pressure method for normal weight concrete." one test for each set of compressive strength specimens measured at point of discharge.
3. Concrete Temperature: Per ASTM C-1064; one test each time a set of compression test specimens are made.
4. Compression Test Specimen: ASTM C31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

    a. An insulated Cure Box for specimen curing shall be supplied by Testing Agency for initial curing as defined in ACI C31.
    b. Means of heating or cooling the Cure Box shall be provided by the Inspection Agency if required in order to maintain a temperature between 60 and 80 degrees F. Contractor shall provide an electrical source to the Testing Agency when required for temperature control.
    c. A maximum-minimum thermometer shall be provided in the Cure Box by the Testing Agency to record the temperature range of the Cure Box during specimen curing. The Testing Agency shall record the maximum/minimum temperature of the Cure Box when transferring the specimens to the laboratory.
    d. Test Specimens shall be moist cured.
    e. Refer to ACI C31 for additional requirements for Test Specimens.

5. Compressive Strength Tests: ASTM C39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 4,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, 1 specimen retained in reserve for later testing if required.

6. Pumped concrete shall be tested at point of discharge per ACI 301.

F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods, as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 034100 - STRUCTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other 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.

1.2 DESCRIPTION OF WORK:

A. Extent of structural precast concrete work is shown on drawings and in schedules.

B. The extent of Structural Precast Concrete is shown on drawings and includes (but not by way of limitation) 8-inch prestressed hollow core concrete planks, 8” solid prestressed spandrel planks, all bearing materials, embedded items, accessories and grouting of plank joints.

1.3 RELATED WORK:

A. Section 033000 - Cast in Place Concrete

B. Section 051200 - Structural Steel

C. Section 055000 - Metal Fabrications

D. Division 07 - Joint Sealants

1.4 QUALITY ASSURANCE:

A. Codes and Standards: Comply with the provisions of the latest edition of the following except where more stringent requirements are shown or specified:

1. ACI 301 "Specifications for Structural Concrete for Buildings."
2. ACI 318 "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
4. Precast/Prestressed Concrete Institute, “PCI Design Handbook, Precast and Prestressed Concrete.”

5. Precast/Prestressed Concrete Institute MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products."
6. Girder-Slab Technologies LLC of New Jersey, 1-888-478-1100 or www.girder-slab.com, “Design Guide”.
7. AWS D1.1 - 2004 “Structural Welding Code” - Steel
8. “Code of Federal Regulations, Part 1926” per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Fabricator Qualifications:

1. Fabricator must be an active producer member of the Prestressed Concrete Institute (PCI) and participate in its Plant Certification Program. Manufacturer shall be certified at time of bidding and for duration of project in Category C2. Certificate shall be submitted for record purposes.
2. Firms must have a minimum of 5 years successful experience in fabrication of precast concrete units similar to units required for this project.
3. Fabricator must have sufficient production capacity to produce required units without causing delay in work.

C. Erector’s Qualifications:

1. Regularly engaged for at least 5 years in the erection of precast structural concrete similar to requirements of this project.
2. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS D1.1 “Standard Qualification Procedure.”

    a. Provide certification that welders to be employed in work have satisfactorily passed AWS D1.1 qualification tests and maintained a current certification. Current certification and/or continuity log shall be submitted and be available in the shop and field at all times.
    b. If re-certification of welders is required, retesting will be the Contractor’s responsibility.

1.5 SUBMITTALS:

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner’s Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor,

representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

I. Product Data:

1. Submit a copy of the fabricator's certificate indicating participation in the PCI Plant Certification Program.
2. Submit producer's or manufacturer's specifications and installation instructions for the proprietary products and bearing materials. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

J. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned

without review. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.

1. Indicate member dimensions and cross section
2. Indicate location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.
3. Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate all openings in units.
4. Indicate welded connections by AWS standard symbols.
5. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.
6. Anchorage: Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for placement.
7. Openings: Provide size and location of plant cast openings in the plank.
8. Erection Sequencing: Include erection procedure for precast units and sequence of erection.

K. Performance Design: Design Calculations:

1. Provide complete design calculations prepared and stamped and signed by a registered Professional Engineer licensed in the State of Maine.
2. Calculations submitted without affixed stamp and signature will be rejected and returned without review.
3. Plank Design Criteria:

    a. Design Loads: As indicated on the drawings
    b. Code: Comply with ACI 318, Latest Edition
    c. Maximum Superimposed Live Load Deflection:

        1) Floors: Span/480
        2) Where possible, design planks to be non-composite. Notify the Architect and Engineer if planks are to be designed as composite with the concrete topping.
        3) Camber: Indicate camber in design calculations. See installation tolerances for additional information on anticipated camber.
        4) Structural Steel Plank Headers: Design where required or indicated.
        5) Holes and openings: Design planks to accommodate field cored holes as indicated within. See Architectural Drawings for opening layout information.

L. Certificate of Compliance: At completion of fabrication, the precast plank fabricator shall submit a Certificate of Compliance stating that the work was performed in accordance with the construction documents.

M. Plant Concrete Mix Design:

1. Trial Batch Method: Submit laboratory test reports for concrete materials and mix design tests.

2. Field Experience Method: Submit required records of strength tests.

N. Field Grout Mix Design: Minimum Strength 4,000 psi. Submit all laboratory test reports and materials. Prepare mixes by the field experience method and/or trial mixtures per the requirements of chapter 5 of ACI 318. Include calculation of average strength and standard devotion.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Deliver precast concrete units, accessories and bearing materials to project site in such quantities and as such times to assure continuity of installation. Coordinate deliver with Structural Steel erection. Store units on appropriate dunnage at project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.

B. Deliver anchorage items which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

PART 2 - PRODUCTS:

2.1 FORMWORK

A. Provide forms and, where required, form facing materials of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surfaces.

B. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in the PCI manual referenced above.

C. Unless forms for plant manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, unless otherwise indicated.

B. Tendons:

1. Uncoated, 7 wire stress relieved strand complying with ASTM A 416. Use grade 250 unless Grade 270 is required by design and has been indicated on shop drawings.

2. Strand similar to the above, but having the size and ultimate strength of wires increased so that the ultimate strength of the strand is increased approximately 15%, or strand with increased strength but with fewer number of wires per strand, may be used at the manufacturer's option.

C. Steel Wire: ASTM A 82, plain, cold-drawn, steel.

D. Welded Wire Fabric: ASTM A 185.

E. Deformed Welded Wire Fabric: ASTM A 497.

F. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations.

2.3 CONCRETE AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III: Use only one brand and type of cement throughout project, unless otherwise acceptable to Architect.

B. Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source. Local aggregates not complying with ASTM C 33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to Engineer.

C. Water: Potable and free from foreign materials in amounts harmful to concrete and embedded steel.

D. Air-Entraining Admixture: Not Required.

E. Water-Reducing Admixture: ASTM C 494, Type A. Types B, C, D or E may be used, subject to the Architect's approval.

F. Calcium Cloride, chloride ions or other salts are not permitted.

G. Cement Grout: Portland cement, ASTM C 150, Type 1, and clean, natural sand, ASTM C 404. Maximum ratio of 3.0 parts sand to 1.0 part cement, by volume, or as required to attain specified strength. Grout mix requires verification indicated in Submittals section.

2.4 RELATED MATERIALS

A. Steel Shapes: ASTM A 36.

B. Bearing Pads: Provide bearing pads for precast hollow slab units in accordance with manufacturer's recommendations and as indicated. Bearing pads shall not stain or leach to adjacent construction.

1. Plastic: Multi-monomer plastic strips, non leaching, and shall support construction loads with no visible overall expansion. Korolath or equal reviewed by Architect.
2. Frictionless Pads: Terrafluorethylene (TFE), with glass fiber reinforcing as required for service load bearing stress.
3. Tempered Hardboard Pads: PS 58, smooth both sides.

C. Accessories: Provide clips, hangers, weld plates, embedded items, anchor rods and other accessories required for installation of project units and for supports of subsequent construction or finishes.

2.5 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type of concrete required.

B. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.

C. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. Use material, including all admixtures, proposed for use on the project.

D. Produce standard-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:

1. Compressive strength: 5,000 psi minimum at 28 days.
2. Release strength for prestressed units: 3,500 psi minimum or per PCI requirements (which ever is more stringent).

E. Cure compression test cylinders using same methods as used for precast concrete work.

F. Admixtures:

1. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's acceptance.
2. Use amount as recommended by admixture manufacturer for conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.6 FABRICATION:

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of the PCI Manual referenced above and as specified for types of units required.

B. Plant-Mix Concrete: Comply with requirements of ASTM C 94, and as modified below:

1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.

C. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorage where they do not affect position of main reinforcement or placing of concrete. Do not relocate bearing plates in units unless acceptable to Architect.

D. Holes and Openings: Cast holes and/or openings for openings larger than 10" diameter or 10" square in accordance with final shop drawings, and where otherwise noted. Smaller holes will be field cut by trades requiring them, as acceptable to Architect & MEP. Planks shall be designed to allow cutting of strands anticipated with this requirement.

E. Form Coating: Coat surfaces of forms with bond breaking compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bound with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

F. Surface Preparation: Clean reinforcement of loose rust and mill scale, earth and other materials which reduce or destroy bond with concrete.

G. Reinforcement:

1. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations.
2. Locate and support reinforcing with chairs, runners, bolsters, spacers and hangers, as required.
3. Place reinforcement to obtain the specified coverages for concrete protection.
4. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
5. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

H. Tendon Pretensioning: Pretensioning of tendons for prestressed concrete may be accomplished either by single strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.

I. Concrete Placement: Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

J. Plank Surface Finish:

1. Bottom and top surface of planks: Provide a primer ready smooth finish, clean of debris, honey combining, imperfections, oils and other foreign materials.

K. Identification: Provide permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface which will not show in finished structure.

L. Concrete Curing: Curing by low-pressure steam, steam vapor, radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.

M. Detensioning: Delay detensioning of prestressed units until concrete has attained at least 70% of design stress or per PCI requirements, as established by test cylinders.

1. If concrete has been heat-cured, perform detensioning while concrete is still warm and moist, to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.
2. Detensioning of pretensioned tendons may be accomplished either by gradual release of tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

N. Finish of Formed Surfaces: Provide finishes for formed surfaces or precast concrete as indicated for each type of unit, and as follows:

1. Standard Finish: Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.
2. Finish of Unformed Surfaces: Apply trowel finish to unformed surfaces unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish. Apply scratch finish to precast units which will receive a topping after installation. Following initial strikeoff, transversely scarify surface to provide ridges approximately 1/4" deep.

a. Provide non-slip finish for stair treads and landings. Coordinate finish with Architect.

O. Adequately reinforce slab units to resist transporting and handling stresses.

P. Provide headers of structural steel shapes for openings larger than one slab width in accordance with hollow slab unit manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Bearing Pads: Install bearing pads where indicated, as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.

B. Welding:

1. Perform welding in compliance with AWS D 1.1, including qualification of welders.

2. Protect units from damage by field welding or cutting operations and provide noncombustible shield as required.

C. Damaged Coated Surfaces: Repair damaged coating surfaces by cleaning and applying a coat of liquid galvanizing repair compound to galvanized surfaces and compatible primer and paint to painted surfaces.

D. Powder-Actuated Fasteners and Field Installed Mechanical Fasteners: Powder-actuated fasteners and field installed mechanical fasteners may be used for surface (top or bottom) attachment of accessory items in precast, prestressed unit. Precast manufacturer shall provide guidance documentation to Contractor indicating special instructions for the use of these fasteners in the field.

E. Installation Tolerances:

1. Tolerances shall be verified at time of erection, and prior to joint grouting or attachment of permanent connections.
2. Replacement or correction of structural precast members, fabricated and supplied out of tolerance shall be the responsibility of the Fabricator, and at the Fabricator's expense in a manner that shall not inhibit the progress of the project.
3. Tolerances not indicated within shall comply with PCI's "Tolerance Manual for Precast and Prestressed Concrete Construction", MNL-135.
4. Install precast units without exceeding following tolerance limits at time of or following erection:

    a. Camber: Deviation from theoretical level line at supports (positive indicates upward camber):

        1) Maximum Camber: 1" or the span length divided by 360 (least value applies)
        2) Minimum Camber: -1/4"

    b. Variations from Level or Elevation: 1/4" in any 20' run; 1/2" in any 40' run; total plus or minus 1/2" at any location.
    c. Variation from Position in Plan: Plus or minus 1/4" maximum at any location.
    d. Offsets in alignment of Adjacent Members at Any Joint: 1/16" in any 10' run; 1/4" maximum.

F. Temporary Shoring and Bracing: This is the sole responsibility of the Contractor. Provide temporary shoring and bracing members with connections of sufficient strength to support imposed construction loads. Contractor shall provide all shoring necessary to erect precast plank on steel supporting structure. Contractor shall employ the services of a Specialty Engineer Registered in the State of Maine to design such shoring. Shoring design shall account for all construction loads, unbalanced loading, torsional loading and temporary lateral effects on the steel frame and precast concrete elements. The design shall account for all loadings until such time that the construction is completed. Comply with OSHA Standard referenced previous.

G. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:

1. Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. For Girder Slab construction, break out cores and dam per the manufacturer's recommendations. Alternatively, core openings and dams may be provided in the plant.
2. Provide reinforcement in joints were indicated.
3. Pack spaces with grout material consolidating until voids are completely filled.
4. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces.
5. Keep grouted joints damp and warm for not less than 7 days after initial set.
6. Promptly remove grout material from exposed surfaces before it hardens.
7. Grout shall attain the specified 28-day strength prior to application superimposed loads including topping for the Girder Slab System.

3.2 PLANT QUALITY CONTROL EVALUATIONS DURING FABRICATION:

A. Fabricator Requirements:

1. Fabricator is responsible to provide testing to indicate compliance of plank materials and tensioning stresses with manufacturing requirements. Any plank not meeting the requirements of manufacturer shall be repaired or replaced at no cost to the Owner.
2. Fabricator must be an active producer member of the Prestressed Concrete Institute (PCI) and participate in its Plant Certification Program.

B. The Owner reserves the option to employ a separate testing laboratory to evaluate precast manufacturer's quality control and testing methods.

1. The precast manufacturer shall allow Owner's testing facility access to materials storage areas, concrete production equipment, and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
2. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits will be subject to additional testing as herein specified.
3. Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. Repair or remove and replace rejected units as required to meet construction conditions.
4. Strength of Units: The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following conditions:
5. Failure to meet compressive strength tests requirements.
6. Reinforcement, and pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.
7. Concrete curing, and protection of precast units against extremes in temperature, not as specified.
8. Precast units damaged during handling and erection.
9. Testing Precast Units: When there is evidence that strength of precast concrete units does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C 42 and as follows:

a. Take at least 3 representative cores from precast units of suspect strength, from locations directed by Architect.
b. Test cores in a saturated-surface-dry condition per ACI 318 if concrete will be wet during use of completed structure.
c. Test cores in an air-dry condition per ACI 318 if concrete will be dry during use of completed structure.
d. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85% of 28-day design compressive strength.
e. Test results will be made in writing on same day that test is made, with copies to Architect, Contractor, and precast manufacturer. Include in test reports the project identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, name, and type of member or members represented by core tests, design compressive strength compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of bearing.

10. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.
11. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerance, and finishes, shall be replaced with precast concrete units that meet requirements of this section. Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

3.3 FIELD QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. Testing Agency/Project Special Inspector shall verify reinforcement (WWF or reinforcing bar), including joint reinforcement. Agent shall verify reinforcement has been chair/placed with proper clearances.

B. The Owner shall employ a Testing Laboratory to inspect, sample and test the materials and the production of grout and to submit test reports. Testing shall be performed by technicians certified by the Maine Concrete Technician Certification Board and/or ACI concrete field testing technician Grade I.

C. Grout shall be sampled and tested for quality control during placement. Quality control testing shall include the following, unless otherwise directed by the Architect.

D. See Submittals section for report requirements.

E. Sample fresh Grout: ASTM C-172, except modified slump to comply with ASTM C-94

F. Slump: ASTM C-143: One test for each grout load at point of discharge and one test for each set of compressive strength specimens.

G. Air Content: ASTM C-173: volumetric method or ASTM C-231 pressure method, one for each set of compressive strength specimens.

H. Temperature: For each load, at time of arrival at point of discharge.

I. Compression Test Specimens: ASTM C-31: one set of four cylinders. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

J. Compressive Strength Tests: ASTM C39; one set for each 5 cu. yds. or fraction thereof, of grout placed in any one day or for each 4,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, 1 specimen retained in reserve for later testing if required.

K. Refer to Section 03 30 00, “Cast-in-Place Concrete” for additional requirements. Substitute therein the word “grout” for the word “concrete.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other 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.

1.2 DESCRIPTION OF WORK:

A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.

B. Structural steel is that work defined in AISC “Code of Standard Practice” and as otherwise shown on drawings.

1.3 RELATED WORK

A. Section 053000 - Metal Deck

B. Section 055000 - Metal Fabrications

1.4 QUALITY ASSURANCE:

A. Codes and Standards: Comply with latest provisions of the following, except as otherwise indicated:

1. AISC “Code of Standard Practice for Steel Buildings and Bridges”, Latest Edition.

    a. Exclude the word “structural” in reference to the “Design Drawings” in section 3.1 of the Code.

2. AISC “Specification for Structural Steel Buildings”, including “Commentary” and Supplements issued thereto.
3. AISC “Specifications for Structural Joints using ASTM A 325 or A 490 Bolts” approved by the Research Council on Structural Connections of the Engineering Foundation.
4. AWS D1.1 - “Structural Welding Code” - Steel.

5. AWS D1.3 - "Structural Welding Code" - Sheet Steel.
6. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."
7. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. 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 D1.1 qualification tests and maintained a current certification. Current certification and/or continuity log shall be submitted and be available in the field.
2. If re-certification of welders is required, retesting will be the Contractor's responsibility.

C. Fabricator Qualifications: Fabricator must be a member of the American Institute of Steel Construction (AISC), be certified for SBD – Conventional Steel Building Structures, STD – Standard for Steel Building Structures. Fabricator shall be certified at time of bidding and for duration of project.

1.5 SUBMITTALS

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the

Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.

2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

I. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel certified mill reports for each grade of steel covering chemical and physical properties and yield strengths.
2. High-strength bolts (each type), including nuts and washers.
3. Structural steel primer paint (where applicable).
4. Structural steel top coat paint (where applicable). (Refer to Division 9)
5. AWS D1.1 Welder certifications.
6. Expansion/Adhesive Anchors (coordinate with section 03 30 00).

J. Fabricator's Quality Control Procedures: Fabricator shall submit their written procedural and quality control manuals, and evidence of periodic auditing of fabrication practices by an approved inspection Agency.

K. Fabricator's Certificate of Compliance: At completion of fabrication, fabricator shall submit a certificate of compliance stating that the work was performed in accordance with the construction documents.

L. Shop Drawings:

1. Shop Drawing Review: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.

a. Review of the shop drawings will be made for the size and arrangement of the members and strength of the connections. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings indicating all members, braced frames, moment frames and connections. Incomplete submittals will not be reviewed.

2. Connection Design: Submit design calculations prepared and stamped by a Professional Engineer registered in the State of Maine for all beam and column connections not tabulated in the AISC "Manual of Steel Construction" (ASD or LRFD). Submit design for all building braced frames and moment frames where applicable, as indicated on design drawings. Connection designs shall be submitted prior to or with the Shop Drawing Submittal.

a. Fabricator and Erector are responsible to provide connections that meet the requirements of AISC standards. All shop and field welds, bolts, plates and miscellaneous components required to provide complete connection assemblies shall be provided.
b. Unless indicated otherwise, simple shear connections shall be designed to support reactions indicated on the drawings. All connections shall have a minimum of 2 bolts rows in the line of force, and no connection capacity shall be less than 10 kips (unfactored).
c. Braced frame connections shall be designed utilizing the Uniform Force Method, for reactions indicated on the drawings, with a connection geometry that does not induce a moment on the connected beam or column.
d. To the greatest extent possible and where required herewithin, welds shall be designed and detailed to be installed downhand.
e. Column splices shall be designed and detailed per AISC standards. Column splices at braced frames shall be designed and detailed per AISC requirements and support forces indicated on the Drawings.

3. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of test conducted and test results.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place, in ample time to not delay work.

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

D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Steel materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Structural Steel Shapes, Plates and Bars (U.N.O): ASTM A 36 minimum, higher strength steel is acceptable.

B. Structural Steel Hot Rolled Wide Flange Shapes: ASTM A 992 Grade 50 (ASTM A572 Grade 50 with special requirements per AISC Technical Bulletin #3, dated March 1997)

C. Steel Tube: ASTM A 500, Grade B, Fy = 46 ksi.

D. Steel Pipe: ASTM A 53, Grade B.

E. The Girder-Slab System and D-Beam Girders shall be distributed and assembled by steel contractors authorized by Girder-Slab Technologies LLC of New Jersey, in conformance with its Design-Guide & Distribution requirements. Steel Contractor/Distributor contact information: 1-888-478-1100 or www.girder-slab.com.

