C. WAYNE STEVENS, JR.
PUBLIC SAFETY FACILITY

GLADE – HIGHLANDS REGIONAL INDUSTRIAL PARK

GLADE SPRING, VA 24340

JANUARY 30, 2026

PROJECT MANUAL – VOLUME 2

CONTRACT DOCUMENTS AND SPECIFICATIONS

OWNER:

COUNTY OF WASHINGTON, VIRGINIA
1 GOVERNMENT CENTER PLACE, SUITE A
ABINGDON, VIRGINIA 24210

ARCHITECT / ENGINEER:

THE **LANE** GROUP
Architects – Engineers – Planners
Environmental Specialists
310 WEST VALLEY ST NW
ABINGDON, VA 24210
276.206.8571

TABLE OF CONTENTS

SECTION NO.	SECTION TITLE	
	VOLUME ONE	
	Title Page (Cover)	
	Seal Sheet	
	Table of Contents	
PART I	**GENERAL REQUIREMENTS**	
	Invitation for Bids	
	Instructions to Bidders	AIA A701
	Supplemental Instructions to Bidders	RD 1942-A, Guide 27, Attach. "2"
	Terms and Conditions for Bid	
	Additional Terms and Conditions for Federally Funded Contracts	
	Pre-Bid Question Form	DGS-30-272
PART II	**BID SUBMITTAL DOCUMENTS**	
	Bid Form	DGS-30-220
	Bid Bond	AIA A310
	References	
	Lobbying Certification	
	Debarment and Suspension Certification	
	Vendor eVA Registration Requirements	DGS-30-384
PART III	**CONDITIONS OF THE CONTRACT**	
	Terms and Conditions for Federally Funded Contracts	
	General Conditions of the Contract for Construction	AIA A201-2017
	Attachment to AIA Doc. A201-2017	RD 1942-A Guide 27, Attach. "4"
	Supplemental General Conditions	DGS-30-376
	Labor Standard Provisions	RD Instruction 1940-C, Exhibit A
	Davis Bacon Wage Rates	
PART IV	**CONTRACT FORMS**	
	Notice of Award	DGS-30-068 (CO-9.1)
	Standard Form of Agreement Between Owner and Contractor	AIA A101-2017
	Attachment to AIA Doc. A101-2017	RD 1942-A Guide 27, Attach. "3"
	Exhibit A – Insurance and Bonds	AIA A101-2017
	Performance Bond	AIA A312
	Payment Bond	AIA A312
	Worker's Compensation Certificate of Coverage	DGS-30-076 (CO-9a)
	Notice to Proceed	DGS-30-068 (CO-9.2)
	Application and Certificate for Payment	AIA G702 / G703
	Partial Payment Estimate	RD 1928-18

Affidavit of Payment and Claims	DGS-30-108 (CO-13)
General Contractor Estimate for Change Order	DGS-30-200 (GC-1)
Contract Change Order	AIA G701
Contract Change Order	RD 1924-7
Certificate of Substantial Completion	AIA G704
Certificate of Completion by Architect / Engineer	DGS-30-112 (CO-13.1)
Contractor's Affidavit of Payment of Debts and Claims	AIA G706
Contractor's Affidavit of Release of Liens	AIA G706A
Release of Liens	RD 1924-9
Release of Claimants	RD 1924-10
Consent of Surety to Final Payment	AIA G707
Builder's Warranty	RD 1924-19

PART V GENERAL REQUIREMENTS

Division 1 - Project Requirements

010100	Summary of Work
010400	Procedures and Quality Control
012300	Additive Bid Items
012500	Contract Modification Procedures
012900	Payment Procedures
013000	Submittals
013100	Project Management and Coordination
013200	Construction Progress Documentation
014000	Quality Requirements
015000	Temporary Facilities
016000	Product Requirements
017000	Execution Requirements
017700	Closeout Procedures
017810	Project Record Documents
017820	Operation and Maintenance Data
017900	Demonstration and Training

VOLUME TWO

Title Page (Cover)
Seal Sheet
Table of Contents

PART VI TECHNICAL SPECIFICATIONS

Division 2 – Existing Conditions

This Division is not used.

Division 3 – Concrete

031000 Concrete Forming and Accessories
032000 Concrete Reinforcing
033000 Cast-in-Place Concrete
033543 Polished Concrete Finishing

Division 4 – Masonry

042000 Concrete Unit Masonry
042613 Masonry Veneer

Division 5 – Metals

052100 Steel Joist Framing
053100 Steel Decking
055000 Miscellaneous Metals
057500 Decorative Metal Panels

Division 6 – Wood, Plastics, and Composites

061000 Rough Carpentry
061600 Roof Sheathing / Coverboards
064116 Plastic-Laminate-Faced Architectural Cabinets

Division 7 – Thermal and Moisture Protection

072000 Building Insulation
072140 Foamed-in-Place Masonry Wall Insulation
074116 Insulated Metal Roof Panels
074213 Insulated Metal Wall Panels
075323 EPDM Roofing Membrane
076200 Sheet Metal Flashing and Trim
077100 Roof Specialties
077200 Roof Accessories
079200 Joint Sealants

Division 8 – Openings

081113 Hollow Metal Doors and Frames
081416 Flush Wood Doors
083613 Sectional Overhead Doors
084113 Aluminum-Framed Entrances and Storefronts
085113 Aluminum Windows
087100 Door Hardware (Hardware schedule to be provided by Bid Addendum #1)
088000 Glass & Glazing

Division 9 – Finishes

~~092116 Non – Structural Metal Framing~~ (To be provided by Bid Addendum #1)
092900 Gypsum Board

093013 Ceramic Tiling
~~095113 Acoustical Panel Ceilings~~ (To be provided by Bid Addendum #1)
~~096513 Resilient Base and Accessories~~ (To be provided by Bid Addendum #1)

Division 9 – Finishes

~~099113 Exterior Painting~~ (To be provided by Bid Addendum #1)
~~099123 Interior Painting~~ (To be provided by Bid Addendum #1)
099600 Industrial Protective and Marine Coatings

Division 10 – Specialties

~~101419 Dimensional Letter Signage~~ (To be provided by Bid Addendum #1)
~~102239 Folding Panel Partitions~~ (To be provided by Bid Addendum #1)
~~102800 Toilet, Bath and Laundry Accessories~~ (To be provided by Bid Addendum #1)
104000 Fire Protection Specialties
104400 Specialty Signs
~~105113 Metal Lockers~~ (To be provided by Bid Addendum #1)
105723 Wire Shelving
107313 Metal Canopies
~~107516 Ground Set Flagpoles~~ (To be provided by Bid Addendum #1)

Division 11 – Equipment

This Division is not used.

Division 12 – Furnishings

122413 Manual Roller Window Shade System
123661 Solid Surfacing Countertops

Division 21 – Fire Suppression

See Drawing FP102.

Division 22 – Plumbing

See Drawing MPE101 and MPE102.

Division 23 – Heating, Ventilation & Air Conditioning

See Drawing MPE101 and MPE102.

Division 26 – Electrical

See Drawing MPE101 and MPE102.

Division 31 – Earthwork

311000 Site Clearing

312000 Earthwork for Utilities

313000 Site Grading
313116 Termite Control
314000 Earthwork for Structures
315000 Erosion and Sediment Control

Division 32 – Exterior Improvements

321216 Roadway
~~321713 Parking Bumpers~~ (To be provided by Bid Addendum #1)
321723 Pavement Markings
~~321726 Tactile Warming Surfacing~~ (To be provided by Bid Addendum #1)
329200 Topsoil and Seeding
~~329300 Plants~~ (To be provided by Bid Addendum #1)

Division 33 – Utilities

330100 Water line Construction
330200 Sewer line Construction
330300 Storm Sewer Construction

PART VI EXHIBITS

Temporary Construction Sign for Rural Development Projects

List of Drawings

Boundary Survey by Addison Surveyors dated 01-14-2025

Geotechnical Study by The Lane Group, Inc. dated 11-04-2025

Environmental Report by The Lane Group, Inc. dated February 2025 available upon request.

END OF TABLE OF CONTENTS

SEAL SHEET

COMMONWEALTH OF VIRGINIA D. MICHAEL WEAVER LIC. NO. 9031 01-30-2026 ARCHITECT	COMMONWEALTH OF VIRGINIA MATTHEW R. LANE Lic. No. 34173 1/30/26 PROFESSIONAL ENGINEER
COMMONWEALTH OF VIRGINIA JOHN L. JACOBS Lic. No. 16810 01/30/2026 PROFESSIONAL ENGINEER	COMMONWEALTH OF VIRGINIA DERWIN EUGENE CARTMEL Lic. No. 31491 1/30/26 PROFESSIONAL ENGINEER
COMMONWEALTH OF VIRGINIA JOE W. RIGGS Lic. No. 022741 1-30-26 PROFESSIONAL ENGINEER	COMMONWEALTH OF VIRGINIA ANDREW LEWIS Lic. No. 68421 01-30-2026 PROFESSIONAL ENGINEER

TECHNICAL SPECIFICATIONS

SECTION 031000 – CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

1.2 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Waterstops.
5. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.

a. Location of construction joints is subject to approval of the Architect.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."