1. The open web Dissymmetric Beam shall be fabricated from (ASTM A992/A572 Grade 50) standard steel wide flange sections with flat bar at top-flange and shall meet AISC standards (except for depth, tolerance ± 1/8”), unpainted unless specified. The open web Dissymmetric Beam can be specified to include camber. Cambering can be built in during assembly of the girder.
2. Precast prestressed concrete hollow core lab units (min. 5000 PSI) shall be in 4 or 8 foot widths and shall meet PCI standards and tolerances, 2” min. bearing unless specified otherwise. Open the top of each slab core for proper grout placements and inspection.
3. Reinforcing steel (ASTM A615 Grade 60) shall be placed through the Dissymmetric Beam web openings and into slab cores.
4. Cementitious grout (min. 4,000 PSI) shall be placed monolithically around and through the Dissymmetric Beam web openings and into slab cores filled solid for a minimum of 8”, level to the slab surface with 9/16” min. average thickness over the top-flange (exceptions may apply if using concrete topping). When concrete topping is used, attain specified strength of grout prior to placement.
5. The Girder-Slab System shall be constructed in accordance with Underwriters Laboratories Inc., Floor-Ceiling Assembly Design No. K912 in order to meet fire classification standards and ratings set forth by ICC codes.
6. The Distributor of the Girder-Slab System shall provide to the Project Owner (or its representative) a Girder-Slab Compliance Certificate for each project upon completion of system assembly and construction.
7. Comply with all applicable provisions of the following standards and codes:

    a. Girder-Slab Technologies LLC Design-Guide

b. American Institute of Steel Construction (AISC)
c. American Welding Society (AWS)
d. Precast Concrete Institute (PCI)
e. American Concrete Institute (ACI)
f. American Society of Testing and Materials (ASTM)
g. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory
h. International Code Council Inc. (ICC) – International Building Code
i. Other applicable codes and standards

F. Anchor Bolts: ASTM F1554, Grade 36 weldable steel, unless noted otherwise on drawings. Anchor rods that are to be exposed to weather, located in unheated enclosures, or in contact with pressure treated lumber shall be hot dipped galvanized. All anchor bolts shall be headed or double nutted. "J" or "L" type anchor bolts are not permitted. Unless otherwise noted, specified embedment it to top face of head or nut.

G. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts. Provide hexagonal heads and nuts for all connections.

H. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325 or ASTM A490. Refer to drawings for diameter.
2. Direct tension indicator washers or bolts may be used at Contractor's option.

I. Electrodes for Welding:

1. Minimum 70 ksi electrodes. Filler material shall meet the grouping requirements per AWS D1.1 Table 3.1 for matching strength of connected materials.
2. All filler metal used welding shall meet the following Charpy V-Notch (CVN) requirements.

a. 20 ft-lb at 0 degrees Fahrenheit unless noted otherwise.
b. 20 ft-lb at -20 degrees Fahrenheit and 40 ft-lb at 70 degrees Fahrenheit at all complete joint penetration (CJP) groove welds.

J. Structural Steel Coatings shall be as specified in the Structural Steel Coatings section of this specification, and as specified in Division 9.

K. Steel Coatings for Exterior Exposed Steel: Except where indicated to be primed and painted, Hot Dipped Galvanized per ASTM A123/A123M (latest edition). Galvanizing shall be applied in a manner to provide Class C faying surfaces for slip critical connections. See Structural Steel Coatings section for additional requirements for galvanizing and painting.

L. Non Shrink Cement-Based Grout: See Section 03 30 00

M. Drilled Anchors: Expansion and adhesive by HILTI, SIMPSON or POWERS/RAWL as indicated on the drawings.

2.2 FABRICATION:

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs and other defects.

B. Connections: Weld or bolt shop connections, as indicated.

1. Provide field bolted connections, except where welded connections or other connections are indicated.
2. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.

C. High-Strength Bolted Connection: Install high-strength threaded fasteners in accordance with AISC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts". Unless otherwise indicated, all bolted connections are to be tightened to the snug tight condition as defined by AISC.

D. Welded Construction: Comply with AWS Codes for procedures, appearance and quality of welds, and methods used in correcting welding work.

E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.

F. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

G. Weld Access Holes at Moment Connections:

1. Detailing and Fabrication of welded access holes for all welded moment connections shall meet the requirements of FEMA 350, "Recommended Seismic Design Criteria for New Steel Moment-Frame Buildings". This document is available at www.fema.gov.
2. Weld access hole fabrication details, including but not by limitation, cutting methods and smoothness shall meet the requirements of FEMA 353, "Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications". This document is available at www.fema.gov.

H. Fabricator, Erector and General Contractor shall coordinate safety requirements for the project, in accordance with OSHA Part 1926. Provide all necessary pieces and fabrications as required to safely erect and access the structure for the duration of project construction.

I. Camber, if any, is indicated on the drawings. Camber indicated is the required camber at time of erection. Contractor shall survey camber prior to placing metal deck.

2.3 STRUCTURAL STEEL COATINGS

A. Coordinate coating requirements with the Architect, and with Division 9 of the specifications.

B. To the greatest extent possible, structural steel coatings shall be shop applied.

C. Coordinate steel markings with coating system to eliminate “bleed through” on steel permanently exposed to view.

D. Galvanizing, priming and painting for structural steel permanently exposed to view shall meet the requirements of Section 10 of the Code of Standard Practice, “Architecturally Exposed Structural Steel”.

E. Provide venting/drainage holes in closed tubular members to be hot-dipped galvanized. Holes shall be provided in a location hidden from view in the final condition and in a manner that will not reduce the strength of the member. Hole locations shall be clearly indicated on the Shop Drawings and are subject to review by the Architect.

F. Follow manufacturer’s installation and safety instructions when applying coatings. Adhere to recoat time recommendations set forth by manufacturer.

G. General: Shop priming of structural steel is not required for heated, interior steel not exposed to view unless noted otherwise.

H. Steel which is to receive spray-on fireproofing shall not to be primed or painted, unless specified by the Architect. Coordinate steel coating requirements in pool area with Architect.

I. Coatings: All exterior steel and/or steel permanently exposed to view shall receive a coating. Unless noted otherwise, refer to Division 9 specifications for products and surface preparation requirements.

J. All roof screen steel, including fasteners, shall be hot dipped galvanized, unless noted otherwise on the Architectural Drawings. Complete all shop fabrication prior to galvanizing assemblies.

K. Unheated structural steel to be enclosed with architectural finishes, including but not by limitation, wall panel support girts, shall be primed with rust inhibitive alkyd primer, Tnemec Series 10 unless noted otherwise. Follow manufacturer’s instructions for surface preparation and application. Substitution shall be equal to the above specified products, and shall be submitted for review.

L. Steel Embedded in Concrete/Below Grade: Steel which is embedded in concrete, below grade/slab level, or as otherwise indicated on the drawings, shall be field painted with cold-applied asphalt emulsion complying with ASTM D 1187. Paint embedded areas only. Do not paint surfaces which are to be welded until welding is complete.

M. Field Touch-up: Touch-up all paint and galvanizing damage, including but not by limitation, damage caused during shipping, erection, construction damage, and field welded steel. See Division 9 specifications for additional requirements.

PART 3 - EXECUTION

3.1 ERECTION:

A. General: Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

B. Erection Procedures: Comply with "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

C. Surveys: Employ a Registered Land Surveyor to verify elevations of concrete bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect and Structural Engineer. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been approved by Structural Engineer of Record. Additional surveys required to verify out-of-alignment work and/or corrective work shall be performed at the contractor's expense.

D. Temporary Shoring and Bracing: This is the sole responsibility of the Contractor. Provide temporary shoring and bracing members with connections of sufficient strength to support imposed loads. Remove temporary members and connections when all permanent members are in place, and all final connections are made, including the floor and roof diaphragms. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Comply with OSHA Standard referenced previous. Retain the services of a Specialty Structural Engineer (Not the Engineer of Record) to design specialty shoring and bracing.

E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

1. 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.
2. Welding to anchor bolts for corrective measures is strictly prohibited without prior written approval from the Engineer.

F. Setting Plates and Base Plates:

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Refer to division 3 of the project Specifications for anchor bolt installation requirements in concrete.
2. Clean concrete bearing surfaces of bond-reducing materials. Clean bottom surface of setting and bearing plates.

3. Set loose and attached base plates for structural members on wedges or other adjusting devices.
4. Pack non-shrink grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

G. Concrete slabs that are part of elevated floors framing systems shall achieve 28-day design strength prior to the application of any superimposed loads such as curtain walls, masonry veneer, mechanical equipment and stairs. Additional testing beyond that specified in division 3 required to verify the concrete strength prior to application of superimposed loads shall be done at the Contractor's expense.

H. When installing expansion bolts or adhesive anchors, the contractor shall take measures to avoid drilling or cutting any existing reinforcement or damaging adjacent concrete. Holes shall be blown clean with compressed air and/or cleaned per manufacturer's recommendations prior to the installation of anchors.

I. Field Assembly:

1. Set structural frames accurately to lines and elevations indicated.
2. Align, adjust, level and plumb members of complete frame in to the tolerances indicated in the AISC Code of Standard Practice and in accordance with OSHA regulations.
3. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.
4. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
5. Splice members only where indicated and accepted on shop drawings.
6. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

J. Coat columns, base plates, and brace elements encased in concrete and/or below grade with cold-applied asphalt emulsion. Coordinate coating with concrete work.

K. Erection bolts: Remove erection bolts. On exposed welded construction and at all braced frame members fill holes with plug welds and grind smooth at exposed surface.

L. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as accepted by the Engineer of Record. Finish gas-cut sections equal to a sheared appearance when permitted.

M. Coating Damage: Touch up shop applied paint or galvanizing whenever damaged or bare. See "Coatings" sections for additional requirements.

N. Field Cut Beam Web Penetrations:

1. Field cut beam web penetrations are not permitted without written approval from the Structural Engineer.

2. Gas cutting torches are not permissible for cutting beam web penetrations without written approval from the Structural Engineer.
3. Beams with field cut beam web penetrations may require reinforcement, subject to the evaluation by the Structural Engineer.
4. The evaluation of field cut web penetrations by the Structural Engineers for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be compensated by the General Contractor or Design-Build Subcontractor.
5. The cost of executing field cut web penetrations and the associated beam reinforcement for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be paid for by the General Contractor or Design-Build Subcontractor.
6. Field cut beam web penetrations may not be permitted in certain locations, subject to the evaluation by the Structural Engineer.

O. Welders shall have current evidence of passing and maintaining the AWS D1.1 Qualifications test available in the field.

P. Welding electrodes, welding process, minimum preheat and interpass temperatures shall be in accordance with AISC and AWS specifications. Any structural steel damaged in welding shall be replaced.

Q. Field Welded Moment Connections:

1. Welding of Moment Connections shall meet the requirements of FEMA 353.
2. Backing materials for top and bottom flanges for field welded moment connections shall be removed, backgouge the weld root, and apply a reinforcing fillet weld.
3. Where top flange steel backing materials are utilized, the backing may be left in place. In this case, the backing material shall be welded with a reinforcing fillet weld.

3.2 QUALITY CONTROL:

A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.

1. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor’s quality control efforts in the field.

B. Testing: Owner shall engage an Independent Testing Agency to inspect all high-strength bolted and welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.

1. Testing agency shall conduct tests and state in each report which specific connections were examined or tested, whether the connections comply with requirements, and specifically state any deviations therefrom.

2. Contractor shall provide access for testing agency to places where structural steel work is being fabricated, produced or erected so that required inspection and testing can be accomplished. Testing agency may inspect structural steel at plant before shipment. The Engineer, however, reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

C. Inspection Requirements (to be performed by the Independent Testing Agency):

1. Bolted Connections: Inspect all bolted connections in accordance with procedures outlined in the AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts.
2. Snug Tight Bolted Connections:

    a. The inspector shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.
    b. If the inspector does not monitor the installation of bolts, he shall visually inspect the connection to determine that all plies of connected material have been drawn together and conduct tests on a sampling connection bolts to determine if they have been tightened to the snug tight condition. The test sample shall consist of 10% of the bolts in the connection, but not less than two bolts, selected at random. If more than 10% of the tested bolts fail the initial inspection, the engineer reserves the right to increase the number of bolts tested.

3. Slip Critical Bolted Connections:

    a. The inspector shall monitor the calibration of torquing equipment and the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.
    b. If the inspector does not monitor the calibration or installation procedures, he shall test all bolts in the affected connection using a manual torque wrench to assure that the required pretension has been reached.

4. Field Welded Connections: inspect and test during fabrication of structural steel assemblies, and during erection of structural steel all welded connections in accordance with procedures outline in AWS D1.1. Record types and location of defects found in work. Record work required and performed to correct deficiencies.

    a. Certify welders and conduct inspections and tests as required. Submit welder certifications to Engineer of Record. Perform visual inspection of all welds. Primary and secondary welds, including fillet welds, full penetration welds, and deck puddle welds, applied in the field and/or shop, shall be visually inspected.
    b. Welds deemed questionable by visual inspection shall receive non-destructive testing. In addition, all partial and full penetration welds, and any other welds indicated on the drawings are to receive non-destructive testing. Non-destructive testing methods include the following:

        1) Radiographic Inspection (RT): ASTM E 94 and ASTM E 142; minimum quality level "2-2T".

2) Ultrasonic Inspection (UT): ASTM E 164.
3) Magnetic Particle (MT) inspection procedures may be utilized at the inspectors discretion in addition to RT or UT inspection. MT procedures shall not replace RT or UT procedures without permission from the Structural Engineer.

c. All welds deemed unacceptable shall be repaired and retested at the Contractor's expense.

D. Inspector shall verify that all ferrules are removed when applicable and that metal deck is free of debris prior to concrete placement.

E. Testing and inspection reports shall be submitted to the Owner, Architect and Engineer within 48 hours of completion of each test or inspection.

F. Nonconforming Work: Contractor shall be responsible for correcting deficiencies in structural steel work which inspections laboratory test reports have indicated to be not in compliance with requirements. Additional tests and/or surveys shall be performed, at the Contractor's expense, as may be necessary to show compliance of corrected work. Any costs associated with the Engineer's review and disposition of faulty works shall be borne by the Contractor.

END OF SECTION

SECTION 053000 – METAL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other 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.

1.2 DESCRIPTION OF WORK

A. Extent of metal floor and roof deck is shown on the drawings and includes type C floor deck, roof deck, cell closures, end plates, metal lath column closures, welding washers and sump plates or pans.

1.3 RELATED WORK

A. Section 05 12 00 - Structural Steel

B. Section 05 50 00 - Metal Fabrications

1.4 QUALITY STANDARDS

A. Codes and Standards: Comply with provisions of the following codes and standards, except where more stringent requirements are indicated or specified:

1. AISI "Specification for the Design of Cold Formed Steel Structural Members”.
2. AWS D1.1 "Structural Welding Code" - Steel
3. AWS D1.3 "Structural Welding Code" - Sheet Steel
4. Steel Deck Institute (SDI) " Design Manual for Floor Decks and Roof Decks”.
5. “Code of Federal Regulations, Part 1926” per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Qualification of field welding: Qualify welding process and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."

1.5 SUBMITTALS

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become

corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

I. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

J. Shop Drawings:

1. Shop Drawing Review: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings.

a. Submit detailed drawings showing layout and types of deck panels, galvanizing, shop paint, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing, and all other accessories. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings. Incomplete submittals will not be reviewed.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Store materials to permit easy access for inspection and identification. Keep deck sheets off ground, using pallets, platforms, or other supports. Protect deck sheets and packaged materials from corrosion and deterioration.

C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. United Steel Deck
2. Wheeling Corrugating Co.
3. Epic Metals Corporation
4. Vulcraft

B. Materials:

1. Steel for Metal Deck Units:

a. Floor Deck Units: ASTM A1008, Grade C, D or ASTM A653, Structural Quality, grade 40 or higher
b. Roof Deck Units: ASTM A1008, Grade C, D, or E, or ASTM A653, Structural Quality, grade 33 or higher.

2. Miscellaneous Steel Shapes: ASTM A36 minimum.
3. Sheet metal Accessories: ASTM A526, commercial quality, galvanized.

C. Galvanizing: Conform to ASTM 924-94 with minimum coating class of G60 (Z180) as defined in ASTM A653-94.

D. Paint: Manufacturer's baked on, rust inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphate chemical treated.

E. Flexible closure Strips: Manufacturer standard vulcanized, closed-cell, synthetic rubber.

2.2 FABRICATION:

A. General: Form deck units in lengths to span 3 or more supports, unless otherwise noted on the drawings, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated. For roof deck units, provide deck configurations complying with SDI "Roof Deck Specifications," of metal thickness, depth and width as shown.

B. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6" wide.

C. Metal Closure Strips: Fabricate metal closure strips, cell closures, "Z" closures, column closures, pour stops, girder fillers and openings between decking and other construction, of not less than 0.045" min. (18 gage) sheet steel or as indicated on the drawings. Form to provide tight fitting closures at open ends of cells or flutes and sides of decking.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before permanently fastened. Deck shall be in full

contact with members parallel to ribs and attached as indicated. Do not stretch or contact side lap interlocks.

C. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.

D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

E. Coordinate and cooperate with the structural steel erector in locating decking bundles to prevent overloading of structural members.

F. Do not use decking units for storage or working platforms until permanently installed.

3.2 FASTENING:

A. Floor Deck: Fasten metal deck to supporting steel members as indicated on the Design Drawings: Each deck is to be fastened with a minimum of 5/8" diameter puddle welds spaced not more than 12" o.c. with a minimum of 2 welds per unit at each support. Secure deck units at 6” oc along brace lines, edge of building or at the edge of openings or deck discontinuity. Secure deck to each supporting member in ribs where sidelaps occur. Use welding washers where recommended by the deck manufacturer. Deck units shall bear over the ends of supports by a minimum of 1.5. Sidelaps: #10 Tek screws, 5/8” arc puddle welds or 1” long fillet welds, intervals not exceeding 36 inches. Crimped or button punched sidelaps are not permitted.

B. Roof Deck: Each deck is to be fastened with a minimum of 5/8" diameter puddle welds spaced in a 24/4 pattern (3N deck) or 36/7 pattern (1.5B deck) with a minimum of 2 welds per unit at each support if incomplete sheet is utilized. Where support is parallel to support, at edge of building, at brace lines, at edge of opening or deck discontinuity provide puddle welds at 6” o.c. Secure deck to each supporting member in ribs where sidelaps occur. Deck units shall bear over the ends of supports by a minimum of 1.5”. Sidelaps: #10 Tek screws, 6 per span.

C. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

D. Uplift loading: Floor deck units are not required to resist uplift loads. Decking units used at the roof level shall be designed for a net uplift of 15 psf.

E. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.

F. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.

G. Touch-Up Painting:

1. Painted Deck: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

    a. Touch up painted surfaces with same type paint used on adjacent surfaces.
    b. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.3 QUALITY CONTROL:

A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.

B. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor’s quality control efforts in the field.

C. Testing: Owner shall engage an Independent Testing Agency to inspect all puddle welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.

D. Deck Testing Requirements (to be performed by the Independent Testing Agency):

1. Deck and accessory welding and/or attachments subject to inspection and testing. Work found to be defective will be removed and replaced at the Contractor's expense.
2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. If re-certification of welders is required, re-testing will be the Contractor's responsibility.

END OF SECTION

SECTION 054000 - EXTERIOR COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other 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.

1.2 DESCRIPTION OF THE WORK

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

1. Provide and install steel stud structural framing system at exterior walls, including all tile siding support structure, as noted on the Drawings.
2. Providing and installing miscellaneous fasteners, hat channels, stiffeners, bridging, expansion joints, and accessories necessary to complete the work.

B. Related work specified elsewhere:

1. Interior Partition Walls: Division 9
2. Exterior Gypsum Sheathing: Division 9

1.3 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, “Specification for the Design of Cold-Formed Steel Structural Members”.
2. AWS D1.1 "Structural Welding Code" - Steel.
3. AWS D1.3 "Structural Welding Code" - Sheet Steel.
4. ASTM C 954, Standard specification for steel drill screws for the application of gypsum board or metal plaster bases to steel studs from 0.033 in. to 0.112 in. thickness.
5. ASTM C 955, Standard Specification for Load-Bearing Steel Studs, Runners, and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.

6. ASTM C 1007 Standard Specification for installation of load bearing steel studs and related accessories.
7. Standard Specification for installation of load bearing steel studs and related accessories.
8. ASCE 7-05 "Minimum Design Loads for Building and Other Structures."
9. International Building Code, 2009 Edition
10. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Maximum Allowable Deflections: Deflection limitations, (either horizontal or vertical), include the effect of studs only, not sheathing or facing material. Spans are measured in inches between the attachments to structural steel or concrete.

1. Supporting Siding: 1/360 of span

C. Design wind pressures: Design wind pressures calculated in accordance with ASCE 7, 2005 Edition for Components and Cladding, shall be used in the design of the exterior cold formed steel framing system. Utilize wind speed, importance factor and exposure indicated on the project General Notes.

D. Deflection Clip / 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 3/4" Live Load. Where light gage framing is supported by girts, and not foundation walls, allow for ¾" Live Load + 1 ¼" Dead Load (girt) deflection (2" total).

1.4 SUBMITTALS

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

I. 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
2. Anchors and anchor bolts
3. Self drilling screws

J. Shop Drawings:

1. Shop Drawing Review: Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.
2. General: Submit shop drawings showing the following:

a. Stud gages and spacings.
b. Sizes, gages and fastenings for all built-up members including but not limited to headers and jambs.
c. Shop Coatings
d. Type, size, quantity, locations and spacings of all anchorages and self drilling screws.
e. Details of attachment to structure and adjacent work
f. Tile siding support structure.
g. Supplemental strapping, bracing, splices, bridging, hat channels and other accessories required for proper installation.
h. Critical installation procedures.

3. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
4. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings. Incomplete submittals will not be reviewed.

K. Design calculations shall be prepared by a Professional Engineer (Specialty Engineer) registered in the State of Maine, illustrating the design of exterior steel stud wall systems including all all necessary stiffeners and bracing connections and anchorage required for a complete structural system.

L. The Specialty Engineer shall design the support and attachments of siding elements, such that siding self weight is supported and pull out loads under wind or seismic loads will not be exceeded. Coordinate this design with siding specifications.