2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

   a. Plywood, metal, or other approved panel materials.
   b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      1) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:
   1. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.

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

   1. Minimize joints.
   2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

   1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
   2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

   1. Provide and secure units to support screed strips.
   2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

   1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
   2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer or tool corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

   1. Determine sizes and locations from trades providing such items.
   2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

   1. Construct joints true to line with faces perpendicular to surface plane of concrete.
   2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   3. Place joints perpendicular to main reinforcement.
   4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.

      a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

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

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

O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout:

1. Location of construction joints shall be as indicated on Drawing S101.

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A185, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

B. Steel Tie Wire: ASTM A1064, annealed steel, not less than 0.0508 inch in diameter.

1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 48 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated on the Drawings.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel-reinforcement placement.
2. Steel-reinforcement mechanical splice couplers (if used).

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including formwork, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Structural Notes on Drawing S001.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 312300 "Earthwork for Structures" for drainage fill under slabs-on-ground.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

5. Vapor retarders.
6. Liquid floor treatments.
7. Curing materials.
8. Joint fillers.

B. Design Mixtures: For each concrete mixture. Submit the following in accordance with ACI accepted methods.

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Intended placement method.
10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints are indicated on Drawing S101.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.

3. Aggregates.
4. Admixtures.

C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.

D. Preconstruction Test Reports: For each mix design.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.

B. Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specification for Tolerances for Concrete Construction and Materials."
3. CRSI "Recommended Practice of Placing Reinforcing Bars"
4. AWS D1.4, "Structural Welding Code."
5. ACI "Manual of Standard Practices for Detailing Reinforced Concrete Surfaces."

C. Pre-Installation Conference: Conduct Conference at Project Site.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94 and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.

B. Hot-Weather Placement: Comply with ACI 301and ACI 305.1.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Refer to Section 031000, “Concrete Forming and Accessories.

B. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

2.2 STEEL REINFORCEMENT

A. Refer to Section 032000, “Concrete Reinforcing.”

B. Reinforcing Bars: ASTM A 615/A615M, Grade 60, deformed.

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

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI’s Manual of Standard Practice.”

2.3 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.4 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150, Type I/II, supplemented by Fly Ash.
2. Fly Ash: ASTM C618, Class C or F, 25 percent of cementitious material maximum.

B. Normal-Weight Aggregates: ASTM C33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete.

Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

1. Water-Reducing Admixture: ASTM C494, Type A.
2. Retarding Admixture: ASTM C494, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.

E. Water and Water Used to Make Ice: ASTM C94, potable.

2.5 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F: White.

C. Curing Paper: Eight-feet wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

D. Water: Potable or complying with ASTM C1602.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming, Non-dissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

H. Verify method of curing with polishing and floor covering contractor.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Floor Slab Protective Covering: Eight-feet-wide cellulose fabric.

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned based on laboratory trial mixture or field test data, or both, in accordance with ACI 301.

   1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

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

   1. Fly Ash or Other Pozzolans: 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

   1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.9 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings:

   1. Exposure Class: ACI 318 F1.
   2. Minimum Compressive Strength: 3000 psi at 28 days.
   3. Maximum w/cm: 0.49.
   4. Slump Limit: 5 inches, plus or minus 1 inch.
   5. Air Content:

      a. Exposure Class F1: 2 percent, plus or minus 1 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size.

B. Class B: Normal-weight concrete used for foundation piers:

   1. Exposure Class: ACI 318 F2.
   2. Minimum Compressive Strength: 3000 psi at 28 days.
   3. Maximum w/cm: 0.49.
   4. Slump Limit: 4 inches, plus or minus 1 inch.
   5. Air Content:
      a. 2 percent, plus or minus 1 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size.

C. Class C: Normal-weight concrete used for interior slabs-on-ground:

1. Exposure Class: ACI 318 F0.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.45. No Fly Ash.
4. Minimum Cementitious Materials Content: 470 lb/cu. yd.
5. Slump Limit: 4 inches, plus or minus 1 inch.
6. Air Content:

    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

D. Class D: Normal-weight concrete used for exterior slabs:

1. Exposure Class: ACI 318 F3.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content:
    a. Exposure Classes F3: 5.5 – 6.0 percent, plus or minus 1 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size.

2.10 FABRICATING REINFORCEMENT

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

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94 and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer or tool exterior corners and edges of permanently exposed concrete.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.3 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.4 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

   a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
   b. Remove projections larger than 1/4 inch.
   c. Patch tie holes.
   d. Surface Tolerance: ACI 117 Class B.
   e. Locations: Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete.

2. ACI 301 Surface Finish SF-3.0:

   a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
   b. Remove projections larger than 1/8 inch.
   c. Patch tie holes.
   d. Surface Tolerance: ACI 117 Class A.
   e. Locations: Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.

2. Repeat float passes and straightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12-inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches , and sealed by waterproof tape or adhesive.

            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.

        3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

            a) Water.
            b) Continuous water-fog spray.

b. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

c. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval. Contractor is solely responsible for the appearance and performance of placed concrete product and shall take necessary steps, including testing, repair and/or replacement to provide a suitable final product.

1. No VOIDS allowed in any exposed concrete surfaces. Contractor shall remove and replace all defective concrete as determined by the Architect.

3.12 TOLERANCES

A. Conform to ACI 117.

3.13 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.

3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

   a. Test reports shall include reporting requirements of ASTM C31, ASTM C39, and ACI 301, including the following as applicable to each test and inspection:

      1) Project name.
      2) Name of testing agency.
      3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
      4) Name of concrete manufacturer.
      5) Date and time of inspection, sampling, and field testing.
      6) Date and time of concrete placement.
      7) Location in Work of concrete represented by samples.
      8) Date and time sample was obtained.
      9) Truck and batch ticket numbers.
      10) Design compressive strength at 28 days.
      11) Concrete mixture designation, proportions, and materials.
      12) Field test results.
      13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
      14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

   1. Headed bolts and studs.
   2. Verification of use of required design mixture.
   3. Concrete placement, including conveying and depositing.
   4. Curing procedures and maintenance of curing temperature.
   5. Verification of concrete strength before removal of shores and forms from beams and slabs.
   6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172 shall be performed in accordance with the following requirements:

   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

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

   2. Slump: ASTM C143:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611:

   a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231 pressure method, for normal-weight concrete;

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064:

   a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

6. Compression Test Specimens: ASTM C31:

   a. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
   b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39.

   a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
   b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
   c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:

a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.

1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.14 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit use of pipe-cutting machinery over concrete surfaces.
4. Prohibit placement of steel items on concrete surfaces.
5. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 033000

SECTION 033543 – POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Liquid floor treatments.
2. Polished concrete surface finish requirements.

1.2 ACTION SUBMITTALS

A. Product data.

B. Samples: Actual sample of finished products.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. An installer experienced in performing polished concrete finishing with a minimum of five previous projects similar in material, design, and extent to that indicated for this Project.
2. Trained and certified by manufacturer of polished concrete system materials.
3. Concrete Polishing Craftsman of the Concrete Polishing Council.

B. Polished Concrete Standards: Comply with ACI 310.1.

C. Mockup.

PART 2 - PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear liquid materials for the applications of cleaning solutions, densifiers, and sealers that strengthen or protect polished concrete surfaces.

2.2 POLISHED CONCRETE SURFACE FINISH REQUIREMENTS

A. Aggregate Exposure Class: Class A Cement Fines 85 to 95 percent fines; 5 to 15 percent fine aggregate for a smooth, consistent, and clean look.

B. Polish Concrete Appearance Levels: Level 4: Highly Polished (Very High Gloss) 800-grit and higher polish; DOI 70 to 100; Haze Reading less than 10; Reflective Sheen: High to highest.

C. Slip Resistance: Minimum Dynamic Coefficient of Friction (DCOF) of 0.42. Provide required slip resistance based on final gloss level and determined by the Concrete Polishing Council.

2.3 ACCESSORIES

A. Repair Materials: As recommended in writing by manufacturer to repair and fill cracks, and repair surfaces compatible with polishing materials.

PART 3 - EXECUTION

3.1 APPLICATION

A. Provide polished concrete finishing to comply with approved mockup.

B. Machine grind floor surfaces progressively to receive aggregate and polish appearance levels indicated to match approved mockup.