M. Professional Engineer responsible for design of cold formed framing shall review the installation and submit a correspondence indicating compliance with the design. Review shall include all work. Any discrepancies noted shall be corrected and reviewed by the Engineer prior to the submittal of the correspondence.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchorage devices, which are to be embedded in cast-in-place, in ample time to not delay work.

C. Store materials to permit easy access for inspection and identification. Keep cold formed members off ground, using pallets, platforms, or other supports. Protect cold formed members and packaged materials from corrosion and deterioration.

D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 FRAMING MEMBERS

A. Steel Studs:

1. Acceptable manufacturers: Manufacturer shall be a member of the Steel Stud Manufacturers Association.
2. Minimum stud shall be 6", 18 gage with 1.625" flange at siding.
3. Maximum Spacing: 16 inches, on-center.
4. Minimum studs indicated have not been engineered, but are provided as a general guideline. Engineering of studs is the responsibility of the Specialty Design Engineer referenced in the Submittals Section, and not the Engineer of Record nor the Architect of Record. Any exterior stud size, gage, spacing, bracing and connection information shown on the Contract Documents is schematic only. The Contractor shall provide the studs and built-up sections, engineered by the Specialty Engineer. If studs of a thicker gage or lesser spacing are required by the Specialty Engineer's design, the studs shall be provided at no additional cost to the Owner.
5. Provide channel-shaped load-bearing studs, channel-shaped joists, runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, stiffeners, fasteners, and other accessories recommended by manufacturer for complete framing system
6. Steel framing materials shall comply with ASTM A 446, A 570, or A 611, as applicable. Fabricate all components from structural quality sheet steel with the following minimum yield points:

    a. 16 ga. and heavier 50,000 psi
    b. 18 ga., 33,000 psi
    c. 20 ga., 33,000 psi (permitted for bottom track only).

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

B. Screws and other attachment devices:

1. Provide a protective cadmium or zinc plated coating 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.

C. Standard Steel Shapes: Standard steel shapes, plates, etc. shall conform to material and finish specifications in Division 5 -Miscellaneous Metals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Product Storage: Store studs, 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: 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. Provide blocking and strapping within 12” of slip joint and at 8’-0” o.c., or as required for member bracing.

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.

E. Anchorage to Structure: Securely anchor studs and track to floor construction and overhead structure. Provide fasteners at a maximum of 16” on center. Provide slip joints where non-bearing vertical studs meet floor or roof structural steel, or as indicated on the drawings. Provide sill sealer beneath all floor tracks.

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. Lintels: Lintels supporting masonry veneer shall be secured to studs by screws or power-driven anchors. Method of anchorage shall be sufficient to support veneer with a factor of safety of 3.0.

I. Bridging/Bracing: Provide horizontal strap bracing for all walls. Minimum requirements are as follows: Horizontal bracing shall be continuous 20 gage x 1 1/2" wide steel straps on each face of the stud, located at 4’-0” maximum for the full height of the wall. Provide CR runner solid bridging at 8’-0” for the full height of the wall at each line of bracing. An additional row of bracing shall be provide within 12 inches of the slip joint.

J. Tolerances: Finished installation shall be level and plumb within a tolerance of 1/8 inch in 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 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work included under this Section includes, but is not limited to, providing all labor, materials, equipment, and incidentals to conduct and complete the Work related to the planned building, parking, structures, lawn areas, utilities and site improvements as specified herein and shown on the Drawings.

1. Excavate all materials, including soil, boulders, abandoned utilities, existing and previous building foundations, pavements, curbs, granite blocks, and all other materials as necessary to construct the building improvements shown on the Drawings, and as specified in the Geotechnical Report prepared by S.W. Cole Engineering, Inc.
2. The CONTRACTOR shall be solely responsible for impacts and damage to structures due to his/her work, and for corrective action or repairs needed to restore the structure(s) to its original condition at no additional cost to the OWNER. Where structures are adversely affected by construction operations, they shall be repaired, restored and replaced in accordance with the requirements outlined herein.
3. The CONTRACTOR shall note that over-excavation, site preparation and placement of fill is required. Contractor shall conduct work per recommendations of the geotechnical report prepared by S.W. Cole Engineering, Inc.
4. Geotechnical investigations of the site have noted the presence of debris, including ash, glass, and metal. Contractor shall excavate, backfill, and prepare soils in accordance with recommendations of Geotechnical Report prepared by S.W. Cole Engineering, Inc.
5. Handle, process, re-handle, segregate, and stockpile materials during the course of the Work. Existing on-site materials may require processing prior to reuse. Processing may include crushing, blending, screening, and other measures to meet the requirements herein and as directed by the ENGINEER. Only those soils and other materials approved by the ENGINEER shall be reused on-site.
6. Prepare, grade, shape, compact and protect all subgrades, backfills, and ground surfaces shown on the Drawings.
7. Dewater as necessary to enable construction of site improvements, including backfilling, in-the-dry. The CONTRACTOR shall be responsible for control, pumping, and legal disposal of groundwater, precipitation, or other water which enters or accumulates in excavations to maintain stable subgrades and allow all below-grade construction to be conducted in-the-dry.
8. Provide, place, moisture condition, compact, and grade fill, backfill and other materials to the horizontal and vertical limits to construct the proposed site improvements and achieve the lines and grades as shown on the Drawings.
9. Place plastic separators, vapor barriers, mudmats, and geotextiles as necessary and as specified in Geotechnical Report.
10. Install foundation drainage system elements at the locations shown on the Drawings.

11. Preserve and protect existing structures and utilities and new site improvements during the course of the Work.
12. Manage and legally dispose off-site all excess excavated materials, including, but not limited to, soil, rock, boulders, water, demolition waste, and debris that cannot be reused on-site. Contractor shall note the presence of debris and ash detected in boring logs. Contractor shall provide testing of soils as necessary for disposal per local, state, and federal regulations.
13. Obtain, maintain and pay for all required permits, licenses, and approvals prior to commencing the Work of this and other related Sections.
14. Provide and install erosion control during the Work as indicated on the Drawings, as required in the Specifications, and in accordance with applicable regulations and permits.
15. The CONTRACTOR shall be solely responsible for impacts and damage to any existing structures due to their Work, and for corrective action or repairs needed to restore the structure(s) to original condition at no additional cost to the OWNER.
16. Complete required compaction tests and provide minimum thicknesses of gravel under pavement and slabs, and reach minimum required compaction values.
17. Furnish and place all additional fill as required to complete work for contract.
18. Removal of all unsuitable material from site.
19. Removal of all abandoned utility lines incidental to work.
20. Contractor shall protect existing utilities, with special consideration of the CMP duct bank located on site. Refer to Duct Bank Engineering plans prepared by Gagnon Engineers.

1.2 RELATED REFERENCES

A. Specification Sections:

1. Selective Site Demolition: Section 02 41 13
2. Dewatering: Section 31 23 19
3. Erosion and Sedimentation Control: Section 31 25 13

B. State of Maine Department of Transportation “Standard Specifications – Revision of December 2002”

C. State of Maine Department of Transportation “Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Revisions of December 2002”

D. Manual of Accident Prevention in Construction - Associated General Contractors of America, Inc.

E. 29 CFR 1926/1910 - OSHA Safety and Health Standards for Construction Industry

F. Standard Specifications for Highways and Bridges - Maine Department of Transportation, current edition

G. Geotechnical Investigation, prepared by S.W. Cole Engineering, Inc., see attachment.

1.3 PROTECTION

A. Paved Surfaces: Do not operate equipment that will cause damage on paved surfaces. Any damage to existing roads or other paved surfaces caused by construction equipment shall be repaired at no additional cost to OWNER.

B. Maintain excavations with approved barricades, lights, and signs to protect life and property until excavation is filled and graded to a condition acceptable to the PROJECT ARCHITECT and ENGINEER.

C. Protect structures, utilities, property monuments, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. The CONTRACTOR shall be responsible for actual cost of repair or replacement of any items damaged as a result of construction activities, including any professional services required for inspection of repairs and replacement.

1.4 QUALITY ASSURANCE

A. Testing and Inspection: OWNER shall be responsible for all testing, unless otherwise noted. The cost for retesting due to failed tests shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall be responsible for coordinating with PROJECT ARCHITECT and ENGINEER to allow for testing to be performed at the frequencies specified. A minimum of 48 hours notice for in-place testing shall be given to allow proper scheduling by ENGINEER.

B. The ENGINEER will observe the CONTRACTOR'S earthwork activities, including excavation, dewatering, subgrade preparation, backfilling and on-site reuse of excavated materials. The Contractor shall provide sufficient notice to the ENGINEER to allow the ENGINEER to be present to observe the Work.

C. The ENGINEER will conduct field and laboratory density testing of placed and compacted soils to confirm compliance with the requirements of this Section. Field and laboratory density testing will be conducted in general conformance with ASTM or other applicable reference standards. The CONTRACTOR shall cooperate with the ENGINEER in all respects to facilitate any testing or observations.

D. The CONTRACTOR shall not place or compact any fill, prepare subgrades or place concrete on bearing surfaces unless the ENGINEER is present to observe the Work. Materials placed and/or compacted which do not conform to project specifications for the area, shall be removed and replaced with appropriate, suitable material when directed by the OWNER or the ENGINEER at no additional cost to the OWNER. Costs related to testing or replacement of nonconforming Work or materials, and/or delays caused by nonconforming Work or materials, shall be paid for by the CONTRACTOR at no additional cost to the OWNER.

E. The presence of the ENGINEER shall not relieve the CONTRACTOR of its responsibility to perform the Work in accordance with the Contract Documents, nor shall it be construed to relieve the CONTRACTOR from full responsibility for the means and methods of construction, protection of site improvements against damage, and for safety on the construction site. The CONTRACTOR shall comply with all applicable laws, rules, ordinances and regulations of the

Federal Government, the State of Maine, and the City of Portland, governing the transportation, storage, handling and use of explosives. All labor, materials, equipment and services necessary to make the blasting operations comply with such requirements shall be provided without additional cost to the Owner.

F. The CONTRACTOR shall adhere to the applicable requirements of the specifications, OSHA Standards and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section.

G. The CONTRACTOR may conduct additional field and laboratory testing or screening tests for its own information at no additional cost to the OWNER.

H. In case of conflict between regulations or between regulations and Specifications, the CONTRACTOR shall comply with the strictest applicable codes, regulations, or Specifications.

1.5 JOB AND SUBSURFACE CONDITIONS

A. Site Information: A geotechnical investigation was completed for this project. A copy of the report and associated borings is attached to these specifications.

B. The CONTRACTOR may make his own borings, hand probes, explorations, and observations to determine soil, water levels, and other subsurface conditions at no additional cost to OWNER. Coordinate with OWNER prior to start of additional investigative work.

C. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations. Coordinate with utility companies for actual locations and shut-off services. If utilities are encountered that are not shown or that are shown incorrectly on the Drawings, notify PROJECT ARCHITECT immediately. Repair damaged utilities to satisfaction of PROJECT ARCHITECT and utility.

1.6 SUBMITTALS

A. Excavation and Backfilling

1. A narrative and drawings (plans and elevations at 1 in.= 40 ft scale) describing the schedule, construction sequence and procedures for excavation, subgrade preparations, foundation construction, cold weather subgrade protection, backfilling, dewatering, soil handling, stockpiling and other related activities.
2. Details of proposed backfill materials and equipment.
3. Proposed types and sources of all off-site fill materials, including topsoil. For each type of soil to be utilized as fill or backfill, the CONTRACTOR shall deliver on 50-lb. bag sample from each borrow source or supplier to the ENGINEER’S laboratory for review and laboratory testing. Do not import any material to the site unless accepted by the ENGINEER. With each sample provide the following documentation:

    a. Location of the borrow source site.

b. Present and past usage of the source site material.
c. All previously existing report(s) associated with an assessment of the source site as related to the presence of oil or hazardous materials.
d. If materials are suspected of containing oil and/or hazardous materials based on the ENGINEER'S review of the submitted data described above, the CONTRACTOR shall submit the following chemical test data on the material. The cost of any required testing shall be borne entirely by the CONTRACTOR. The ENGINEER will review the data and determine its acceptability for use on site.

4. For use of filter fabrics and foundation drain piping, submit manufacturer's literature for approval by the ENGINEER.
5. Details regarding proposed dewatering procedures including general approach to dewatering; equipment; pumping locations; discharge locations; means for preventing the pumping of fines from subgrade soils; means for controlling suspended solids in effluent.

1.7 LINES, GRADES AND TOLERANCES

A. The CONTRACTOR shall be responsible for establishing all lines, grades and other survey control to complete the Work as shown on the Drawings.

B. Maintain the moisture content of backfill materials as necessary to allow for the material to be readily placed to the degree of compaction specified herein.

C. Construct finished soil and backfill surfaces to the elevations indicated on the Drawings.

D. Compact backfill materials to the specified degree of compaction.

PART 2 - MATERIALS

2.1 MATERIALS

A. General: All materials utilized for this Project shall be obtained from a source that has been licensed or permitted for such use by local and state authorities. The CONTRACTOR shall be required to submit evidence of such if so requested.

1. Suitable materials: Suitable soil materials are defined as those complying with ASTM D2487 soil classification groups GW, SM, SW, and SP, or as required by Geotechnical Report.
2. Unsuitable materials: Materials containing excessive amounts of water, blue clay, vegetation, organic matter, debris, pavement, stones or boulders over 6-inches in greatest dimension, frozen material, and material which, in the opinion of the ENGINEER, will not provide a suitable foundation or subgrade.
3. On-Site Material: Any suitable material from on-site excavation.
4. Material for embankments and general site fills may contain pieces of excavated ledge having a greatest dimension of up to 6-inches, unless otherwise approved by ENGINEER.

5. Inspection: The ENGINEER may inspect off-site sources of materials and order tests of these materials to verify compliance with these Specifications.
6. Sieve Analysis: Submit sieve analysis in accordance with ASTM D422 for all materials prior to start of construction.

B. Gravel/Aggregate Base: Hard, durable gravel equal to MDOT 703.06 Type A or Type B material as specified on the drawings. Sieve analyses by weight:

Type A Aggregate Base

Sieve Size	% Passing by Weight
2"	100
1/2"	45 - 70
1/4"	30 – 55
No. 40	0 – 20
No. 200	

Type B Aggregate Base

Sieve Size	% Passing by Weight
4"	100
1/2"	35 - 75
1/4"	25 – 60
No. 40	0 – 25

Sieve Size	% Passing by Weight
1/4"	25 – 70
No. 40	0 – 30

C. Structural Fill: Clean, non-frost susceptible, sand and gravel, free of organics and other deleterious materials, meeting the following gradation:

Sieve Size	% Passing by Weight
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
No. 40	0 to 30

D. 3/4" Crushed Stone: Durable, clean angular rock fragments obtained by breaking and crushing rock material. Gradation shall be:

Sieve Size	% Passing by Weight
1"	100
3/4"	90 – 100
3/8"	20 – 55
No. 4	0 – 10

E. Sand: Sand shall be well-graded coarse sand without excessive fines and free from loam, clay, and organic matter. Beach sand shall not be used. The grading requirements are as follows:

Sieve Size	% Passing by Weight
3/8"	100
No. 4	95 – 100
No. 16	50 – 85
No. 50	10 – 30

F. Fabric Protection Layer: As specified on the Contract Plans.

PART 3 - EXECUTION

3.1 GENERAL

A. CONTRACTOR shall coordinate all activities with the City of Portland and the OWNER. If sidewalk closures or parking restrictions are necessary to complete the work, CONTRACTOR shall be responsible for obtaining approval and permits from City of Portland as well as paying any associated fees.

3.2 EXCAVATION

A. General: Excavation shall include the removal of all encountered materials, including but not limited to, soil, boulders, asphalt pavement, concrete (reinforced and unreinforced), miscellaneous debris, buried and abandoned foundations and utilities, site improvements, incidental structures and all other materials encountered to the limits shown on the Drawings, or designated in the Specifications. Where excavations are required to be made into the Zone of Influence (ZOI) below an existing or new foundation, utility or other structure, CONTRACTOR shall be responsible for having excavation and bracing system, underpinning, or other system designed by Professional Engineer licensed in the State of Maine to: 1) provide support to protect the soil within the ZOI from loosening and becoming disturbed, and 2) protect the structure from movement. The ZOI beneath a structure or utility is defined by imaginary lines extending outward 2 ft laterally beyond the bottom edge of a footing or from the springline of a utility and down on a one horizontal to one vertical (1H:1V) slope to the top of the natural inorganic bearing soils. Soils located within the zone of influence provide foundation support. Excavation and backfilling shall be performed in the day.

B. Call Dig Safe prior to beginning any excavation.

C. Rock Excavation includes removal and disposal of materials and obstructions encountered that cannot be excavated with modern, track-mounted, heavy-duty excavating equipment without drilling, blasting, or ripping; includes boulders larger than 2 cubic yards each.

D. Do not perform rock excavation or excavation of unsuitable materials until material to be excavated has been cross-sectioned and classified by ENGINEER.

E. Earth Excavation: Remove and dispose of obstructions visible on ground surface, underground structures, utilities, and items indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation.

F. Excavation in Paved Areas: Cut pavement prior to excavation to provide a clean, uniform edge. Minimize disturbance of remaining pavement. Cut and remove the minimum amount of pavement required to do the Work. Use shoring and bracing where sides of excavation will not stand without undermining pavement.

G. Excavation for Structures: Over-excavate, handle, process, segregate, and stockpile soils per recommendations of Geotechnical Report prepared by S.W. Cole. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Use shoring and bracing as required by OSHA standards.

H. Excavation for Utility Trenches: Excavate to widths shown on the Drawings and depths indicated or required to establish indicated slope and invert elevations. Produce an evenly graded, flat trench bottom at the subgrade elevation required for installation of pipe and bedding material. Place backfill material directly into trench or excavation. Do not stockpile material to be used as backfill along edges of trenches. Load excavated material directly into trucks, unless otherwise permitted by the ENGINEER.

I. Unauthorized Excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of PROJECT ARCHITECT. Unauthorized excavation, as well as remedial work directed by PROJECT ARCHITECT, including refilling, shall be at CONTRACTOR's expense.

J. Refilling Unauthorized Excavation: For trenches, use 3/4-inch crushed stone. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by PROJECT ARCHITECT.

K. Excavation of Unsuitable Materials: When excavation has reached required subgrade elevations, notify PROJECT ARCHITECT and ENGINEER who will make an inspection of conditions. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper only at the direction of the PROJECT ARCHITECT and ENGINEER and replace excavated material as specified.

L. Material Storage: Stockpile and maintain suitable surplus excavated materials for re-use as backfill within the Project limits, as directed by PROJECT ARCHITECT and ENGINEER. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations.

3.3 BLASTING

A. General: CONTRACTOR shall obtain approval of OWNER, PROJECT ARCHITECT, and City of Portland before blasting.

B. Pre-blast Survey shall be the responsibility of the CONTRACTOR. Provide pre-blast survey prior to any blasting or blasting related operations. A written report of the preblast survey will be provided to the OWNER and PROJECT ARCHITECT by the CONTRACTOR and will be available for review by the City of Portland. A copy of the blasting plan will be submitted to the City of Portland, OWNER and PROJECT ARCHITECT for review and approval prior to the initiation of the site preparation work.

C. All owners of dwellings or residences located within 500-feet of the blasting location shall be notified, in writing, by the CONTRACTOR a minimum of 30 days prior to the scheduled blasting date about the proposed blasting and how to request a pre-blast survey. Upon request, the CONTRACTOR shall determine the pre-blasting condition of any structure located within this area and prepare a written report. The pre-blast survey shall be limited to the surface conditions of the structures but shall comply in all respects with 30 CFR, Chapter VII, Section 816.62.

1. Pre-blast Survey shall include, but not be limited to:

    a. Video tape of each structure within 500-feet of the blasting location to show pre-blast conditions. Highlight existing defects in structures and pavements. Provide some means of establishing scale of existing defects (i.e., include tape measure or folding ruler at defect during video taping).
    b. Video taping shall be done with commercial grade equipment to allow equipment still viewing without distortion of the viewed area.
    c. Still photos and videotapes shall be retained by the pre-blast surveyor and shall be available for viewing by the OWNER and PROJECT ARCHITECT within 24 hours upon request.

2. A blasting plan shall be prepared which addresses:

    a. Airblast Limits
    b. Ground Vibrations
    c. Maximum Peak Particle Velocity

3. The blasting plan shall meet criteria established in Chapter 3 (Control of Adverse Effects) in the Blasting Guidance Manual of the United States Department of the Interior Office of Surface Mining Reclamation and Enforcement.
4. Provisions and measures to monitor and assure compliance with the blasting plan.
5. The blasting plan and preblast survey shall conform to all recommendations of the project geotechnical report and supplemental geotechnical evaluations included in these Specifications.

D. Particle Velocities: Maximum allowable peak particle velocity shall be limited to 1.25 inches per second within 300 feet of the blast site. Monitor at location designated by OWNER.

E. Documentation: Submit an accurate record of the blasting operation to the PROJECT ARCHITECT. A copy should be retained by the blasting firm for at least 3 years. This record shall consist of the following information as listed in 30 CFR, Chapter VII, Section 816.68.

1. Name of the firm conducting the blast.

2. Location, date, and time of the blast.
3. Name, signature, and certification number of the blaster conducting the blast.
4. Identification, direction, and distance, in feet, from the nearest blast hole to the nearest dwelling, public building, school, church, community or institutional building outside the project area.
5. Weather conditions, including those that may cause possible adverse blasting effects.
6. Type of material blasted.
7. Sketches of the blast pattern including number of holes, burden, spacing, decks, and delay pattern.
8. Diameter and depth of holes.
9. Types and total weight of explosives used.
10. Mats or other protections used.
11. Seismographic and airblast records, which shall include: type of instrument, sensitivity, and calibration signal or certification of annual calibration; exact location of instrument and the date, time, and distance from the blast; and the vibration and/or airblast level recorded.