C. Apply penetrating stain densifier treatment for polished concrete in polishing sequence and in accordance with manufacturer's written instructions, allowing recommended drying time between successive coats.

D. Apply sealers to polished concrete in polishing sequence and in accordance with manufacturers' written instructions.

E. Continue progressively polishing to aggregate and polish appearance levels to match approved mockup for final finish appearance.

F. Visually inspect to remove defects and repolish areas that are defective. Repolish those areas that do not meet specified aggregate and polish levels per approved mockup.

G. Complete edges of floor finish that adjoins surrounding floor areas in a sharp and clean manner.

H. Neutralize and clean polished floor surfaces.

I. Protect installed polished concrete surfaces from damage during construction in accordance with manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests at three random locations for areas up to 100 sq. ft. and inspections and to submit reports.

B. Measure polish specular gloss level, DOI, and haze as specified; repolish if required to achieve Project requirements.

C. Verify aggregate exposure as specified. Machine surfaces if required to achieve Project requirements.

D. Verify compliance of slip resistance to comply with specified slip-resistance rating.

E. Prepare test and inspection reports.

END OF SECTION 033543

SECTION 042000 – UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Steel reinforcing bars.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 QUALITY ASSURANCE

A. Manufacturer: Obtain masonry units from one manufacturer and of one uniform texture and color.

B. Comply with recommendations of ACI 530.1/ASCE6/TMS 602, "Specifications for Masonry Structures."

C. Coordinate with other disciplines, (i.e., electrical trade), for the concealment of all gang boxes, conduits, etc.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product. For masonry units, include data on material properties.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109 for compressive strength, ASTM C1506 for water retention, and ASTM C91 for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.6 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.
   2. Pattern and Texture: Standard pattern, ground-face finish and standard pattern, split-face finish.

C. CMUs: ASTM C90.

   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
   2. Density Classification: Lightweight.

D. CMU Lintels: ASTM C1623, matching CMUs in split-face texture, and density classification. Provide lintels with net-area compressive strength not less than that of CMUs.

E. CMU Sill Blocks: Solid units with smooth-ground chamfered top outside edge. ASTM C1623, matching CMUs in split-face texture, and density classification.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Masonry Cement: ASTM C91.

C. Hydrated Lime: ASTM C207, Type S.

D. Sand: ASTM C144.

E. Aggregate for Mortar: ASTM C144.

F. Aggregate for Grout: ASTM C404.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

H. Water: Potable.

2.4 REINFORCEMENT

A. Continuous Masonry Wire Reinforcing: Truss type, 9 gage welded steel wire, 0.8 ounce hot-dip zinc coating (after fabrication), width 1-1/2" to 2" less wall thickness. All joint reinforcing, and all anchors embedded in masonry shall be galvanized.

B. Uncoated-Steel Reinforcing Bars: ASTM A615 or ASTM A996, Grade 60.

C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

D. Masonry-Joint Reinforcement, General: ASTM A951.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.5 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82, with ASTM A153, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008, Commercial Steel, with ASTM A153, Class B coating.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226, Type I (No. 15 asphalt felt).

2.7 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use masonry cement mortar unless otherwise indicated.
3. For exterior masonry, use masonry cement mortar.
4. For reinforced masonry, use masonry cement mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.

C. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.

3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

C. Cut masonry units with a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to fit adjoining work neatrly. Use full units without cutting wherever possible.

D. Frozen Materials and Work: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen work. Remove and replace masonry work damaged by frost or freezing.

E. Do not lower the freezing point of mortar by use of admixtures or anti-freeze agents. Do not use calcium chloride in mortar and grout. Refer to ACI 1/ASCE 6/TMS602 and 5/TMS 402 for hot and cold conditions for masonry installations.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.

3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations. Lay-up walls plumb and true and with courses level, accurately spaced and coordinated with other work.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items. Fill space between hollow metal frames and masonry solidly with mortar. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar and grout into core.

D. Coordinate with other disciplines, (i.e., electrical trade), for the concealment of all gang boxes, conduits, etc.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls which are to be concealed or to be covered with other direct-applied finishes (other than paint) unless otherwise indicated.

E. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher unites which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.5 CAVITY WALLS

A. Bond wythes of cavity walls together as follows:

1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes or tab-type reinforcement.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.6 MASONRY-JOINT REINFORCEMENT

A. Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch of exterior side of walls and 1/2 inch at other locations. Lap reinforcement a minimum of 6 inches at ends of units. Do not bridge control and expansion joints with reinforcing except at walls openings. Cut and bend units as directed by manufacturer for continuity at returns, offsets, pipe enclosures and other special conditions. Space continuous horizontal reinforcing not more than 16 inches o.c. vertically.