F. All blasting shall be performed in accordance with all pertinent provisions of the "Manual of Accident Prevention in Construction", issued by the Associated General Contractors of America, Inc., of the "Construction Safety Rules and Regulations", as adopted by the State Board of Construction Safety, Augusta, Maine, and the Maine Department of Transportation "Standard Specifications" Section 105.2.6, Use of Explosives. Blasting through the overburden will not be allowed.

G. Drilling Equipment will be equipped with suitable dust control apparatus that must be kept in repair and used during all drilling operations.

H. Open Blasting shall pertain to all blasting required for the placement of foundations and other project elements not specifically identified in paragraph H, Utility Trench Blasting. Blasting for placement of underdrain piping and associated appurtenances depicted along building footings will be considered Open Blasting.

I. Utility Trench Blasting shall pertain to all blasting required for the placement of any pipe, utility structure, or associated appurtenances. Utilities associated with the site shall include water distribution and service, sanitary sewer collection and service, storm sewer collection, underground electrical service, telecommunications, data, and geothermal related elements, as indicated on the drawings.

3.4 STABILITY OF EXCAVATIONS

A. General: Slope sides of excavations shall comply with OSHA Regulations and Local Codes. Shore and brace where sloping is not possible due to space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling. Shoring and bracing shall be designed by a Professional Engineer licensed in the State of Maine.

3.5 DEWATERING

A. General: Perform all Work in the dry. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

B. Do not allow water to accumulate in excavations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey water removed from excavations and rainwater to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

D. CONTRACTOR shall obtain necessary licenses from the City of Portland Public Services prior to directing dewatering into the City's combined sewer infrastructure.

3.6 SUBGRADE PREPARATION

A. General

1. Care shall be taken to avoid disturbance to subgrades.
2. Provide a firm, smooth, stable, undisturbed subgrade as judged by the ENGINEER. Loose, disturbed soil shall be removed by hand shovel.
3. Subgrades consisting of cohesive soils shall not be "backbladed" or compacted to prepare a smooth surface.
4. Subgrades shall be prepared as recommended in the attached geotechnical report prepared by S.W. Cole.
5. Movement of construction equipment directly over exposed final subgrades, except for compaction equipment, shall not be permitted.
6. The exposed subgrade will be examined in the field by the ENGINEER to observe the strength and bearing capacity of the soils. Disturbed or soft or unstable soils, as judged by the ENGINEER, shall be excavated and replaced with lean concrete, granular fill, or other acceptable materials at no additional cost to the Owner.
7. Prevent soil subgrades from freezing and frost. Soil subgrades that freeze prior to concrete or backfill placement shall be thawed and recompacted, or removed and replaced with non-frozen backfill, lean concrete or other acceptable material as directed by the PROJECT ARCHITECT.
8. Excavations shall not undermine existing foundations, streets, sidewalks, or structures.

B. Contaminated material shall be identified and disposed of per local, state, and federal regulations.

3.7 BACKFILL AND FILL

A. General: Place suitable soil material in layers to required elevations as shown on the Drawings. Fill, backfill, and compact to produce minimum subsequent settlement of the material and provide adequate support for the surface treatment or structure to be placed on the material.

Place material in approximately horizontal layers of beginning at lowest area to be filled. Do not impair drainage.

B. Placement: Place backfill and fill materials in layers not more than 12-inches in loose depth for material compacted by heavy compaction equipment, and not more than 9-inches in loose depth for material compacted by hand-operated tampers. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

1. Place backfill and fill materials evenly adjacent to structures to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
2. Do not allow heavy machinery within 5 feet of structure during backfilling and compacting.

C. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including dampproofing, and/or waterproofing.
2. Inspection, approval and recording locations of underground utilities.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with suitable materials.
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
7. Backfill cast-in-place concrete structures when the concrete has developed adequate strength.
8. Use care in backfilling to avoid damage or displacement of underground structures and pipe.

D. Backfilling Trenches: See Trench Detail on the Drawings.

1. Bed pipe in 3/4-inch crushed stone, unless otherwise indicated. Limits of bedding and requirements for remaining trench backfill shown on Drawings.

E. Replacement of Unsuitable Materials:

1. Below normal grade: See paragraph 3.2 J.
2. Above normal grade: Replace unsuitable material with suitable material from on-site. All excess suitable material must be used before additional material from off-site is used.

3.8 COMPACTION

A. Methods: Use methods which produce the required degree of compaction throughout the entire depth of material placed without damage to new or existing facilities and which are approved by the ENGINEER. Adjust moisture content of soil as required. Remove and replace material that is too wet to compact to required density. Compact each horizontal layer of fill and slope as Work progresses.

B. Degree of Compaction: Compact to the following minimum densities:

FILL AND BACKFILL LOCATION	DENSITY
Under structure foundations and slab on grade	95% of max.
Top 3 feet under pavement	95%
Below top 3 feet under pavement	92%
Structural fills	95%
Pipe Bedding	95%

1. Maximum density: ASTM D1557.
2. Field density tests: ASTM D1556 (sand cone) or ASTM D2167 (rubber balloon), or ASTM D2922 (nuclear methods).

C. Testing: In-place densities using field tests will be determined by the ENGINEER. Perform additional work to obtain proper compaction if in-place densities do not meet specified densities at no additional cast to the OWNER.

D. Protection of Fill

1. The CONTRACTOR shall take the necessary steps to avoid disturbance of subgrade and underlying soils during excavation and backfilling operations. Procedures for excavating and backfilling shall be revised as necessary to avoid disturbance of subgrade and underlying soils, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering, and other acceptable control measures. Disturbance shall include the deterioration of backfill (after placement and satisfactory compaction) due to the Contractor's operations, such as moving equipment, hauling trucks, etc. All excavated or backfilled areas or subgrades that become disturbed during construction shall be removed and replaced with acceptable materials.
2. Prevent materials below constructed foundations from freezing. Materials that become frozen shall be removed and replaced, including foundations, at no additional cost to the OWNER.
3. At the completion of Work, all ground surfaces shall be left in a firm, stable, unyielding, reasonably uniform condition, free of ruts and surface irregularities, in accordance with grading requirements shown on the Drawings.

3.9 GRADING

A. Grading: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish surface within specified tolerances and compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Structure Lines: Grade areas adjacent to structure to drain away from structures and to prevent ponding.

C. Finish surfaces free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.
2. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
3. Fill Under Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.

D. Compaction: After grading, compact subgrade surfaces as required.

3.10 EROSION CONTROL

A. Provide erosion control measures as specified in Section 31 25 13 and as shown on Drawings.

3.11 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during warranty period; remove surface, add backfill material, compact, and replace surface. Restore appearance, quality, and condition of surface to match adjacent work, and eliminate evidence of restoration work to greatest extent possible.

3.12 DISPOSAL OF EXCESS MATERIALS

A. Remove excess excavated material and dispose of it off-site in a lawful manner, unless otherwise directed by ENGINEER.

END OF SECTION 312000

SECTION 312001 - CU-SOIL STRUCTURAL SOIL

PART 1 - GENERAL

1.1 DESCRIPTION

A. This item includes all work required to furnish and place CU-Soil (a structural soil) to the depths and locations shown on the plans or as directed by the Engineer. This structural soil is an aggregate/soil/tackifier hydrogel mixture designed to meet engineering requirements for proctor density and CBR values to support pavement, while allowing better drainage and increased soil volume, supportive of tree growth. Work shall cover all costs for spreading, rough grading, and fine grading of the structural soil.

1.2 RELATED SECTIONS

A. Section 32 93 00 TREE & SHRUB PLANTING

1.3 SUBMITTALS:

A. Action Submittals:

1. Shop Drawings: Product labels/data sheets.
2. Proof of product license.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The structural soil shall conform with "CU-Soil" as patented by Cornell University, Patent #5,849,069. CU-Soil is a mixture of crushed stone, clay loam and Hydrogel, which is a potassium propenoate-propenamide colpolymer. Licensed products include the following:

1. Frank Paolangeli, Ithaca, New York; (607) 273-8139; Cell: (607) 279-0315
2. Sultana Sand & Stone, Inc., Brooktondale, New York; (607) 539-7868; Contact: Mr. Kim Whetzel.
3. East Coast Mine, Quogue, NY
4. Tully Environmental Co. d/b/a Evergreen Recycling of Corona, NY
5. Ascape Landscape, New City, NY

B. The CU-Soil mix shall have a moisture content of 10% (AASHTO T-99 optimum moisture).

C. The pH of the material shall be between 5.5 and 6.0.

D. Gradation: The structural soil material shall consist of three components mixed in the following proportions by weight:

1. Crushed Stone: 100 parts
2. Clay Loam: 20 parts
3. Hydrogel: 0.03 parts

E. Crushed Stone shall be granite or sandstone (no limestone shall be used) and shall be narrowly graded from 19 mm to 38 mm, highly angular with no fines and in the following proportions:

Sieve Size	Percent Passing by Weight
38 mm	90 to 100
25 mm	20 to 55
20 mm	10

F. Clay loam shall meet the following requirements:

1. Not less than 25% or more than 30% of the clay loam by weight shall be sand. 100% of the sand fraction shall pass the 2 mm sieve and 100% shall be retained by the 50 um sieve.
2. Not less than 20% or more than 40% of the clay loam by weight shall be silt. The particle size distribution for the silt shall be 2 um to 50 um.
3. Not less than 25% or more than 40% of the clay loam by weight shall be clay. The particle size distribution for the clay shall include all particles smaller than 2 um.
4. Not less than 2.75% or more than 5% of the clay loam by weight shall be decayed organic matter (humus) as determined by ASTM F-1647. If organic amendments are needed to obtain the specific organic matter content of the topsoil, the organic matter source shall be peat, composted leaves (leaf mold) or other approved organic amendments. Peat shall be sphagnum peat having ash content not exceeding 15%, as determined by ASTM D-2974. Leaf mold must be substantially free of sticks, stones, roots, plastic, glass, metal, and other debris. One hundred (100%) percent of the leaf mold must pass a 0.5 inch screen. The leaf mold chemical analysis shall conform to the following:

    a. The soluble salt content (conductivity) must be less than 150 MHOS per cubic meter for a 1:5 leaf mold to water ratio.
    b. The pH shall not exceed 6.8.
    c. The carbon/nitrogen ratio shall fall between 12:1 and 25:1.

G. The Hydrogel/Wetting Agent shall be potassium propenoate-propenamide copolymer hydrogel such as:

1. Gelscape, Amereq Corporation, NY
2. Soilmoist, JRM Chemical Inc., Cleveland, OH
3. Supersorb, Aquatrols Corporation, Cherry Hill, NY
4. Or Approved Equal.

PART 3 - EXECUTION

3.1 SITE QUALITY CONTROL

A. Do not proceed with the installation of the CU-Soil material until all walls, curb footings and utility work in the area have been installed. Confirm that the sub-grade is at the proper elevation and compacted as required. Sub-grade elevations shall slope parallel to the finished grade.

B. Clear the excavation of all construction debris, trash, rubble and any foreign materials. In the event that fuels, oils, concrete, washout silts or other material harmful to plants have been spilled into the sub-grade material, excavate the soil sufficiently to remove the harmful material. Fill any over excavation with approved fill and compact to the required sub-grade compaction.

C. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use ½" plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.

D. Do not deliver or place soils in frozen, wet, or muddy conditions. Material shall be delivered at or near optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698). Protect soils and mixes from absorbing excess water and from erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter the site prior to compaction. If water is introduced into the material after grading, allow material to drain or acrate to optimum compaction moisture content.

3.2 PLACEMENT

A. The structural soil shall be placed to the line and grade shown on the plans or as directed by the Engineer.

1. Install CU-Soil in 6-inch lifts and compact each lift. Compact all materials to 90 95% compaction from a standard AASHTO Compaction Curve (AASHTO T 99).
2. No placement or compaction shall occur when moisture content exceeds 2 percent above the optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698).
3. Protect CU-Soil during delays in compaction with plastic or plywood as directed by the Engineer.
4. Field tested permeability shall be within 0.5 and 1.0 inches per hour.

B. After the initial placement and rough grading of the CU-Soil, but prior to the start of the fine grading, the contractor shall request the review of the rough grading by the Engineer. The Engineer reserves the right to conduct infiltration/permeability testing prior to continuance of work.

C. The Contractor shall set sufficient grade stakes for checking the final grades. Adjust the finish grades to meet field conditions as directed. Fill all dips and remove any bumps in the overall plane of the slope.

D. All fine grading shall be inspected and approved by the Engineer prior to the installation of other items to be placed on the CU-Soil.

END OF SECTION 312001

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide, install, and maintain all necessary material and equipment used to keep excavation free of standing or flowing water and to transport water to a suitable discharge point.

B. Provide measures to dispose of water in accordance with all local, state and federal regulations, including the City's Industrial Pretreatment Program. Notify the City of Portland Public Services Department prior to conducting dewatering operations.

1.2 REFERENCES

A. Specification Sections:

1. Selective Site Demolition: Section 02 41 13
2. Earth Moving: Section 31 20 00
3. Erosion and Sedimentation Control: Section 31 25 13
4. Utilities: Division 33

1.3 SUBMITTALS

A. At least 2 weeks prior to the start of construction in any areas of anticipated dewatering, submit to the PROJECT ARCHITECT and City of Portland Public Services Department, a written plan for removal, storage, treatment, and disposal of groundwater from excavations. Do not proceed with construction in any of these areas until the plan has been reviewed and approved by the PROJECT ARCHITECT and City of Public Services Department.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION

3.1 DEWATERING EXCAVATIONS

A. Perform all work in the dry. Prevent surface water or groundwater from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations.

B. Provide and maintain pumps, well points, sumps, hoses, filters, and all other dewatering system components necessary to convey water away from excavations.

C. Minimize the suspended solids content in the water by lining the excavation collection area with crushed stone and placing the pump intake in a perforated bucket.

D. Convey water removed from excavations to a frac tank. Do not use trench excavations as temporary drainage ditches. Do not allow silt laden water to discharge to gutters or storm drainage system. Do not discharge water directly to the storm, sanitary or combined sewer.

E. Any damages to existing facilities or new work resulting from the failure of the CONTRACTOR to maintain the work areas in a dry condition shall be repaired by the CONTRACTOR, as directed by the ENGINEER, at no additional expense to the OWNER. Pumping shall be continuous where specified or directed or as necessary to protect the work and to maintain satisfactory progress.

F. Onsite recharge of dewatering effluent shall not be allowed unless otherwise approved by the City of Portland and ENGINEER.

3.2 STORAGE/TREATMENT/DISCHARGE PROCESS

A. Water removed from excavations shall be stored in a frac tank to allow settling of solids and testing prior to discharge. The dewatering pump line shall be placed at the opposite end from the tank outlet.

B. Limit circulating tank contents to prevent freezing. Do not discharge from the tank while the circulation pump is operating to allow adequate settling time before discharge.

C. If needed for additional storage and treatment volume, provide a second tank to be placed in series for secondary settlement. Transfer the water from the first tank to the second tank by suspending the intake line immediately below the water level to minimize disturbance of sediment at the bottom of the tank.

D. Prior to discharge of the initial tank load, the CONTRACTOR must collect a water sample for laboratory analysis of the parameters identified with an “X” in the lists appended within this specification using the methods identified within the list. The CONTRACTOR must provide the test results to the PROJECT ARCHITECT and City of Portland Environmental Engineering Department. The City will use these test results to develop a baseline for testing of future frac tank loads. All future frac tank loads shall be required to be tested in accordance to the baseline developed by these initial analyses.

E. Both the City and the PROJECT ARCHITECT must provide approval prior to discharge.

F. The CONTRACTOR must provide access to the tanks for the City of Portland Public Services Department to take independent water samples. Do not add water or other materials to the frac tank after collecting the water sample.

G. Managing and treating water determined to have contaminant levels exceeding the City’s Industrial Pretreatment Program limits shall be in accordance with local, state, and federal regulations.

H. The CONTRACTOR shall work with the City of Portland to identify any other contaminants exceeding the Industrial Pretreatment Program discharge limits. The City of Portland may provide recommended treatment methods for water found to exceed the City of Portland's Industrial Pretreatment Program discharge limitations.

I. Follow direction provided by the City of Portland Public Services Department on further testing and disposal requirements.

J. Obtain all local, state, and federal approvals necessary for the discharge of the water. If water is discharged to the combined or sanitary sewer, bag filters must be installed on the discharge piping and water must meet the City of Portland's Industrial Pretreatment Program discharge limitations.

K. The City of Portland and/or the Portland Water District reserve the right to stop the CONTRACTOR from discharging flow to the combined sewer system during periods of time when the Combined Sewer Overflow (CSO) is or has the potential to be active.

L. Cease discharge immediately upon discovery, through testing or other means that discharge is not in compliance with the requirements of local, state or federal regulations or permits. Additional costs from delays in work due to non-conformance with the requirements shall be borne by the CONTRACTOR at no additional cost to the OWNER.

3.3 DIVERSION OF WATER

A. The CONTRACTOR shall be responsible for providing and maintaining all ditching, grading, sheeting, and bracing, pumping and appurtenant work for the protection from flooding as necessary to permit construction of work in the dry.

B. Upon completion of the contract work, the CONTRACTOR shall remove all temporary construction and shall do all necessary earthwork and grading to restore the areas disturbed to their original condition or to such other conditions as indicated or directed by the OWNER.

C. Water shall not be permitted to flow into or through excavations in which work is under way or has been partially completed. The CONTRACTOR shall not restrict or close off the natural flow of water in such a way that ponding or flooding will occur, and shall at all times prevent flooding of public and private property. All damages resulting from flooding or restriction of flows shall be the sole responsibility of the CONTRACTOR, at no additional expense to the OWNER.

City of Portland and Portland Water District Industrial Waste Report

Location:						**Sample Date:**		
Sample Type						**Sample Condition**		
Composite	**X**	**Grab**		**Discrete**		**Refrigerated**		
	ID No	**Parameter**	**Preservative**	**Method**	**Report Value**	**Duplicate % Recovery**	**Analysis Date**	**Analyst**
X	23	***pH* (Composite)**	Analysis (ASAP)	150.1				
X	1	***Caustic Alk.***	Refrigerate	310.1				
X	30	***TSS***	Refrigerate	160.2				
X	14	***Cadmium***	HNO3 to pH <2	200.7				
X	14	***Copper***	HNO3 to pH <2	200.7				
X	14	***Chromium***	HNO3 to pH <2	200.7				
X	14	***Lead***	HNO3 to pH <2	200.7				
X	14	***Nickel***	HNO3 to pH <2	200.7				
X	14	***Zinc***	HNO3 to pH <2	200.7				
X	32	***Silver***	HNO3 to pH <2	200.7				
X	54	***Mercury***	HNO3 to pH <2	245.1				
X	62	***Arsenic***	HNO3 to pH <2	206.2/200.7				

Person(s) Sampling:		**Community:**		**Location:**			
Type Of System:	Industrial	Combined	Sanitary	Storm			
Automatic Sampler Information:							
Date/Time Set:		Start Time:		Time Period:			
Time Interval:		Samples per Bottle:		No. of Bottles:			
Date/Time Pulled:		Comments:					
Grab Sample Information (including bottle size & type)							
Date/Time Pulled:				No. of Samples:			
1000 ml HDPE Amber		1000 ml Glass		950 ml Plastic			
Other Bottle Type:							
Relinquished by:		**Received by:**					
Reviewed for release by:				**Date:**			

City of Portland and Portland Water District Industrial Waste Report

Location:						**Sample Date:**		
Sample Type						**Sample Condition**		
Composite		**Grab**		**Discrete**				
	ID No	**Parameter**	**Preservative**	**Method**	**Report Value**	**Duplicate % Recovery**	**Analysis Date**	**Analyst**
X	56	***Tot. Cyanide* (Grab)**	NaOH to pH >12, Refrigerate	335.2				
Person(s) Sampling:			**Community:**			**Location:**		
Type Of System:		Industrial	Combined	Sanitary	Storm			
Automatic Sampler Information:								
Date/Time Set:		Start Time:		Time Period:				
Time Interval:		Samples per Bottle:		No. of Bottles:				
Date/Time Pulled:		Comments:						
Grab Sample Information (including bottle size & type)								
Date/Time Pulled:				No. of Samples:				
1000 ml HDPE Amber		1000 ml Glass		950 ml Plastic				
Other Bottle Type:								
Relinquished by:			**Received by:**					
Reviewed for release by:					**Date:**			

City of Portland and Portland Water District Industrial Waste Report

Location:						**Sample Date:**		
Sample Type						**Sample Condition**		
Composite		**Grab**		**Discrete**				
	ID No	**Parameter**	**Preservative**	**Method**	**Report Value**	**Duplicate % Recovery**	**Analysis Date**	**Analyst**
X	**1**	***pH***	Analyze (ASAP)	150.1				
		Caustic Alk.	Refrigerate	310.1				
Person(s) Sampling:				**Community:**		**Location:**		
Type Of System:		**Industrial**		**Combined**		**Sanitary**	**Storm**	
Automatic Sampler Information:								
Date/Time Set:			Start Time:			Time Period:		
Time Interval:			Samples per Bottle:			No. of Bottles:		
Date/Time Pulled:			Comments:					
Grab Sample Information (including bottle size & type)								
Date/Time Pulled:						No. of Samples:		
1000 ml HDPE Amber			1000 ml Glass			950 ml Plastic		
Other Bottle Type:								
Relinquished by:			**Received by:**					
Reviewed for release by:						**Date:**		

City of Portland and Portland Water District Industrial Waste Report

Location:						**Sample Date:**		
Sample Type						**Sample Condition**		
Composite		**Grab**	**X**	**Discrete**				
	ID No	**Parameter**	**Preservative**	**Method**	**Report Value**	**Duplicate % Recovery**	**Analysis Date**	**Analyst**
X		***FLASHPOINT* (Closed Cup)**	**None**					

Person(s) Sampling:		**Community:**	**Portland**	**Location:**			
Type Of System:	**X** Industrial	Combined	Sanitary	Storm			
Automatic Sampler Information:							
Date/Time Set:		Start Time:		Time Period:			
Time Interval:		Samples per Bottle:		No. of Bottles:			
Date/Time Pulled:		Comments:					
Grab Sample Information (including bottle size & type)							
Date/Time Pulled:				No. of Samples			
1000 ml HDPE Amber		1000 ml Glass		950 ml Plastic			
Other Bottle Type:							
Relinquished by:		**Received by:**					
Reviewed for release by:				**Date:**			

City of Portland and Portland Water District Industrial Waste Report

Location:						**Sample Date:**		
Sample Type						**Sample Condition**		
Composite		**Grab**		**Discrete**				
	ID No	**Parameter**	**Preservative**	**Method**	**Report Value**	**Duplicate % Recovery**	**Analysis Date**	
		PCB's and Pesticides		EPA 608				
		(GRO) Gasoline RangeOrganics		Me HETL 4.2.17				
		(DRO) Diesel RangeOrganics		Me HETL 4.1.25				
X		***Hydrocarbon (PAH Range)***		EPA 8015				
Person(s) Sampling:				**Community:**		**Location:**		
Type Of System:		**Industrial**	**Combined**	**Sanitary**	**Storm**			
Automatic Sampler Information:								
Date/Time Set:		Start Time:		Time Period:				
Time Interval:		Samples per Bottle:		No. of Bottles:				
Date/Time Pulled:		Comments:						
Grab Sample Information (including bottle size & type)								
Date/Time Pulled:				No. of Samples:				
1000 ml HDPE Amber		1000 ml Glass		950 ml Plastic				
Other Bottle Type:								
Relinquished by:			**Received by:**					
Reviewed for release by:					**Date:**			

END OF SECTION 312319

SECTION 312513 - EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide, inspect, and maintain devices to control erosion, siltation, sedimentation, and dust that occur during construction operations. Undertake every reasonable precaution and do whatever is necessary to avoid erosion of soil.

B. Furnish and install stabilized construction entrances, catch basin inlet sediment filters, and siltation fences as required.

C. Provide measures to control dust caused whether on or off the Project site.

D. Deficiencies in erosion control measures indicated by failures or erosion shall be immediately corrected by providing additional measures or different techniques to correct the situation and prevent subsequent erosion.

E. Exposure of soils on embankments, excavations, and graded areas shall be kept as short as possible. Initiate seeding and other erosion control practices as soon as reasonably possible.

1.2 QUALITY ASSURANCE

A. Conform to all requirements of applicable federal, state and local permits, and Contract Documents, and conform to the recommendations of the Standards (see Part D below) whether the measures are specifically noted herein, or not.

1.3 REFERENCES:

A. "Maine Erosion and Sedimentation Control BMPs" prepared by the Maine Department of Environmental Protection, most recent updated version.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use the following materials in construction of sediment traps, erosion control devices, and slope protection as specified on the DRAWINGS. Other materials require approval of the ENGINEER.

B. Siltation Fence: MIRAFI Silt Fence, Geotex Silt Fence, or approved equal.

C. Catch Basin Inlet Sediment Barrier: ACF Environmental, Inc. High Flow Siltsack® or approved equal.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION DEVICES

A. General: Provide the following devices to control erosion. Other devices require approval of the ENGINEER.

B. Silt Fence:

1. Install silt fence prior to any earthwork including grubbing.
2. Place where shown on Drawings or as directed by the ENGINEER. Install parallel to contours where possible, prior to site clearing and grading activities.
3. Bury lower edge of fabric at least 8 inches below ground surface to prevent underflow.
4. Curve ends of fence uphill to prevent flow around ends.
5. Inspect frequently; repair or replace any damaged sections.
6. Remove fence only when adequate grass catch has been established as determined by the ENGINEER.

C. Catch Basin Inlet Sediment Barrier: Install, check, and clean or replace per manufacturer's recommendations.

3.2 REMOVAL OF TEMPORARY EROSION CONTROL

A. Remove temporary materials and devices when permanent soil stabilization has been achieved. Re-use materials in good condition if approved by the ENGINEER.

B. Remove unsuitable materials from site and dispose of in a legal manner.

3.3 SUBGRADE PREPARATION

A. Grade and compact, where possible, areas to receive protection to a uniform slope. Allow for depth of protection stone layer.

3.4 MAINTENANCE

A. Inspect erosion control practices immediately after each rainfall and at least daily during prolonged rainfall or snowmelt for damage. Provide maintenance and make appropriate repairs

or replacement at no additional cost to the OWNER, until Project acceptance or as required to comply with maintenance requirements if longer.

B. Remove silt from silt fence when it has reached one foot above grade or prior to expected heavy runoff or siltation.

END OF SECTION 312513

SECTION 316329 - DRILLED CONCRETE PIERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

A. The drawings and general conditions of the contract, including General and Supplementary Conditions and other Division 1 Specification sections apply to the 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 other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

A. General

1. The Work covered by this Section, without limiting the generality thereof, consists of furnishing all plant, labor, equipment, appliances and material and performing all operations in connection with the installation of foundations to support column loads with rock socketed drilled piers as shown on the Drawings.
2. The Contractor shall include all Work necessary to maintain a stable excavation during drilling and concreting.

B. The work identified under this section shall include installing a temporary or permanent steel casing in order to provide an outer sleeve for drilling and pier construction.

C. The Contractor shall manage drill spoils generated from pier installation. Drill spoil solids will be removed from the site, and disposed of by the Contractor.

D. Work includes installation of reinforcing as shown on the drawings and placement of concrete (tremie method if water is present in excavation) from the bottom of each pier to top elevation.

E. The Contractor shall protect adjacent buildings, property, streets, public utilities and structures, and completed work, from damage associated with excavation operations.

F. Remnants of old utilities, foundations, walls, slabs, and other buried structures may exist within the site area and may be encountered during drilled pier excavation.

G. Prior to pier construction, determine location of utilities. Protect, maintain and/or relocate utilities interfering with pier construction pre drawing requirements.

H. Support and protect utilities if and as necessary. The Contractor shall be responsible for all damage to utilities caused by pier construction operations. Fully and promptly repair and/or restore all utilities which are damaged at no expense to the Owner, the City of Portland, or utility owner.

1.3 RELATED WORK:

A. Section 033000: Cast-in-Place Concrete

B. Division 31 Earthwork Specifications

1.4 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the latest edition of the following except where more stringent requirements are shown or specified

1. ACI “Manual of Concrete Practice”.
2. ACI 336.1 “Specification for the Construction of Drilled Piers”
3. ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials”.
4. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."
5. ACI 212.3R "Chemical Admixtures for Concrete."
6. ACI 301 "Specifications for Structural Concrete for Buildings.
7. ACI 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete."
8. ACI 304.2R "Placing Concrete by Pumping Methods."
9. ACI 306 R "Cold Weather Concreting."
10. ACI 309R "Guide for Consolidation of Concrete."
11. ACI 315 "ACI Detailing Manual."
12. ACI 318 "Building Code Requirements for Reinforced Concrete."
13. ACI 347R "Guide to Formwork for Concrete."
14. Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars."
15. “Code of Federal Regulations, Part 1926” per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Materials and installed work may require testing and retesting, as directed by the Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

C. Comply with all rules, regulations, laws and ordinances of the State of Maine, City of Portland and all other authorities having jurisdiction. All labor, materials, equipment and services necessary to make work comply with such requirements shall be provided without additional cost to Owner.

D. Field Monitoring and Testing

1. Full-time monitoring of the Work of this Section will be provided by the Owner. No Work shall be completed except in the presence of an authorized representative of the Owner.
2. The Owner will provide on-site monitoring of concrete placement. Concrete test cylinders will be taken by the Owner's Testing Agency during placement. The Contractor shall fully cooperate with the Owner's Testing Agency to facilitate obtaining and storing samples. See specification section 033000 for additional information.
3. Concrete volumes shall be measured to ensure that the volume of concrete placed in each pier is equal to or greater than the theoretical volume of the hole created by the auger.

E. Approvals given by the Owner's Representative or by testing agencies shall not relieve the Contractor of the responsibility for performing the Work in accordance with the Contract Documents.

1.5 JOB CONDITIONS:

A. Refer to the Geotechnical Report for subsurface data.

B. The Contractor shall protect adjacent property, public utilities and structures, and completed work, from damage associated with the foundation installation operations. Damage due to foundation installation shall be repaired by the Contractor at no additional cost to the Owner.

C. The Contractor shall be aware that cobbles and boulders could be encountered within the soil strata and shall develop appropriate means and methods to remove them from excavations if/when they are encountered.

1.6 LINES AND GRADES:

A. The Contractor shall stake the locations of the foundations 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 responsible for the maintenance and protection of the baseline and benchmark, and all location stakes.

B. The Contractor shall employ a Maine licensed Land Surveyor who shall establish lines and levels. The Contractor shall be responsible for the correct location of foundations and establishing actual locations. Locations of the centers of completed piers shall be shown on a drawing in relation to the design location and submitted to the Engineer and Owner's Representative within two days after completing the pier. Drawings certified by said Surveyor shall include the following:

1. Column lines and north arrow.
2. Each foundation element identified by a separate number.
3. Elevation of the foundation bearing surface to nearest 0.1 foot.
4. Deviation in inches, to the nearest one-half inch, from plan location at cutoff elevation.

1.7 SUBMITTALS:

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be submitted for review at least 3 weeks prior to the start of the Work.

D. All submittals shall be reviewed and returned within 10 working days.

E. Incomplete submittals will not be reviewed.

F. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.

G. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles

H. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.

I. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copy in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copy are received.
3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.

5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

J. Shop Drawings shall include plan layout (scale 1 in.= 10 feet.) of drilled piers, showing the proposed location, length, diameter, bottom elevation, and identification number for each individual unit.

K. Shop Drawings:

1. Shop Drawing Preparation: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings is prohibited. Shop drawings created from reproduced Construction Documents will be returned without review. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315, showing bar schedules, stirrup and tie spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete elements. Include supplemental reinforcing and bar supports necessary to support reinforcing steel at proper location within forms.

   a. Review of the shop drawings will be made for the size and arrangement of reinforcement. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
   b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided all items listed prior. Incomplete submittals will not be reviewed.

L. Mix designs: Submit all laboratory test reports and materials for each mix design listed in accordance with Spec. 030000 – Cast-in-Place Concrete. Prepare mixes by the field experience method and/or trial mixtures per the requirements of chapter 5 of ACI 318. Include the calculation of average strength and standard deviation. Proportioning by water cement ratio method will not be permitted.

M. The drilled pier installation contractor shall submit for review a list of at least five projects indicating relevant previous project experience. Experience shall emphasize rock drilling/coring for foundation units to similar sizes and depths as required in these Contract Documents. The submittal shall include project names, locations and a list of references for each project who can attest to the Contractor's performance on the project.

N. Submit procedures, layout, set up of drill spoil segregation and material handling facility, and procedures for disposal of drill spoils. Submittal shall include proposed drill spoil segregation operation and procedures for separating drill spoil solids from liquids.

O. Description of all equipment to be used for construction of the drilled piers, including staging areas, space requirements for operations, fabrication of reinforcing cages, and storage of materials.

P. Proposed Means and Methods (submit for information only, not for review):

1. Proposed method of continuous monitoring for plumbness and deviation of drilled piers during excavation and details of corrective measures to be implemented as required.
2. Contractor's proposed method of maintaining stability of excavated drilled piers when left open overnight.
3. Contractor's proposed method of cleaning the bottom of the drilled piers prior to tremie concreting, and verifying the depth of the pier.
4. Contractor's proposed method to remove obstructions that may be encountered at the drilled pier location.

Q. As-Built Records:

1. During drilled pier construction, the Contractor shall maintain and submit to the Owner's Representative as-built records of the Work. These as-builts shall contain, as a minimum, the following:

   a. Pier identification.
   b. Plan dimensions of the pier, and top and bottom elevations.
   c. Dates and times of pier excavation, bottom cleaning, reinforcing steel placement, tremie concreting, and volume of concrete placed.
   d. Description of soils encountered, description of obstructions and excavation problems, if any, and the time spent.
   e. Description of steel reinforcing, threaded inserts, variations from shop drawings, if any.
   f. Plumbness and deviation from plan location.

2. During drilled pier construction, any unusual conditions encountered shall be noted and reported to the Geotechnical Engineer and Structural Engineer immediately.

R. Test Reports: Test reports shall be submitted to the Owner, Architect and Engineer within 48 hour after completion of each test.

PART 2 - PRODUCTS

2.1 CONCRETE:

A. The design and testing of concrete mixes for use in drilled piers shall conform to the requirements of specification section 033000.

1. Minimum compressive strength of 5,000 psi at 28 days.
2. See specification section 033000 Cast-in-place Concrete for additional requirements.

2.2 REINFORCING MATERIALS:

A. Reinforcing bars shall be standard deformed steel reinforcing bars conforming to the requirements of ASTM A615, Grade 60.

PART 3 - EXECUTION

3.1 GENERAL:

A. Foundation elements shall be installed by a contractor specializing in the type of work described hereinafter, having experience on similar installations under similar soil, rock and groundwater conditions.

B. The Contractor shall provide a fully equipped excavation rig in full-time operation at the site during the Work, and shall mobilize additional equipment, if necessary, to complete the Work on schedule.

C. The Contractor shall coordinate foundation installation operations with other work on the project.

D. The Contractor shall protect adjacent property, utilities and structure, and completed Work from damage, including settlement due to loss of ground, associated with the foundation installation operations. Damage due to foundation installation shall be repaired by the Contractor at no additional cost to the Owner.

E. The foundation subcontractor is responsible for controlling the amount of dust and dirt created by the foundation installation process using whatever methods are most appropriate.

F. All foundations shall be installed at the proper locations as shown on the Drawings. Foundation locations shall be checked during installation and appropriate measures taken, as necessary, to maintain the correct location.

G. Where the installation process for any pier is interrupted or a loss of concrete pressure occurs, the pier shall be re-drilled to five feet below the elevation of the tip of the auger.

H. Augered cast-in-place piers shall not be installed within six pier diameters center-to-center of a pier filled with concrete less than 12 hours old.

I. If the concrete level in any completed pier drops due to installation of an adjacent pier, the pier shall be replaced.

J. Monitoring and evaluation of the foundation excavation at any stage will be made by the Owner’s Geotechnical Representative. The Contractor shall measure the depth to the bearing stratum at the request of the Owner’s Geotechnical Representative to determine compliance with the specification requirements. If it is the Owner’s Geotechnical Representative’s conclusion, based on visual observations or other methods, that the rock at the foundation bearing level is not capable of supporting the design load, the Owner’s Geotechnical

Representative will direct the Contractor to drill deeper. Foundations shall not be concreted until the hole has been evaluated and accepted by the Owner's Geotechnical Representative.

K. If, while drilling the foundations, the Contractor encounters an obstruction, the Owner's Representative shall be notified immediately. Obstructions will be defined as concrete, timber, logs and other man-placed material which prevent the advance of the foundation excavation. The Owner's Representative will require the Contractor to probe to locate the extent of the obstruction. After such probing, the Owner's Representative will direct the Contractor to remove the obstruction. Boulders or cobbles encountered in the naturally deposited soils shall not be considered obstructions.

3.2 DRILLED-IN PIER:

A. Rock-socketed drilled piers shall be installed at the lines and grades indicated on the Drawings. At selected locations as shown on the Drawings, the pier will be advanced a designated depth into the bedrock.

B. Drilled piers shall have a diameter equal to or greater than the minimum diameter shown on the Drawings or as specified hereinafter.

C. Piers shall be machine-drilled. The method of pier installation shall be determined by the Contractor, subject to the approval of the Owner's Representative. Pier installation shall be made by non-displacement methods such as augering, rotary drilling or other methods. The rock socket shall be formed by such methods as coring, rotary drilling or chiseling.

D. Drilling shall be made in such a manner to prevent loss of ground beyond the specified diameter. The drilling operation shall employ the use of a permanent or temporary casing. The casing shall extend a minimum depth of 2 ft. below the top of the rock.

3.3 ROCK SOCKET CONSTRUCTION:

A. Piers shall be drilled into the rock to depths as shown on the Drawings or as directed by the Owner's Representative.

B. Suitable rock is defined as hard to moderately hard, slightly weathered bedrock. Reference the Geotechnical Report for additional information.

3.4 PLACING REINFORCING STEEL AND CONCRETE:

A. Do not place steel or concrete until the drill hole has been evaluated by the Owner's Representative.

B. Maintain minimum three inch clearance between and sides of excavation and reinforcement.

C. Prior to placing concrete and reinforcing steel, the bottom of the pier shall be cleaned of all loose material using equipment designed for that purpose or similar equipment acceptable to the Owner's Representative.

D. Reinforcing steel assemblies shall be accurately located and securely held in place prior to and during the concreting. As the steel cage is lowered into the pier, suitable guides and spacers, such as concrete skids, shall be used. If the sides of the rock socket are disturbed during installation of the reinforcing steel such that loose rock fragments are found to have accumulated on the bottom of the pier, the Contractor shall re-clean the bottom of the excavation.

E. If the pier excavation is dry, concrete shall be place in accordance with specification section 030000. Concrete deposited from the top of the pier shall be poured in a rapid and continuous operation through a funnel hopper centered at the top of the pier. Concrete shall not be chuted directly into the pier.

F. If water is present in the pier excavation, concrete shall be placed by tremie pipes, either by gravity flow or by pumping, in such a manner that the concrete fills the pier progressing from the bottom, rising uniformly to the cutoff elevation and such that intermixing of the concrete and any accumulated water will not occur.

1. The tremie pipe shall be kept as close to the center of the pier as possible.
2. The tremie pipe shall be suitably made to prevent mixing of the concrete and any accumulated water and shall be of adequate size to permit the free flow of concrete. Initially, there shall be a suitable plug at the bottom of the tremie, which will not discharge concrete until the concrete head has at least reached the level of any accumulated water/fluid in the pier. Thereafter, a positive concrete head will be maintained throughout.
3. The bottom of the tremie pipe shall be embedded at least 5 ft into the concrete during placement, and this depth shall be maintained throughout the pour.

G. The concrete level during placement shall be kept essentially horizontal.

H. Concrete shall be placed in the drill pier hole within two hours after placement of reinforcing steel cage and shall proceed continuously until completion of the concreting. If foundations cannot be concreted the same day in which they are drilled, the reinforcing steel shall not be placed in the drill hole. Foundations that are not concreted within four hours after completion of drilling operation shall be re-cleaned prior to concreting.

I. Provide steel dowels as detailed or scheduled. Secure reinforcement, including dowels, in place, free of contact with sides of excavations.

J. Wet-setting of rebar or any other embedments into plastic concrete is prohibited. All items to be embedded into concrete shall be installed prior to placement of concrete. Provide additional reinforcements and/or templates as required to secure embedments at proper position.

K. All concrete for the piers shall be carefully placed so as to form a consolidated monolith to at least one foot above cut-off.

L. Concrete shall be placed in the presence of an approved testing agency.

M. Notify Engineer/Project Special Inspector 48 hours prior to scheduled placement and obtain approval or waiver of review prior to placement

3.5 IMPROPER INSTALLATION:

A. The cost of any and all changes due to improper installation shall be paid by the Contractor. This shall include additional services by the Owner's design team made necessary by such failure, as well as costs for labor and materials.

3.6 TOLERANCES AND CRITERIA FOR ACCEPTANCE:

A. Piers shall be accurately located. The center of pier at any level shall not be greater than D/10 from the design location, where D is the least diameter of the pier. Any deviation greater than 2 inches will require evaluation and possible replacement, to the satisfaction of the Engineer, at no additional cost to the Owner. At top of the drilled pier, pier center shall not deviate more than 2 inches from design center.

B. The foundation bearing surface shall be prepared in accordance with the criteria established herein.

3.7 FIELD AND QUALITY CONTROL:

A. Full-time monitoring of foundation installation operations will be provided by the Owner's Consultant employed by and paid for by the Owner. No foundations shall be installed except in the presence of an authorized representative of the Owner.

B. Approvals given by the Architect, Owner's Representative, Owner's Geotechnical Representative, Owner's Structural Engineer, or by testing agencies will not relieve the Contractor of the responsibility for performing the Work in accordance with the Contract Documents.

END OF SECTION

SECTION 316813 - ROCK FOUNDATION ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other 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.

1.2 DESCRIPTION OF WORK:

A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section and, without limiting the generality thereof, furnish and include the following:

1. This work consists of furnishing all labor, materials and equipment necessary to properly install and test rock anchors and accessories at locations shown on the Contract Drawings.
2. Work includes designing rock anchors to provide the required design load & lock-off load capacity, providing adequate bond length and stressing length to meet the requirements specified herein and shown on the Contract Drawings, providing materials and equipment for, and installing rock anchors to carry the design loads, prestressing all rock anchors, and testing rock anchors as specified herein.

1.3 RELATED WORK:

A. Section 033000: Cast-in-Place Concrete

B. Division 31 Earthwork Specifications

1.4 REFERENCES:

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein.