B. Reinforce masonry openings greater than 1 foot with horizontal joint reinforcing placed in 2 horizontal joints approximately 8 inches apart, both immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 2 feet beyond the jambs of the opening.

3.7 LINTELS

A. Provide precast masonry lintels wherever openings of more than 1 foot are shown. Thoroughly cure precast lintels before handling and installation.

B. Provide a minimum bearing at each jamb of 4 inches for openings less than 6 feet and 8 inches for wider openings.

3.8 REINFORCED UNIT MASONRY

A. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.9 GROUTING

A. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist group pressure.

B. Comply with requirements of ACI 530/ASCE6/TMS602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

E. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

G. Prism Test: For each type of construction provided, according to ASTM C1314 at seven days and at 28 days.

3.11 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.12 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick.
2. Mortar materials.
3. Ties and anchors.
4. Embedded flashing.
5. Accessories.
6. Mortar mixes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type and color of brick and colored mortar.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product.

1.4 MOCKUPS

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction, typical exterior and interior walls in sizes approximately 72 inches long x 48” high.

1.5 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.

2.2 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C216.
1. Basis of Design for face brick shall be Glen-Gery “Belgian Grey Wire Cut”.
2. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
3. Size (Actual Dimensions): 2 1/4” high x 7 5/8” long x 3 5/8” thick.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.
2. Pattern and Texture: Standard pattern, ground-face finish and standard pattern, split-face finish.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

E. Colored Cement Products: Packaged blend made from Portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Masonry Cement:

a. Match color of face brick veneer to achieve a monolithic appearance.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture as recommended by manufacturer for use in masonry mortar of composition indicated.

G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

H. Water: Potable.

2.5 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
2. Stainless Steel Wire: ASTM A580/A580M, Type 304.
3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire.

2. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized steel or stainless steel wire.

D. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from **0.1084-inch-thick steel sheet, galvanized after fabrication**.
3. Fabricate wire ties from **0.187-inch** diameter, **hot-dip galvanized steel** wire unless otherwise indicated.
4. Masonry-Veneer Anchors; Vertical Slotted L-Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting vertical leg with slotted hole for wire tie **and washer at face of insulation**.
5. Masonry-Veneer Anchors; Double-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double pintle wire tie. **Provide with seismic tie, clip, and continuous wire in veneer.**

2.6 EMBEDDED FLASHING

A. Flexible Flashing: Use **one of** the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 40 mil.

2. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 40 mil.
3. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of polyester-reinforced ethylene interpolymer alloy.

   a. Monolithic Sheet: Elastomeric thermoplastic flashing, 40 mil thick.
   b. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 25 mil thick, with a 15-mil-thick coating of adhesive.

4. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 40 mil thick.

B. Drainage Plane Flashing: Fabricate from rubberized asphalt, elastomeric membrane and drainage membrane to shapes indicated, including weep tabs, termination bar and drip edge. Provide flashing materials as follows:
1. Rubberized Asphalt: 40 mil thick.
2. Elastomeric Membrane: EPDM complying with ASTM D463740 mil.
3. Fabricate continuous flashings in sections 60 inches long, minimum.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Termination Bars for Flexible Flashing: **Aluminum** or **Stainless steel 1/8 inch by 1 inch**.

F. Termination Bars for Flexible Flashing, Flanged: [**Stainless steel sheet 0.019 inch by 1-1/2 inches (0.48 mm by 38 mm)**] [**Aluminum sheet 0.064 inch by 1-1/2 inches (1.63 mm by 38 mm)**] with a 3/8-inch (10-mm) flange at top [**and bottom**].

2.7 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

B. Weep/Vent Products: Use the following unless otherwise indicated:

1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

a. Match color of brick veneer.

C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

D. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.8 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use masonry cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Use Type N unless another type is indicated.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Application: Use pigmented mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond pattern. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

3.4 MORTAR BEDDING AND JOINTING

A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached and seismic anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed connector sections and continuous wire in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

3.6 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier or air barrier, lapping at least 4 inches.
3. At lintels, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.

C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors to access scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Inspections: Special inspections in accordance with Level 2 in TMS 402.

C. Testing Prior to Construction: One set of tests.

D. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.