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

    a. A36 Standard Specification for Structural Steel
    b. A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless
    c. A722 Standard Specification for Uncoated High Strength Steel Bars for Prestressed Concrete
    d. C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
    e. C150 Standard Specification for Portland Cement

2. Post-Tensioning Institute (PTI):

    a. Recommendations for Prestressed Rock and Soil Anchors, Latest Issue

1.5 SUBMITTALS

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.

2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

I. Shop Drawings: Engineered shop drawings, stamped by a Professional Engineer licensed in the State of Maine, shall be submitted for review prior to proceeding with the work.

1. Shop drawings shall include, but not be limited to:

a. Rock Anchor Schedule giving:

1) Rock anchor number
2) Load for each rock anchor, including factor of safety
3) Lock-off load for each anchor
4) Type and size of rock anchor
5) Bonded length, and
6) Stressing length
7) Borehole diameter

b. A drawing of the rock anchor system and corrosion protection including:

1) Centralizers and their location
2) Anchorage, and
3) Anchorage, bonded length and stressing length corrosion protection system

c. Calculations: Design calculations shall be submitted for review. Design calculations shall include, but not limited to: tendon size, lock-off load, recommended design load factor of safety per Post-Tensioning Institute (PTI) Recommendations for Prestressed Rock and Soil Anchors, Latest Issue – [not less than 1.67], bonded length for each rock anchor based upon the allowable grout to rock bond stress given in the project geotechnical report, core size, and unbounded length.

2. The Contractor shall also submit the following information for review not less than 20 working days prior to the commencement of rock anchor installation:

    a. Prestressing steel bar manufacturer's mill test reports for the rock anchors.
    b. Applicable literature from cement grout suppliers giving details on setting times as a function of temperature, strength gain with time, and recommended storage, mixing and placement procedures.
    c. Applicable manufacturer certification and/or literature for anchorage fittings and accessories:
    d. Detailed description of the proposed procedures, including specific makes and models of equipment to be used for drilling, placing, grouting, and post-tensioning rock anchors.
    e. Detailed description of proposed procedures and applicable manufacturer's literature for the equipment to be used for testing rock anchors, including but not limited to the following:

        1) (1) The description shall include diagrams showing the arrangement of the testing equipment relative to the rock anchor and anchorage hardware, the method for locking-off the required transfer load, and calibration data for the system of jack and gauges.
        2) (2) The calibration of the testing equipment shall have been performed by a certified independent testing laboratory within 6 months of use on-site and shall be presented in the form of gauge pressure vs. actual jack force.

3. During grouting operations, the following data shall be recorded by the Contractor and submitted:

    a. Type of mixer and grout pump
    b. Type of grout
    c. Water/grout ratio
    d. Types of additives and their concentrations in mix
    e. Grout injection pressure
    f. Test sample strength
    g. Volume of grout placed

4. The Contractor shall also submit a report to the Construction Manager within 20 working days after completion of the rock anchor work. The report shall contain as-built drawings showing the locations of the rock anchors, total rock anchor lengths, stressing lengths and bonded lengths.
5. A manufacturer's Material Safety Data Sheet (MSDS) must be submitted, when applicable.

1.6 QUALITY ASSURANCE

A. The work on the project shall be performed in accordance with the latest issue of "Recommendations for Prestressed Rock and Soil Anchors", Post-Tensioning Institute, Phoenix, Arizona.

B. The Contractor shall submit records documenting a minimum of two (2) years experience in rock anchor installation and a minimum of five (5) previous rock anchor projects of similar or greater scope as qualification for this project. Names of individuals (with address, affiliation, title, and telephone number) who can attest to the adequacy of the work done on those projects shall also be submitted.

C. Do not install rock anchors until the Engineer has reviewed the sequence of installation for all rock anchors.

D. Alignment and Tolerances

1. Install rock anchors to within one degree from vertical.
2. Install rock anchors within two inches of the required location unless otherwise directed by the Engineer.

1.7 DEFINITIONS

A. Rock Anchor: A high strength steel tendon, fitted with an anchorage at one end and an anchor device permitting force transfer to the ground on the other end.

B. Anchorage: Portion of the rock anchor, including anchor head, and anchor plate, which is used to transfer load from the structure to the rock anchor.

C. Bonded Length: Portion of rock anchor which transfers the tensile force from the rock anchor to the ground.

D. Stressing Length: Portion of rock anchor which is in smooth sheathing.

E. Smooth Sheathing: Enclosure around stressing length to prevent permanent bond between the prestressing steel and the surrounding grout and to provide corrosion protection.

1.8 DELIVERY, STORAGE AND HANDLING

A. All rock anchors and components shall be handled and stored in such a manner as to avoid corrosion and physical damage.

B. Damage, such as abrasions, cuts, nicks, welds, weld spatters or heavy corrosion and pitting, will be a cause for rejection of the element. Rejected elements shall be replaced at no cost to the Owner in terms of either material replacement or resulting time delays.

1.9 JOB CONDITIONS

A. Limited variations from the patterns or locations shown on the Contract Drawings will be permitted to accommodate local conditions, subject to review of the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Steel Tendons: Tendons for rock anchors shall be continuously threaded Grade 150 steel bars conforming to ASTM A722,

1. Steel tendon shall meet or exceed Class I corrosion protection.
2. The sheath encapsulating the tendons shall be able to safely withstand deformations occurring during transportation, installation, stressing, testing, and transferring load to the tendons.
3. The stressing length of rock anchors shall be protected with smooth sheaths that are filled with anti-corrosion grease, heat-shrink sleeves, and secondary grout after stressing.

B. Plastic Sheathing/Sleeves

1. Smooth sheathing/sleeves shall be seamless polyethylene having a minimum wall thickness of 60 mils. The materials shall be free of water soluble chlorides and other ingredients which might enhance corrosion, hydrogen embrittlement or stress corrosion of the prestressing steel. The plastic shall be non-reactive with the grout and its ingredients.
2. Corrugated sheeting shall be polyvinyl chloride having a minimum wall thickness of 30 mils.
3. The plastic sheathing/sleeve shall be gas and water-tight, resistant against chemical attacks and aging.

C. Steel: Steel, except steel tendons, shall conform to the requirements of ASTM A36.

D. Grout: FOSROC 10-35 TEKROC P shall be used for rock anchors.

1. Grout bags which have been in storage more than 90 days shall not be used.
2. Grout bags shall be kept under cover and in a dry condition.
3. The lowest practical water:grout ratio with acceptable workability shall be used.
4. Prior to testing anchors, verify that the grout has sufficient strength to transfer the rock anchor load to the ground.
5. Expansive admixtures may not be added to the grout.
6. Water for mixing grout shall be potable, clean and free of injurious quantities of substances known to be harmful to Portland cement or prestressing steel.
7. Mix grout in accordance with the manufacturer’s recommendations.

E. Centralizers

1. Centralizers shall be placed at five foot intervals in the bond length starting at the end so that no less than 2 inches of grout cover is achieved along the tendon.
2. Centralizers may be made of any material, except wood, that is not deleterious to the prestressing steel or plastic sheath.

3. Centralizers shall permit the free flow of grout.

F. Miscellaneous Steel Hardware

1. Steel plates shall conform to ASTM A36.
2. All bolts, nuts and washers shall conform to the tendon manufacturer's specifications.
3. Trumpets shall conform to ASTM A53, with a minimum wall thickness of 0.20 inches.
4. All anchorage components shall develop at least 95 percent of the minimum guaranteed ultimate strength of the tendon.

2.2 EQUIPMENT

A. Grouting Equipment: Equipment for mixing grout shall be a high speed colloidal mixer with shearing action.

PART 3 - EXECUTION

3.1 PREPARATION

A. Tendons shall be fabricated in accordance with reviewed Shop Drawings and shall be free of dirt, detrimental rust, or other deleterious substances.

B. The bonded length shall be degreased prior to installation. No solvent residue shall remain on the tendon.

3.2 CONSTRUCTION CONTROL

A. The rock anchor shall be properly inspected before placement into the borehole. While inserting the rock anchor into the hole, it shall be protected from any damage, especially damage to the corrosion protection media.

B. Rock anchors shall be inserted freely to the prescribed length in the hole. They shall not be driven into the hole or cut off for insertion.

C. In no case shall the stressing length of a rock anchor be shortened to less than the minimum length shown on the Engineered Shop Drawing Submittal.

D. The tendon shall be concentric in the hole.

E. Grout pressure shall be measured at the point of injection. The grout gate mechanism shall be cleaned prior to delivery to the site and periodically during the project to prevent clogging.

F. Grout components shall be mechanically mixed for 5 to 10 minutes to ensure proper dispersion of grout mix.

G. The established water grout ratio shall be accurately controlled.

H. Pumping and injection of the grout shall commence immediately after mixing.

I. Grouting shall continue until the returning grout escaping from the hole is of the same composition as grout being injected.

J. The trumpet shall extend well over the tendon sheathing. It shall remain undamaged during placement and stressing. The tendon shall not contact the trumpet at the bearing plate.

K. Prior to testing anchors, verify that grout has sufficient strength to transfer the anchor load to the ground.

3.3 INSTALLATION

A. The hole for rock anchors shall be drilled at locations indicated on the Contract Drawings.

B. The hole diameter shall be determined by the Contractor to produce the required load capacities. The rock anchor hole shall extend at least one-half foot beyond the tendon length to be installed.

C. The Contractor shall be responsible for maintaining an obstruction-free and open hole for rock anchor installation and grouting. The Contractor shall be solely responsible for determining the drilling method, grouting pressures, and rock anchor bonded length, subject to the provisions stated herein and review by the Engineer. The Contractor shall design the bonded length to satisfy the rock anchor testing acceptance criteria in accordance with the design loads. The grouting pressure and grouting method shall be based on consideration of existing ground conditions.

D. The drilling method used shall:

1. Cause minimum disturbance to the surrounding ground and not result in any ground loss.
2. Not result in collapse of the hole during drilling.
3. Maintain the position and inclination of the drilled hole, allow the hole to reach the design depth, and produce the design diameter of the drilled hole.

E. Before installation of the grout or anchor, the bonded length of each hole shall be cleaned of all debris by a method reviewed by the Engineer.

F. The Contractor shall immediately revise his operations to prevent reoccurrence of obstructed or otherwise unsatisfactory holes and modify rock anchor installation procedures as required. Temporary casing shall be used if the hole tends to collapse during drilling or placement of the anchor. The temporary casing shall be withdrawn as grout is placed.

G. Grout shall be injected at the lowest point of the rock anchor hole. Grouting shall proceed such that the hole is filled without formation of air voids, grouting progressively from the bottom to top.

H. The grout in the stressing length zone shall be the same as that for the bonded length zone. The stressing length grouting shall be done by low pressure pumping similar to the bonded length. Grout shall terminate one foot before the anchor plate area prior to stressing and testing. Final grouting up to the anchor plate shall be completed upon completion of testing and stressing. The Contractor shall provide the fittings or components needed to accomplish this.

I. The grouting equipment shall be capable of continuous mixing and shall produce a grout free of lumps. The grout pump shall be equipped with a grout pressure gauge at the nozzle capable of measuring at least 150 psi or twice the actual pressure used.

J. If grout loss from the drilled hole exceeds three times the volume of the annular space between the drilled hole and rock anchor, then rock anchor installation shall be discontinued and the tendon removed from the hole and cleaned. The Contractor shall fully pressure grout the drilled hole with a cement grout at a pressure of at least 5 psi above hydrostatic pressure, re-drill the hole 24 hours after the grout sets, and install rock anchors as described herein above.

K. The Contractor may, at own option, conduct a water pressure test in the drilled hole prior to grouting. When water loss is greater than 0.25 gallons per mixture at a pressure of at least 5 psi above hydrostatic pressure (within the bonded length of the drill hole) measured for at least 10 minutes, then the drilled hole shall be pressure grouted as described above.

L. A grout pad shall be placed under the bearing plate to level the plate prior to stressing and testing.

3.4 ROCK ANCHOR TESTING

A. Each rock anchor shall be tested.

B. Copies of all test results and graphs shall be transmitted to the Construction Manager as each test is completed.

C. Rock anchors shall be tensioned by direct pull with a hollow ram hydraulic jack of a model recommended by the anchor manufacturer, so mounted as to prevent bending of the rock anchor. Tensioning of a rock anchor shall not commence until the cement grout has set.

D. Jacks shall have ram travel at least equal to theoretical elastic elongation of the stressing length plus one-half the bonded length at the maximum test load. A pressure gauge shall be used with each jack. Gauges shall be calibrated with a single jack. All gauges shall be accurate enough to read 100 psi changes in pressure. For performance tests, the jack used shall have two (2) calibrated gauges: a master gauge and a back-up gauge. The pump shall be capable of applying each load increment in less than 60 seconds.

E. For the performance tests, the master gauge and back-up gauge shall be connected to the same pressure hose between the pump and jack and be used to measure the applied loads. If the load measured by the master gauge and back-up gauge differ by more than ten (10) percent, the jack, master gauge and back-up gauge shall be recalibrated as a unit at no expense to the Owner.

F. The weight of the jack shall be supported externally and not by the tendon.

G. Use a dial gauge, with 0.001 inch precision, aligned perpendicular to the loading head to measure elongation of the tendon. The dial gauge shall be supported on an independent reference point and shall be in contact with the tendon head or an extension of the tendon head.

H. All testing shall be performed in the presence of the Engineer. Notice shall be given to the Engineer not less than 48 hours prior to the start of a test.

I. Maintain each load increment or decrement for at least 1 minute, or until movement ceases.

J. Performance Test:

1. Performance tests shall be performed on at least three rock anchors at locations across the structure requiring rock anchors prior to delivery of remaining anchors to confirm design.
2. The performance tests will include stressing and monitoring a rock anchor. During testing, rock anchor movement, measured at the anchor head, shall be monitored for each load increment to the nearest 0.001 inch from an independent, fixed reference point. The loading sequence shall be as follows:

Cycle	Load
1	AL
0.25 P	
AL	
2	0.25 P
0.50 P	
AL	
3	0.25 P
0.50 P	
0.75 P	
AL	
4	0.25 P
0.50 P	
0.75 P	
1.00 P	
AL	
5	0.25 P
0.50 P	
0.75 P	
1.00 P	
AL	

6 0.25 P
0.50 P
0.75 P
1.00 P
1.20 P
1.33 P

to Lock-off Load

P = Design Load (as shown on Contract Drawings)
AL = Alignment Load = 0.05P

3. The lock-off load shall be per design, and in accordance with Post-Tensioning Institute (PTI) Recommendations for Prestressed Rock and Soil Anchors, Latest Issue.
4. Each load increment should be maintained for at least 30 seconds or until no dial gauge movement is observed with respect to a fixed reference point.
5. The maximum test load shall be held for 10 minutes. Total movements with respect to a fixed reference point shall be recorded at 1 minute, 2, 3, 4, 5, 6 and 10 minutes. If the total movement between 1 minute and 10 minutes exceeds 0.040 inches, the test load shall be held for an additional 50 minutes. Total movements shall be recorded at 15 minutes, 20, 25, 30, 40, 50 and 60 minutes.
6. The Contractor will plot the tendon head movement vs. load for each load increment. He will also plot the creep movement for the load-hold stage as a function of the logarithm of time. The Engineer will review these data from each performance test to determine whether the rock anchor is acceptable.
7. Where, in the opinion of the Engineer, significant differences are indicated from previous performance tests, run additional performance tests on the next adjacent rock anchor to be installed.

K. Proof Test

1. All rock anchors not performance tested shall be proof tested. The requirements for loading and monitoring for proof tests are the same as for performance tests, except that the load sequence shall be as shown in the following:

P = Design Load
AL = Alignment Load (0.05P)

AL
0.25 P
0.50 P
0.75 P
1.00 P
1.20 P
1.33 P (Hold)
Adjust test load to lock-off load

2. Each load increment should be maintained for at least 30 seconds or until no dial gauge movement is observed with respect to a fixed reference point.
3. For proof tests, maintain the maximum proof load for 10 minutes. The jack shall be repumped as necessary in order to maintain a constant load. Anchor movement shall be measured and recorded at 1 minute, 2, 3, 4, 5, 6 and 10 minutes. If the anchor movement exceeds 0.04 inches between 1 and 10 minute readings, maintain the maximum proof load for an additional 50 minutes. Total movements shall be recorded at 15, 20, 25, 30, 40, 50 and 60 minutes.

L. Lift-Off Readings: After applying the lock-off load to the rock anchor and prior to removing the jack, a lift-off load reading shall be made. The load determined from the lift-off reading shall be within 5 percent of the specified lock-off load. If the load is not within 5 percent of the lock-off load, the anchorage shall be reset and another lift-off reading shall be made.

3.5 ACCEPTANCE CRITERIA

A. The following three criteria shall be satisfied:

1. Displacement of the tendon head shall be greater than $0.8\ PL_S/AE$ where,

   P = applied load

   L_S = length from jack pulling head to bottom of stressing length

   A = total cross sectional area of steel tendons

   E = modulus of elasticity of steel tendons

2. Displacement of the tendon shall be less than $P\ (L_{S+}L_b/2)AE$ where,

   L_b = bonded length of tendon

3. Creep per log cycle $(d_2-d_1)/\log\ (t_2/t_1)$ shall be less than 0.04 inch between the 1 and 10 minute readings and less than 0.08 inch between the 6 and 60 minute readings, where,

   d_1 = measured displacement at time t_1

   d_2 = measured displacement at time t_2

   t_1 = time of first displacement measurement

   t_2 = time of second displacement measurement

B. Rock anchors not meeting Criterion 1 shall not be incorporated into the structure and shall be replaced at no cost to the Owner. Those not meeting Criteria 2 or 3 may be accepted to work at loads less than design values; the acceptable load for these rock anchors will be determined by the Engineer. When additional anchors are needed due to anchors not meeting Criteria 2 or 3, the additional anchors shall be installed at no cost to the Owner.

3.6 RECORD OF WORK

A. Documentation of all work done shall be recorded accurately, completely and provided to the Construction Manager. This shall include drilling of the rock anchor hole, water testing, grouting, testing and stressing of rock anchors, equipment used for testing and their calibration data, type of steel tendons, materials and procedures used for corrosion protection of anchors.

END OF SECTION

SECTION 321200 - FLEXIBLE PAVING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide and install hot mix asphalt (HMA) pavement as specified and as directed by the PROJECT ARCHITECT. This work includes:

1. HMA pavement including driveway aprons, roadways, and trench patches
2. Painting and pavement markings

1.2 REFERENCES

A. Specification Sections:

1. Earth Moving: Section 31 20 00

B. “Standard Specifications: Highways and Bridges", current revision, Maine Department of Transportation.

C. State of Maine Department of Transportation “Standard Specifications – Revision of December 2002”

D. State of Maine Department of Transportation “Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Revisions of December 2002”

E. AASHTO M320-Standard Specification for PGAB.

1.3 SUBMITTALS

A. Material Certificates: Certificates signed by material producer and CONTRACTOR stating that each material complies with specified requirements.

B. Design Mix: Provide design mix for each grade of pavement to be used at least 20 days prior to start of paving.

C. Certified Weigh Slips: If required by the OWNER, provide for each truck load of bituminous material.

1.4 QUALITY ASSURANCE

A. Comply with any road opening permits issued for the Work.

1.5 JOB CONDITIONS

A. Weather and Seasonal Limitations: Follow MDOT "Standard Specification" Section 401.07.

B. Tack Coat Limitations:

1. Apply bituminous prime and tack coats only when the ambient temperature in the shade is at least 50°F for 12 hours immediately prior to application.
2. Do not apply when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE AND SUBBASE

A. Refer to Section 31 20 00.

2.2 ASPHALT CEMENT

A. General: Comply with materials requirements, MDOT "Standard Specification", Section 702.

2.3 BITUMINOUS PAVEMENTS

A. Comply with materials requirements, MDOT "Standard Specification", current revision, Section 401, Superpave Mixes, used as indicated on the Drawings.

1. HMA 19mm
2. HMA 12.5mm
3. HMA 9.5mmShims: Hot Mix Asphalt, Shim

2.4 BITUMINOUS TACK COAT

A. General: MDOT "Standard Specifications" Section 702.04.

2.5 MARKING PAINT

A. General: Alkyd-resin type, ready-mixed complying with AASHTO M 248, Type I.

B. Color: White for shoulder striping, bicycle lane demarcation, and directional arrows; blue for handicapped parking symbols; yellow for other lane demarcation striping.

PART 3 - EXECUTION

3.1 BASE AND SUBBASE

A. General: Do not begin paving operations until base and subbase have been accepted.

3.2 BITUMINOUS PAVEMENTS

A. General: MDOT Standard Specifications.

B. Base Course: Section 401.

C. Surface Course: Section 403.

D. Saw cuts and butt joints shall be used in existing pavement as indicated on the Drawings to facilitate the installation of new pavement.

3.3 BITUMINOUS TACK COAT

A. General: Apply tack coat immediately prior to placing pavement adjacent to curbing, gutters, manholes, pavement, etc. for adequate bond. Generally a tack coat will not be required for pavement placed immediately following the rolling of the underlying course.

B. MDOT Standard Specification Section 409.

C. Rate of Application: 0.05 to 0.15 gallons per square yard.

3.4 TRENCH PATCHING

A. General: Do not leave more than 1000 linear feet of backfilled trench unpaved at any one time. Place aggregate base and subbase as shown on the Drawings.

B. Permanent Patching:

1. Remove all existing pavement and regrade base material and compact as required.
2. Provide base and surface courses to the depths shown on the Drawings.

3.5 TRAFFIC AND PARKING LOT MARKINGS

A. Cleaning: Sweep and clean surface to eliminate loose material and dust.

B. Striping: Use chlorinated-rubber base traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.

C. Apply paint with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide minimum 12 to 15 mils dry thickness.

END OF SECTION 321200

SECTION 321600 - CURBS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Remove, stockpile, dispose/deliver existing curbing as directed. Provide all new Type 1 granite curbing and tipdowns as shown on the Drawings.

1.2 REFERENCES

A. Specification Sections:

1. Earth Moving: Section 31 20 00.
2. Flexible Paving: Section 32 12 00.
3. Sidewalks: Section 32 20 00.

B. State of Maine Department of Transportation “Standard Specifications – Revision of December 2002”

C. State of Maine Department of Transportation “Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Revisions of December 2002”

D. American Society for Testing and Materials (ASTM): C 615-68 (1972), Structural Granite

E. “Standard Specifications: Highways and Bridges", current revision, Maine Department of Transportation

1.3 SUBMITTALS

A. Shop Drawings:

1. Dimensions of cut curbing.
2. Manufacturers construction data for granite curbs.
3. Manufacturers printed data on recommended installation procedures for granite curb.

B. Certificates: Manufacturer's certification that products meet specification requirements.

PART 2 - PRODUCTS

2.1 GRANITE CURB

A. Vertical face curb, Type 1, straight sections.

B. Vertical face curb, Type 1, circular sections.

C. Tip-down curb, Type 1.

D. MDOT Specification, Paragraph 712.04.

2.2 JOINT PAD

A. Bituminous Fiber Joint Filler: Preformed strips of composition below, complying with ASTM D1751: Asphalt saturated fiber board.

B. MDOT Specification, Paragraph 609.03

PART 3 - EXECUTION

3.1 INSPECTION:

A. Verify that earthwork is completed to correct line and grade.

B. Check that subgrade is smooth, compacted, and free of frost or excessive moisture.

C. Do not commence work until conditions are satisfactory.

3.2 INSTALLATION

A. For installation of granite Type 1 curbing, comply with appropriate Paragraphs of MDOT Specification, 609.

3.3 CLEANING

A. Clean competed work with appropriate agent and rinse thoroughly.

END OF SECTION 321600

SECTION 322000 – SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

A. This work shall consist of providing and installing brick sidewalks on bituminous concrete base in accordance with these specifications and in reasonably close conformity with the lines and grades as shown on the plans.

B. This work shall include the construction of sidewalk ramps at locations as shown on the plans and shall be in accordance with the sidewalk pedestrian ramp typical details and with the current Americans with Disabilities Act requirements.

1.2 REFERENCES

A. Specification Sections:

1. Earth Moving: Section 31 20 00.
2. Flexible Paving: Section 32 12 00.
3. Curbs and Gutters: Section 32 16 00.

B. State of Maine Department of Transportation “Standard Specifications – Revision of December 2002”

C. State of Maine Department of Transportation “Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Revisions of December 2002”

D. City of Portland Technical Manual

PART 2 - PRODUCTS

2.1 BRICK

A. New Brick: Shall conform to the City of Portland technical standards for brick sidewalks. Brick shall conform to requirements of ASTM Standard Specifications for Building Brick (made of clay or shale) Designation C62-66 for Grade SW with the following modifications:

1. The absorption limits shall be from 8 to 12 percent for the average of 5 bricks.
2. The compressive strength shall not be less than 8000 pounds per square inch (psi).
3. The modulus of rupture shall not be less than 1000 pounds per square inch (psi).

4. Bricks shall be Pine Hall Pathway Paver Brick, manufactured by Pine Hall Brick Co., Madison, North Carolina, distributed by Lachance as Item # 193623. Bricks shall be of standard size (2-1/4" deep x 3-3/4" wide x 8" long) with permissible variations not to exceed 1/16" in depth, 1/8" in width or 1/4" in length.

B. All base courses and joints shall conform to the applicable subsections of Division 700 of the Maine Department of Transportation Standard Specifications.

2.2 SAND-CEMENT BASE

A. Materials: Six (6) parts of washed mortar sand to one (1) part Portland Cement.

PART 3 - EXECUTION

3.1 BRICK

A. Subgrade: The subgrade for the sidewalks shall be shaped parallel to the proposed surface of the walks and shall be thoroughly compacted. All depressions occurring shall be filled with a suitable material and again compacted until the surface is smooth and hard.

B. Foundation: After the subgrade has been prepared, a foundation of crushed gravel shall be placed upon it. After being thoroughly compacted, the foundation shall have a thickness as shown on the plans and typical details and shall be parallel to the proposed surface of the work.

C. Bituminous Base: A layer of hot bituminous pavement shall be spread upon the properly prepared crushed gravel, as shown in the typical detail.

D. Sand-Cement Base: A layer of sand-cement base course material one (1") inch in thickness shall be spread upon the properly prepared bituminous base course. The course shall be thoroughly compacted and present a hard smooth surface parallel to the proposed finished slope and grade of the walks.

E. Brick Placement: After the sand base course has been properly prepared, the brick shall be placed in the pattern shown on the plans and typical details. The brick shall be placed as closely together as possible and the sand joints between the brick shall be no wider than that allowed by the natural texture of the brick itself. NO OPEN JOINTS WILL BE ALLOWED. Brick shall be saw cut to fit spaces requiring less than a whole brick. No cut brick shall be less than two (2") inches in length. A journeyman brick mason shall supervise all brick placement.

F. After the bricks are carefully set upon the properly prepared sand-cement base, a plank or heavy sheet of plywood covering several course of brick shall be placed upon the bricks and carefully rammed with a heavy hammer until the bricks reach a firm, unyielding bed and present a surface of the proper slope and grade. Any divergence from line and grade shall be corrected by taking up and relaying the bricks. After the ramming of 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 sidewalk after the joints have been properly

filled, shall be carefully removed by sweeping. Care shall be taken to avoid raking out the joints during removal of excess sand-cement. A final application of sand only shall be spread on the sidewalk. The application of sand shall then be removed by sweeping while the aforementioned precautions are being exercised.

END OF SECTION 322000

SECTION 329300 - TREE & SHRUB PLANTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General: Provide and install all trees and shrubs as shown on drawings. This work includes preparation of subsoil, supply topsoil planting, protection and maintenance of the plant materials.

1.2 RELATED SECTIONS

A. Earth Moving: Section 312000.

B. Structural Soil: Section 312001.

1.3 QUALITY ASSURANCE

A. Standards: ANSI - Z60.1 "American Standards for Nursery Stock".

B. Subcontract landscape work to a single firm specializing in landscape work.

C. Do not make substitutions. If specialized landscape materials is not obtainable, submit proof or non-availability to Engineer, together with proposal for use of equivalent material.

D. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

E. Topsoil: Before delivery of topsoil, furnish Engineer with written statement giving location of properties from which topsoil is to be obtained, names and addresses of owners, depth to be stripped, and crops grown during past 2 years.

F. Trees, Shrubs, and Plants: Provide trees and shrubs of quantity, size, genus, species, and variety shown and scheduled for landscape work.

G. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Plant and Material Certifications:

1. Manufacturer's or vendor's certified analysis for soil amendments and fertilizer materials.
2. Label data substantiating that plants, trees, shrubs and planting materials comply with specified requirements.

C. Planting Schedule: Indicate dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

D. Maintenance Instructions: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).

1.5 DELIVERY, STORAGE AND HANDLING

A. Trees and Shrubs: Provide freshly dug trees and shrubs or those in containers for at least one season. Provide protective covering during delivery, cover to protect from wind exposure during delivery. Do not drop balled and burlapped stock during delivery.

B. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.

C. Do not remove container-grown stock from containers until planting time.

1.6 JOB CONDITIONS

A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

B. Do not install plants when ambient temperatures go below 35 degrees F. or above 90 degrees F.

C. Do not install plants when wind velocity exceeds 30 mph.

1.7 SEQUENCING AND SCHEDULING

A. Planting Time: Proceed with, and complete landscape work as rapidly as portions of site become available.

B. Plant or install materials during normal planting seasons for each type of plant material required.

C. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.

1.8 PROJECT WARRANTY

A. Warranty trees and shrubs, for a period of one year after date of substantial completion, against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusually phenomena or incidents which are beyond Landscape Installer's control.

B. Remove and replace trees, shrubs, or other plants found to be dead or in unhealthy condition during warranty period. Make replacements during growth season following end of warranty period.

C. A warranty inspection will be conducted at end of extended warranty period, if any, to determine acceptance or rejection.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Obtain topsoil from a previously established stockpile on the site, to extent available. Obtain additional topsoil from Engineer approved off-site sources. If onsite topsoil is used, modify soil to meet the standards.

B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam or loam soil as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

% of Total Textural Class	Weight	Average
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 mm dia. range)	5 to 10	7

1. 95% of topsoil shall pass a 2.0 mm sieve.
2. Topsoil shall be free of stones 1 inch in longest dimension, earth clods, plant parts, and debris.
3. Organic matter content shall be 4 to 8% of total dry weight

C. Provide topsoil having a pH value range of 6.0 to 6.5. If the soil does not fall within the pH range specified, it may be amended to bring the pH within the specified limit.

2.2 SOIL AMENDMENTS

A. Lime: Natural dolomitic limestone containing not less than 85 percent of total carbonates with a minimum of 30 percent magnesium carbonates, ground so that not less than 90 percent passes a 10-mesh sieve and not less than 50 percent passes a 100-mesh sieve.

B. Aluminum Sulfate: Commercial grade.

C. Peat Humus: Finely divided peat, so completely decomposed and free of fibers that its biological identity is lost. Provide in granular form, free of hard lumps and with pH range suitable for intended use.

D. Bonemeal: Commercial, raw, finely ground; 4 percent nitrogen and 20 percent phosphoric acid.

E. Superphosphate: Soluble mixture of treated minerals; 20 percent available phosphoric acid.

F. Sand: Clean, washed sand, free of toxic materials.

G. Perlite: Conforming to National Bureau of Standards PS 23.

H. Vermiculite: Horticulture grade, free of toxic substances.

I. Sawdust: Rotted sawdust, free of chips, stones, sticks, soil, or toxic substances and with 7.5 pounds of nitrogen uniformly mixed into each cubic yard of sawdust.

J. Manure: Well rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust or other bedding materials and containing no chemicals or ingredients harmful to plants.

K. Mulch: Organic mulch free from deleterious materials and suitable for top dressing of trees or shrubs, and consisting of ground or shredded bark.

L. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing following percentages of available plant nutrients:

1. For trees and shrubs, provide fertilizer with not less than 5 percent total nitrogen, 10 percent available phosphoric acid and 5 percent soluble potash.

M. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of plants.

2.3 PLANT MATERIALS:

A. Quality: Provide trees, shrubs, and other plants of size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock".

B. Deciduous 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.

C. Deciduous 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. Container grown deciduous shrubs will be acceptable in lieu of balled and burlapped deciduous shrubs subject to specified limitations for container grown stock.
2. Wrapping: Tree-wrap tape not less than 4 inches wide, designed to prevent borer damage and winter freezing.

PART 3 - EXECUTION

3.1 PREPARATION OF PLANTING SOIL:

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

B. Mix specified soil amendments and fertilizers with topsoil at rates specified. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.

C. For planting beds and lawns, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.

1. Mix lime with dry soil prior to mixing of fertilizer.
2. Prevent lime from contacting roots or acid-loving plants.
3. Apply phosphoric acid fertilizer (other than that constituting a portion of complete fertilizers) directly to subgrade before applying planting soil and tilling.

3.2 PREPARATION OF PLANTING BEDS:

A. Loosen subgrade of planting bed areas to a minimum depth of 6 inches using a culti-mulcher or similar equipment. Remove stones measuring over 1-1/2 inches in any dimension. Remove sticks, stones, rubbish, and other extraneous matter.

B. Spread planting soil mixture to minimum depth required to meet lines, grades, and elevation shown, after light rolling and natural settlement. Place approximately 1/2 of total amount of planting soil required. Work into top of loosened subgrade to create a transition layer, then place remainder of the planting soil.

3.3 EXCAVATION FOR TREES AND SHRUBS:

A. Excavate pits and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation.

1. For balled and burlapped (B&B trees and shrubs), make excavations at least half again as wide as the ball diameter and equal to the ball depth, plus following allowance for setting of ball on a layer of compacted backfill:
2. Allow for 3 inch thick setting layer of planting soil mixture.
3. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.

B. Dispose of subsoil removed from planting excavations. Do not mix with planting soil or use as backfill.

C. Fill excavations for trees and shrubs with water and allow water to percolate out prior to planting.

3.4 PLANTING TREES AND SHRUBS:

A. Set balled and burlapped (B&B) stock on layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades. Remove burlap from sides of balls; retain on bottoms. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.

B. Set container grown stock, as specified, for balled burlapped stock, except cut cans on 2 sides with an approved can cutter; remove bottoms of wooden boxes after partial backfilling so as not to damage root balls.

C. Dish top of backfill to allow for mulching.

1. Mulch pits, trenches, and planted areas. Provide not less than 4" thickness of mulch, and work into top of backfill and finish level with adjacent finish grades.

D. Prune, thin out, and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Do not cut tree leaders. Remove only injured or dead branches from flowering trees, if any. Prune shrubs to retain natural character.

E. Remove and replace excessively pruned or misformed stock resulting from improper pruning.

F. Wrap tree trunks of 2 inches caliper and larger. Start at ground and cover trunk to height of first branches and securely attach. Inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures before wrapping.

3.5 MAINTENANCE:

A. Begin maintenance immediately after pruning.

B. Maintain trees, shrubs, and other plants until final acceptance.

C. Maintain trees, shrubs, and other plants by pruning, cultivating, and weeding as required for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports [where used] and reset trees and shrubs to proper grades or vertical position as required. Restore or replace damaged wrappings. Spray as required to keep trees and shrubs free of insects and disease.

3.6 CLEANUP AND PROTECTION:

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.7 INSPECTION AND ACCEPTANCE:

A. When landscape work is completed, including maintenance, Engineer will, upon request, make an inspection to determine acceptability.

1. Landscape work may be inspected for acceptance in portions provided each portion of work offered for inspection is complete, including maintenance.
2. When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by Engineer and found to be acceptable. Remove rejected plants and materials promptly from project site.

END OF SECTION 329300

SECTION 331100 - WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Water distribution piping includes:

1. Furnishing and installing all distribution piping as noted on the Drawings.
2. Verifying location of existing utilities prior to construction.
3. Coordinating with the Portland Water District for connection to the existing utilities.
4. Supply and installation of all valving, and accessories.
5. Flushing, testing and disinfection of all water distribution piping.
6. Repair of water piping damaged during construction.

1.2 REFERENCES:

A. Specification Sections:

1. Earth Moving: Section 31 20 00.
2. Erosion and Sedimentation Controls: Section 31 25 13.

B. Portland Water District Specifications and Procedures, www.pwd.org

1.3 QUALITY ASSURANCE

A. Code Compliance: Comply with State Plumbing Code and local plumbing codes where more stringent. Comply with Maine Department of Human Services, Division of Health Engineering rules.

B. AWWA Standards: Comply with requirements of Section 4 of AWWA C601, "Preventive Measures During Construction" for cleanliness.

C. Other Standards: Comply with requirements of the Portland Water District specifications.

D. Testing: CONTRACTOR shall pay for all flushing, pressure and leakage testing, disinfection, and fire flow testing.

1.4 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each product specified for water service piping.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products shall be in conformance with the Portland Water District's standard specifications.

2.2 PRESSURE PIPE

A. General: Provide fittings and other required piping accessories of same type and class of material as conduit, or of material having equal or superior physical and chemical properties.

B. Copper Tube: Type K conforming to ASTM B88, with compression fittings.

C. Ductile Iron Pipe: Push-on joints unless indicated otherwise, centrifugally cast bituminous-coated, cement-lined (AWWA C104), seal-coated and manufactured in accordance with the latest revision of AWWA Standards C150 and C151. Interior shall be seal-coated twice with asphalt to a minimum of 2 mils dry film thickness. Pipe shall be Class 52 unless indicated otherwise. Weight, class, manufacturer's mark, year of production, and "DI" or "Ductile" shall be cast or stamped on the pipe.

2.3 VALVES, FITTING, CLAMPS, ETC.

A. General: All products used in the construction that come in contact with drinking water shall meet the National Sanitation Foundation Standard 61 for Drinking Water System Components - Health Effects. The products and/or materials covered include, but are not limited to, protective materials (coatings, linings, liners, etc.), joining and sealing materials (solvent cements, welding materials, gaskets, etc.), and mechanical devices used in transmission/distribution systems, (valves, etc.).

B. All valves, joints, corporations stops, clamps, repair sleeves, valve boxes, accessories, and fittings shall be installed per Portland Water District Standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install products in compliance with the Portland Water District's standard specifications and procedures and the manufacturer's instructions. Prevent introduction of any groundwater or foreign materials into pipe during construction. Provide watertight plug in ends of pipe at all times when construction is not in progress. Coordinate all work with the Portland Water District.

B. Excavation: Where location of distribution pipe is known, excavate within 2 feet of pipe by hand.

C. Bedding of Pipe: Bed in sand or crushed stone. Refer to trench detail on Drawings.

D. Cleaning: Clear interior of pipe of dirt and other superfluous material as work progresses. Place plugs in end of uncompleted pipe whenever work stops.

E. Coordinate connections to existing water mains with the Portland Water District. Provide 48 hours notice prior to such work. The CONTRACTOR is responsible for the cost and all work associated with water service taps and connection to existing mains.

F. Water Service Piping: Extend water service piping of size indicated to existing water service. Provide new shutoffs as indicated and shown. Bed pipe in sand or crushed stone. See trench detail on Drawings.

G. Backfill under all existing utility pipes crossed by new utility pipes or work with ¾" crushed stone. The crushed stone backfill shall extend continuously from the bedding of the new pipe to the utility pipe crossed, including a 6" thick envelope of crushed stone all around the existing utility pipe(s). The ¾" crushed stone backfill shall stand at its own angle of repose. No "haunching" or "forming" with common fill will be allowed.

3.2 INSULATION

A. Install as shown on Drawings.

3.3 FLUSHING AND TESTING

A. General: The CONTRACTOR shall not operate any existing Portland Water District valves for filling, flushing or testing the new main. The District will provide the necessary personnel upon request.

B. Flushing: The CONTRACTOR shall flush the new main at a minimum velocity of 2.5 feet per second to remove any particulate matter. Provide the following minimum flow in gallons per minute: 4" dia. - 100 GPM; 6" dia. - 220 GPM; 8" dia. - 390 GPM; 12" dia. - 880 GPM, or as directed by Portland Water District. The CONTRACTOR shall be responsible for disposal of all flushing water and providing any necessary hoses or equipment for flushing.

C. Perform pressure and leakage testing of completed lines. CONTRACTOR shall coordinate all testing with the Portland Water District. Pressurize test pipe to 150 psi and allow to stabilize (+/- 2.5 psi) for a minimum of 15 minutes, or as directed by Portland Water Districtu. Pressure and leakage test shall be conducted at pressure of 150 psi for minimum of two hours. Maximum allowable leakage per 1000 feet of pipeline shall be 0.37 gph for 4-inch diameter pipe and 0.55 gph for 6-inch diameter pipe.

D. Perform operational testing of valves by opening and closing under water pressure to insure proper operation.

3.4 DISINFECTION

A. General: Upon satisfactory completion of the pressure and leak test, all new water mains shall be disinfected before they are placed into service in accordance with AWWA Standard C651, latest revision, procedures specified herein, and as specified by Portland Water District. Fittings required for final connection to existing water main shall be disinfected by swabbing with a sodium hypochlorite solution immediately prior to final connection.

B. Disinfection:

1. The CONTRACTOR shall chlorinate the new water main in accordance with the continuous feed method specified in Section 5.2 of AWWA Standard C651, latest revision, using 5 percent to 15 percent sodium hypochlorite solution.
2. The CONTRACTOR may use calcium hypochlorite granules or tablets placed in the new water mains during installation in accordance with Section 5.1 of AWWA Standard C651, latest revision, in addition to the continuous feed method, not as a substitute.

C. Chlorine Requirement: The new water main shall be chlorinated so that a chlorine residual of not less than 25 parts per million remains in the water after standing 24 hours in the pipe. Chlorine residual at start of the test shall be a minimum of 50 parts per million.

D. Point of Application: Chlorinating solution point of application shall be within 10 feet of the connection to the existing main through a corporation stop inserted in the water main. Alternate points of application may be used when accepted or directed by the Portland Water District.

E. Rate of Application: Water from the distribution system, or other source of supply as accepted by the Portland Water District, shall be controlled to flow very slowly into the new water main during application of the chlorine. The rate of chlorine solution flow shall be in such proportion to the rate of water entering the new water main that the dosage applied to the water will be sufficient for a minimum of 50 parts per million unless directed by the Portland Water District.

F. Retention Period: Treated water shall be retained in the new water main for a minimum of 24 hours. CONTRACTOR shall provide sampling taps at 500 ft. intervals, at all deadends, and at end of all new water mains. Take one sample at each location. Treated water shall contain no less than 25 parts per million of available chlorine.

G. Flushing and Draining:

1. At the end of the retention period, the chlorination water shall be flushed from the main until all heavily chlorinated water has been removed. CONTRACTOR shall arrange for all testing of water. CONTRACTOR shall provide testing at no cost to OWNER.
2. CONTRACTOR shall coordinate with the Portland Water District to obtain all water required for flushing and draining. CONTRACTOR to provide temporary blow-offs as necessary for flushing and draining.
3. Chlorine residual of water being disposed shall be neutralized by treating with one of the chemicals listed in the table below:

Amount Of Chemicals Required To Neutralize Various
Residual Chlorine Concentrations In 100,000 Gallons Of Water*

Residual Chlorine Concentration (mg/l)	Sulfur Dioxide	Sodium Bisulfate	Sodium Sulfite	Sodium Thiosulfate
1	0.8	1.2	1.4	1.2
2	1.7	2.5	2.9	2.4
10	8.3	12.5	14.6	12.0
50	41.7	62.6	73.0	60.0

*Except for residual chlorine concentration, all amounts are in pounds

H. Bacteriological Testing: Following disinfection and final flushing, bacteriological testing shall be done as specified in Section 5 of AWWA C651 as follows:

1. After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line at lease one set from each branch.
2. All samples shall be tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater, and shall show the absence of coliform organisms.
3. If the initial disinfection fails to produce satisfactory bacteriological results, the new main shall be reflushed and resampled. If check samples also fail to produce acceptable results, the main shall be rechlorinated by the continuous-feed or slug methods until satisfactory results are obtained.