E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

3.8 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.9 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042613

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. KCS-series steel joists.
3. Steel joist accessories.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vulcraft

B. New Millennium

2.2 STEEL JOISTS

A. K-Series Steel Joist: Manufactured steel joists of type indicated in accordance with "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

2.3 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.4 STEEL JOIST ACCESSORIES

A. Bridging:

1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories.

B. Apply one coat of shop primer to joists and joist accessories.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction in accordance with SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.
   1. Space, adjust, and align joists accurately in location before permanently fastening.
   2. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds in accordance with AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Certificates:

1. Welding certificates.
2. Product Certificates: For each type of steel deck.

D. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that power-actuated mechanical fasteners comply with requirements.
2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

E. Field Quality-Control Submittals:

1. Field quality-control reports.

F. Qualification Statements: For welding personnel.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding code:

a. AWS D1.3/D1.3M.

B. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its "RoofNav" for Class 1 fire rating and [**Class 1-60**] [**Class 1-75**] [**Class 1-90**] windstorm ratings. Identify materials with FM Approvals Certification markings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel, Grade 33, G60 zinc coating.

2. Deck Profile: Type WR, wide rib
3. Profile Depth: 1-1/2 inches.
4. Design Uncoated-Steel Thickness: 0.0295 inch.
5. Span Condition: triple span or more.
6. Side Laps: Overlapped

2.3 ACCESSORIES

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

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

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, **0.0598 inch** thick, with factory-punched hole of 3/8-inch minimum diameter.

G. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and [**level**] [**sloped**] recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

H. Galvanizing Repair Paint: ASTM A780/A780M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

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

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

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

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

3.2 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 6 inches apart.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or **12 inches** and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

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

1. End Joints: Lapped 2 inches (50 mm) minimum

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

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. [**Weld**] [**or**] [**mechanically fasten**] to substrate to provide a complete deck installation.

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

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

3.3 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

a. Field welds will be subject to inspection.

2. Steel decking will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 053100

SECTION 055000 - MISCELLANEOUS METALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 CODES AND STANDARDS: AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings"; AWS "Structural Welding Code"; comply with applicable provisions unless otherwise indicated.

1.3 SHOP DRAWINGS AND DATA: Show complete details and instructions for fabrication, assembly, and installation. Furnish anchor bolts required for installation in other work; furnish templates for bolt installation.

PART 2 - MATERIALS

2.1 INSERTS AND ANCHORAGES

A. Furnish inserts and anchoring devices to be built into other work for installation of miscellaneous metal items; coordinate delivery to job site to avoid delay.

B. Concrete Inserts: Malleable iron (ASTM A 47) or cast steel (ASTM A 27) inserts, with steel bolts, washers and shims; hot dip galvanized.

2.2 FERROUS METALS

A. STEEL PLATES, ANGLES, BARS: ASTM A 36, Grade 50.

B. WIDE FLANGE SHAPES: ASTM A 572, Grade 50.

C. COLD-FORMED STEEL TUBING: ASTM A 500, Grade B.

D. STEEP PIPE: ASTM A 53, Type F or S, Grade A, Standard Weight (Schedule 40).

E. COLD-ROLLED STEEL SHEETS: ASTM A 366.

2.3 PAINT

A. SHOP PAINT: SSPC-Paint 13. Apply to cleaned and degreased steel surfaces at rate to provide a 2.0-mil dry film thickness.

B. GALVANIZING: ASTM A 386 for assembled parts; A153 for iron and steel hardware.

2.4 FABRICATION, GENERAL

A. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Shop-paint all items not specified to be galvanized after fabrication.

1. Cut shapes and holes continuously, grind edges smooth and flush.
2. Consult with architect regarding available templates.

B. Weld corners and seams continuously; grind exposed welds smooth and flush.

C. Form exposed connections with hairline, flush joints; use concealed fasteners where possible.

2.5 ROUGH HARDWARE: Furnish custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes for framing and supporting and anchoring work.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS: Provide as required to complete work and not included with structural steel framework. Fabricate of welded construction in as large units as possible; drill and tap as required to receive hardware and similar items. Include required anchors for building into other work; spaced not more than 24" o.c.

2.7 MISCELLANEOUS STEEL TRIM: Fabricate to shapes and sizes as required for profiles shown; continuous smooth exposed edges. Provide cutouts, fittings, and anchorages; coordinate assembly and installation with other work.