I. Equipment: Provide water pumps with adequate metering devices. Provide chlorination injection pumps which allow accurate measurement of the disinfection solution being introduced to new water main.

J. Personnel: Submit names of personnel or firm to perform disinfection work.

END OF SECTION 331100

SECTION 333000 - SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install sanitary sewer system as shown on the Drawings. This includes:

1. Sanitary sewer service pipe
2. Repairs to existing pipe damaged during construction
3. Precast manholes and precast concrete structures and their appurtenances
4. Sanitary sewer cleanouts
5. Insulation and/or concrete encasement as necessary for utility crossings
6. Back flow preventers
7. Connection to existing systems

1.2 REFERENCES

A. Specification Sections:

1. Earth Moving: Refer to Section 31 20 00
2. Erosion and Sedimentation Controls: Refer to Section 31 25 13
3. State of Maine Department of Transportation “Standard Specifications – Revision of December 2002”

B. State of Maine Department of Transportation “Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Revisions of December 2002”

C. City of Portland Technical Manual

1.3 SUBMITTALS

A. Manufacturer's product data and installation instructions.

B. Anti-floatation calculations for all precast concrete structures, stamped by Professional Engineer licensed in the State of Maine.

C. Certified copies of tests on pipe units.

D. Construction Records:

1. Record depth and location of the following:

a. Sanitary sewer pipe and service locations, cleanouts, bends in services, connection points to sewer main.
b. Repairs to existing pipes.

2. Record neatly in a permanently bound notebook and submit at Substantial Completion. Provide access to records for PROJECT ARCHITECT at all times. Submit copies to PROJECT ARCHITECT on a weekly basis.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General: Provide fittings of same type and class of materials as pipe. Provide commercially manufactured wyes or tee/wyes for service connections. Fitting must have single piece gasket.

B. PVC Non-Pressure Pipe and Services (Sewer): 4- through 15-inch Diameter: ASTM D3034 or ASTM D3033, 18- through 27-inch Diameter: ASTM F-679, strength requirement SDR 35; push-on joints, ASTM D3212; gaskets, ASTM F477.

2.2 PRECAST CONCRETE STRUCTURES

A. Base Sections: Precast monolithic construction with steps.

B. Barrel Sections: Precast with steps.

C. Top Sections: Precast eccentric cone with steps.

D. Steps: Polypropylene reinforced with steel rod. Meet OSHA requirements, minimum width 16-inches. Cast into concrete.

E. Pipe to Structure Connections: Connections shall be watertight, expandable pipe sleeve with adjustable expansion ring equal to Press-Boot by Press-Seal Gasket Corp., Fort Wayne, Indiana.

F. Joints Between Precast Sections: Watertight, shiplap-type seal with two rings of one-inch diameter butyl rubber sealant.

2.3 FRAMES, COVERS, AND GRATES

A. Material: Cast iron, ASTM A48 Class 30

B. Provide frames, covers and grates as identified on the plans

2.4 MISCELLANEOUS

A. Flexible Couplings: Use and location shall be approved by PROJECT ARCHITECT or ENGINEER.

1. Type A: Dresser Style 253 as manufactured by Dresser, or approved equal.
2. Type B: Neoprene sleeve with stainless steel bands by Fernco, or approved equal.

B. Pipe Supports: Saddle type, steel, painted, adjustable, by ITT Grinnell, or approved equal.

C. Marking Tape: Lineguard III by Tri-Sales, Inc., 2-inch wide, green; detectable with magnetic locators, or approved equal.

D. Frost Barrier: U.V. resistant, high grade polyethylene, minimum thickness six (6) mils.

E. Joint Sealants:

1. Butyl Rubber Sealant: One (1) inch diameter strips manufactured by Kent Seal, or approved equal.
2. Butyl Rubber Caulking: Conform to AASHTO M-198, Type B.
3. Sewer Manhole Inverts: Provide inverts as shown on the Drawings. Configuration to be as required by connecting pipes and as shown on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION OF GRAVITY PIPE AND FITTINGS

A. Methods: Install in accordance with manufacturer's recommendations. Use a laser beam for line and grade unless otherwise permitted by the ENGINEER. Secure each length of pipe with bedding before placing next length. Plug open ends when work is suspended. Bed pipe as shown on Drawings. A 30-inch minimum cover over the top of PVC pipe and DI pipe should be provided before the trench is wheel-loaded.

1. Backfill under all existing utility pipes crossed by new utility pipes or work with ¾” crushed stone. The crushed stone backfill shall extend continuously from the bedding of the new pipe to the utility pipe crossed, including a 6” thick envelope of crushed stone all around the existing utility pipe(s). The ¾” crushed stone backfill shall stand at its own angle of repose. No “haunching” or “forming” with common fill will be allowed.

B. Grade and Line:

1. Lay pipe to line and grade shown on the Drawings. If grade is not shown, determine elevations of start and finish points for each run of pipe. Lay pipe to a uniform grade between these points.
2. Line and grade may be adjusted by the PROJECT ARCHITECT as required by field conditions.

C. Conditions: Lay pipe in the dry. Do not use installed pipe to remove water from work area.

D. Flush and clean all pipe and remove all debris and materials. Flushing and cleaning methods approved by ENGINEER. Gravity flushing is not acceptable.

E. Connections to Manholes and Catch basins: Provide short length of pipe so that joints are located within 3 feet of inside surface of manholes and catch basins for all pipe.

F. Sanitary Sewer Service Fittings and Leads:

1. Size of service leads 6-inch unless otherwise indicated.
2. Depth and location of service to be determined by PROJECT ARCHITECT in field.
3. Provide tee/wye or wye fittings on main line pipe.
4. Provide clean outs as shown and detailed on Drawings.

3.2 INSTALLATION OF MANHOLES

A. Placement: Place precast bases and structures on compacted bedding material so bottom of structure is plumb and pipe inverts are at proper elevations. Place manhole barrel and top sections in the appropriate height combinations. Plug all lifting holes inside and out with non-shrink grout. Construct manhole inverts in accordance with the Drawings.

B. Joints: Follow manufacturer’s instructions for sealing joints between precast sections. Provide two rings of 1 inch diameter butyl rubber sealant. Point joints inside and out with butyl caulk.

C. Frame and Covers:

1. Set to final grade as shown on the Drawings and as specified. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
2. Use two rings of 1 inch diameter butyl rubber sealant between frame and rubber riser. Provide downward force to frame so as to compress the joint, provide a watertight seal, and prevent future settlement. Point compressed joint with butyl rubber caulk sealant.
3. Set manhole frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.

D. Inverts: As specified in paragraph 2.04G of this section

E. Steps: Replace any steps that are out of plumb and proper horizontal placement.

F. Frost Barriers: Wrap each manhole to the maximum excavation depth or not less than 6 feet below grade, with a minimum of four layers of 6 mils each of the polyethylene.

1. Clean manhole exterior of all dirt and remove any protrusions.
2. Apply a 6-inch wide vertical strip of bituminous waterproofing adhesive from the top of manhole to the greatest excavation depth, but not in excess of 6 feet.
3. Start poly wrap at adhesive strip and proceed around manhole continuously, overlapping adhesive strip a minimum of 24 inches on the final layer.

4. Tuck and pleat poly at top in a continuous manner, minimizing size of folds. Extend poly past top of manhole frame and temporarily tuck remainder inside frame, until final backfill and paving.
5. Paved areas: Cut poly flush with manhole rim after pavement is in place.
6. Unpaved areas: Pull loose ends of poly together, remove excess air and tie off end with galvanized wire. Bury with manhole below grade.

3.3 UTILITIES TO BE ABANDONED

A. Close open ends of abandoned underground utilities which are not indicated to be removed. Provide sufficiently strong closures, such as caps or brick and mortar, acceptable to ENGINEER to withstand hydrostatic or earth pressure which may result after ends of abandoned utilities have been closed.

B. All abandoned laterals shall be done in accordance with Section 2.6.11 of the City of Portland's Technical Manual.

3.4 TESTING OF SANITARY SEWERS

A. General: Test all sanitary sewer pipes after backfilling. Install service leads on main line before testing. Perform tests in presence of ENGINEER. A maximum of 1000 feet of pipe may be installed but not tested at any time.

B. Gravity Sewer Leakage Tests: Use low pressure air test as follows:

1. Plug ends of section to be tested.
2. Supply air slowly to the pipe to be tested until the air pressure inside the pipe is 4.0 psi greater than the average back pressure of any groundwater submerging the pipe.
3. Disconnect air supply and allow a minimum of two minutes for stabilization of pressure.
4. Following stabilization period measure drop in pressure over the test period within the following times:

Nominal Pipe Size (in.)	Test Period (min.)
4	4
6	4
8	6
10	6
12	7
15	8
18	9
21	11
24	13

5. Acceptable drop: No more than 1.0 psi.

C. Deflection Test for PVC Gravity Sewer Pipe: Test 100% of pipe with "GO-NO-GO" gauge allowing maximum deflection per ASTM D3034.

D. TV Inspection: All sewers may be inspected by the OWNER using TV pipe inspection. Defects in materials and/or workmanship found during the inspection shall be corrected by the CONTRACTOR.

E. Repair all pipes not passing tests, using materials and methods approved by the ENGINEER, and retest.

END OF SECTION 333000

SECTION 334000 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install storm sewer system as shown on the Drawings. This includes:

1. Storm drain piping
2. Repairs to existing pipe damaged during construction
3. Precast manholes, catch basins and precast concrete structures and their appurtenances as called out on the plans
4. Concrete encasement as necessary for utility crossings
5. Foundation drain
6. Connection to existing systems
7. Installation of tree box filter and all associated appurtenances

1.2 REFERENCES

A. Specification Sections:

1. Earth Moving: Refer to Section 31 20 00
2. Erosion and Sedimentation Controls: Refer to Section 31 25 13

B. State of Maine Department of Transportation “Standard Specifications – Revision of December 2002”

C. State of Maine Department of Transportation “Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Revisions of December 2002”

D. City of Portland “Technical Manual” 2010

1.3 SUBMITTALS

A. Manufacturer's product data and installation instructions.

B. Anti-floatation calculations for all precast concrete structures, stamped by a Professional Engineer licensed in the State of Maine.

C. Certified copies of tests on pipe units.

D. Construction Records: Record depth and location of the following:

1. Storm drain pipe and structure locations and elevations

2. Repairs to existing pipes.
3. Connection points to storm drainage system, and elevations.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General: Provide fittings of same type and class of materials as pipe. Fitting must have single piece gasket.

B. PVC Non-Pressure Pipe and Services (Storm Drain): 4- through 15-inch Diameter: ASTM D3034 or ASTM D3033, 18- through 27-inch Diameter: ASTM F-679, strength requirement SDR 35; push-on joints, ASTM D3212; gaskets, ASTM F477.

C. Foundation Drain Pipe: Foundation drain pipe shall be perforated 4-inch diameter PVC pipe, conforming to the material requirements for PVC storm drain pipe.

D. Reinforced Concrete Pipe: ASTM C76; Class IV, O-ring gasket joints with rubber gaskets, meeting MDOT specifications.

E. Ductile Iron Pipe: AWWA C151; thickness Class 52 AWWA C150; double cement lined, AWWA C104; push-on joints or mechanical joints with rubber gaskets, AWWA C111; fittings, AWWA C110.

2.2 PRECAST CONCRETE STRUCTURES

A. Base Sections: Precast monolithic construction with steps.

B. Barrel Sections: Precast with steps.

C. Top Sections: Precast eccentric cone with steps.

D. Steps: Polypropylene reinforced with steel rod. Meet OSHA requirements, minimum width 16-inches. Cast into concrete.

E. Pipe to Structure Connections: Connections shall be watertight, expandable pipe sleeve with adjustable expansion ring equal to Press-Boot by Press-Seal Gasket Corp., Fort Wayne, Indiana.

F. Joints Between Precast Sections: Watertight, shiplap-type seal with two rings of one-inch diameter butyl rubber sealant.

G. Inverts: Provide inverts as shown on the Drawings. Configuration to be as required by connecting pipes and as shown on Drawings.

2.3 FRAMES, COVERS, AND GRATES

A. Material: Cast iron, ASTM A48 Class 30

B. Provide frames, covers and grates as identified on the plans

2.4 TREE BOX FILTER

A. Underdrained Box Filter: Use underdrained box filter product by Filterra (www.filterra.com or 1-800-349-3458), sized in accordance with the drawings.

1. Filter shall consist of a precast concrete container together with an underdrain system, filter media, plant material, and a decorative grate landscape cover as detailed on plans.

2.5 MISCELLANEOUS

A. Flexible Couplings: Use and location shall be approved by ENGINEER.

B. Pipe Supports: Saddle type, steel, painted, adjustable, by ITT Grinnell, or approved equal.

C. Marking Tape: Lineguard III by Tri-Sales, Inc., 2-inch wide, green; detectable with magnetic locators, or approved equal.

D. Rigid Insulation: Extruded closed-cell rigid foamed polystyrene, 2-inch thickness, width of trench, Styrofoam HI-60, by Dow Chemical, or approved equal.

E. Frost Barrier: U.V. resistant, high grade polyethylene, minimum thickness six (6) mils.

F. Joint Sealants:

1. Butyl Rubber Sealant: One (1) inch diameter strips manufactured by Kent Seal, or approved equal.
2. Butyl Rubber Caulking: Conform to AASHTO M-198, Type B.

PART 3 - EXECUTION

3.1 INSTALLATION OF GRAVITY PIPE AND FITTINGS

A. Methods: Install in accordance with manufacturer's recommendations. Use a laser beam for line and grade unless otherwise permitted by the ENGINEER. Secure each length of pipe with bedding before placing next length. Plug open ends when work is suspended. Bed pipe as shown on Drawings. A 30-inch minimum cover over the top of PVC pipe and DI pipe should be provided before the trench is wheel-loaded.

B. Grade and Line:

1. Lay pipe to line and grade shown on the Drawings. If grade is not shown, determine elevations of start and finish points for each run of pipe. Lay pipe to a uniform grade between these points.
2. Line and grade may be adjusted by the ENGINEER as required by field conditions.

C. Conditions: Lay pipe in the dry. Do not use installed pipe to remove water from work area.

D. Flush and clean all pipe and remove all debris and materials. Flushing and cleaning methods approved by ENGINEER. Gravity flushing is not acceptable.

E. Connections to Manholes and Catch basins: Provide short length of pipe so that joints are located within 3 feet of inside surface of manholes and catch basins for all pipe.

F. Foundation Drain: Provide 4-inch diameter, perforated PVC pipe around perimeter of proposed building, as indicated on the Drawings. Wrap drain in minimum of 6 inches of crushed stone bedding and nonwoven filter fabric.

3.2 INSTALLATION OF MANHOLES/CATCH BASINS

A. Placement: Place precast bases and structures on compacted bedding material so bottom of structure is plumb and pipe inverts are at proper elevations. Place manhole barrel and top sections in the appropriate height combinations. Plug all lifting holes inside and out with non-shrink grout. Construct manhole inverts in accordance with Drawings.

B. Joints: Follow manufacturer’s instructions for sealing joints between precast sections. Provide two rings of 1 inch diameter butyl rubber sealant. Point joints inside and out with butyl caulk.

C. Frame and Covers:

1. Set to final grade as shown on the Drawings and as specified. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
2. Use two rings of 1 inch diameter butyl rubber sealant between frame and rubber riser. Provide downward force to frame so as to compress the joint, provide a watertight seal, and prevent future settlement. Point compressed joint with butyl rubber caulk sealant.
3. Set manhole frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.

D. Inverts: As specified in paragraph 2.02G of this section.

E. Steps: Replace any steps that are out of plumb and proper horizontal placement.

F. Frost Barriers: Wrap each manhole to the maximum excavation depth or not less than 6 feet below grade, with a minimum of four layers of 6 mils each of the polyethylene.

1. Clean manhole exterior of all dirt and remove any protrusions.
2. Apply a 6-inch wide vertical strip of bituminous waterproofing adhesive from the top of manhole to the greatest excavation depth, but not in excess of 6 feet.

3. Start poly wrap at adhesive strip and proceed around manhole continuously, overlapping adhesive strip a minimum of 24 inches on the final layer.
4. Tuck and pleat poly at top in a continuous manner, minimizing size of folds. Extend poly past top of manhole frame and temporarily tuck remainder inside frame, until final backfill and paving.
5. Paved areas: Cut poly flush with manhole rim after pavement is in place.
6. Unpaved areas: Pull loose ends of poly together, remove excess air and tie off end with galvanized wire. Bury with manhole below grade.

3.3 INSTALLATION OF TREE BOX FILTER

A. Concrete box filters shall be constructed as detailed on the plans, placed on a compacted bed of ¾" crushed stone in conformity with lines and grades detailed on the plans. Any modifications to the elevation or location of the Underdrained Box Filters shall be at the direction of and approval of the ENGINEER.

1. If the unit is stored before installation, the top slab must be placed on the box using the 2x4 wood provided, to prevent any contamination from the site. All internal fittings supplied must be left in place as per the delivery.
2. Undisturbed sub-grade material shall be compacted in place prior to placing crushed stone bedding material. Unsuitable material below sub-grade shall be replaced to the ENGINEER's approval.
3. The unit shall be placed on a compacted bed of 12 inches of ¾" crushed stone. The base of the unit shall be set such that the top of the top slab matches the grade of the top of curb immediately adjacent to unit.
4. Outlet connections shall be aligned and connected to the outlet(s) as detailed on the plans.
5. Once the unit is set, the internal wooden forms and protective mesh cover must be left intact. Remove only the temporary wooden shipping blocks between the box and top slab. The top lid should be sealed onto the box section before backfilling, using a nonshrink grout, butyl rubber or similar waterproof seal. The boards on top of the lid and boards sealed in the unit's throat must NOT be removed. The Supplier will remove these sections at the time of activation. Backfilling around the unit shall be performed in a careful manner, backfilling with MDOT Type "B" Gravel 12 inches (min) either side of the unit, in lifts of 6" (max) on all sides. Backfill Type "B" Gravel shall be compacted to 95% maximum density for each lift. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures", unless directed otherwise in contract documents.
6. Erosion Control: The box filter must not be open to runoff until the area that drains to the filter has been permanently stabilized with pavement or other structures, unless the runoff is diverted around the filter. The subcatchment area shall be kept stable, avoiding erosion and deposition of sediments. Contractor shall not activate the unit by removing the temporary boards. Contractor shall contact Manufacturer upon installation and stabilization of the contributing areas to allow manufacturer to "activate" unit.

3.4 UTILITIES TO BE ABANDONED

A. Close open ends of abandoned underground utilities which are not indicated to be removed. Provide sufficiently strong closures, such as caps or brick and mortar, acceptable to City of Portland to withstand hydrostatic or earth pressure which may result after ends of abandoned utilities have been closed.

B. All abandoned laterals shall be done in accordance with Section 2.6.11 of the City of Portland's Technical Manual.

3.5 TESTING OF STORM DRAINS

A. General: Inspect all storm drain pipes after backfilling. Perform inspection in presence of ENGINEER. A maximum of 1000 feet of pipe may be installed but not tested at any time.

B. TV Inspection: All storm drains may be inspected by the OWNER using TV pipe inspection. Defects in materials and/or workmanship found during the inspection shall be corrected by the CONTRACTOR.

C. Repair all pipes not passing inspection, using materials and methods approved by the ENGINEER, and retest.

END OF SECTION 334000

SECTION 335100 - NATURAL GAS DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Confirm location of existing natural gas lines prior to work.

B. Provide new natural gas service as shown on the plans

C. Relocate existing natural gas service as necessary to complete the work

D. Coordinate all natural gas work with Unitil Corp.

1.2 REFERENCES

A. Specification Sections:

1. Earth Moving: Section 31 20 00

B. Unitil Corp. standard technical specifications

PART 2 - PRODUCTS

2.1 MATERIALS

A. Piping, valves, and fittings shall be provided by Unitil.

B. Bedding, backfill, and surface material shall be as shown on the Drawings.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall coordinate all work with Unitil.

B. Contractor shall field verify the location of the gas line prior to work and notify ENGINEER of potential conflicts.

C. Contractor shall perform excavation and provide bedding, backfill, and surface restoration.

END OF SECTION 335100

SECTION 337119 - ELECTRICAL AND COMMUNICATIONS UNDERGROUND DUCTS AND MANHOLES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Confirm location of existing electrical utilities prior to work.

B. Provide underground electrical duct banks

C. Modify existing electrical manholes

D. Protect existing utility poles

E. Provide new electrical transformers and generator

F. Coordinate all electrical utility work with Central Maine Power

1.2 REFERENCES

A. Specification Sections:

1. Earth Moving: Section 31 20 00

B. Central Maine Power standard technical specifications

PART 2 - PRODUCTS

2.1 MATERIALS

A. For sizes and materials, see Electrical Plans.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall coordinate all work with Central Maine Power.

B. Contractor shall field verify the location of existing electrical utilities prior to work and notify Engineer of potential conflicts.

C. For installation requirements, see Electrical Site Plans.

END OF SECTION 337119