PART 3 - INSTALLATION

3.1 Perform cutting, drilling, and fitting required for installation; set work accurately in location, alignment, and elevation, measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other work.

3.2 Set loose items on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 1 part Portland cement to 3 parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material.

3.3 Touch-up shop paint after installation. Clean bolted connections and abraded areas and apply same type paint as used in shop. Use galvanizing repair paint on damaged galvanized surfaces.

END OF SECTION 055000

SECTION 057500 - DECORATIVE FORMED METAL (Additive Bid Item #1)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal privacy screens at Maintenance Bays. (Additive Bid Item #1).

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Show fabrication and installation details for decorative formed metal.

   1. Include plans, elevations, component details, and attachment details.
   2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

C. Samples: For each type of exposed finish required, prepared on 12-inch square Samples of metal of same thickness and material indicated for the Work.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For decorative formed metal elements that house items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.

B. Evaluation Reports: For post-installed anchors, from ICC-ES.

PART 2 - PRODUCTS

2.1 SHEET METAL

A. General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Aluminum Sheet: Flat sheet complying with ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of not less than Alloy 5005-H32.

2.2 MISCELLANEOUS MATERIALS

A. Gaskets: As required to seal joints in decorative formed metal and remain weathertight; as recommended in writing by decorative formed metal manufacturer.

1. ASTM D1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
2. Closed-cell polyurethane foam, adhesive on two sides, release paper protected.

B. Sealants, Exterior: Elastomeric sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.

C. Sealants, Interior: Nonsag, paintable sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.

D. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as necessary for strength, corrosion resistance, and compatibility in fabricated items.

1. Use filler metals that will match the color of metal being joined.

E. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated.

1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

F. Anchor Materials:

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5, unless otherwise indicated.

G. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal and is noncombustible after curing.

H. Isolation Coating: Manufacturer's standard alkali-resistant coating.

2.3 FABRICATION, GENERAL

A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Fold back exposed edges of unsupported sheet metal to form a wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch and support with concealed stiffeners.

C. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness and sufficient strength for indicated use.

1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

D. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

2.4 METAL PANELS

A. Basis of Design Product as manufactured by Direct Metals Company, LLC, 3775 Cobb International Road, Kennesaw, GA 30152-4390, Phone: 770-528-9001, email: info@directmetals.com.

Panel Style: Perforated Metal, Square Hole Type, 3/4" Square on 1" Straight Centers, 1 hole per square inch, 56% open.

Listing Direct Metals Company, LLC as a Basis of Design product is not meant to be proprietary. Other manufacturers who regularly engage in the manufacture / fabrication of similar products will be give consideration as equal products.

B. Form closures and trim from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction, with weathertight joints at exterior installations.

1. Aluminum Sheet: 14 gage.

   a. Finish: Clear Anodic.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

D. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

E. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 057500

SECTION 061000 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood blocking, cants, and nailers.
2. Wood furring and grounds.
3. Wood sleepers.
4. Plywood backing panels.

B. Related Requirements:

1. Section 061600, "Sheathing."

1.2 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Engineered wood products.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber rom weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Framing: Construction or No. 2 grade.

1. Application: Soffit and end wall framing. Blocking.
2. Species:

a. Southern pine or mixed southern pine; SPIB.

3. Application: Framing other than interior partitions.

2.4 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
   1. Extreme Fiber Stress in Bending, Edgewise: As indicated.
   2. Modulus of Elasticity, Edgewise: As indicated.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

   1. Blocking.
   2. Nailers.
   3. Furring.
   4. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 15 percent maximum moisture content and the following species and grades:

   1. Mixed southern pine or southern pine; No. 2 grade; SPIB.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304/305/316 stainless steel.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

D. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washters.

2.8 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Simpson Strong-Tie Co., Inc.
   2. MiTek Products

B. Allowable design loads, as published by manufacturer, shall meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653, G60 (Z180) coating designation.

   1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch thick.

   1. Use for wood-preservative-treated lumber and where indicated.

2.9 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install shear wall panels to comply with manufacturer's written instructions.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 – ROOF SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof Sheathing / Coverboard.

B. Related Requirements:

1. Section 061000, “Rough Carpentry”.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 POLYISO COVERBOARDS

A. High-Density (HD) Poly ISO Board

B. 1/2" thick, R = 2.5+/-.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide insulation screws and 2 to 3 inch metal plates as manufactured by GenFast or Henry.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code" and as indicated on the drawings.

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

END OF SECTION 061600

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Research reports.

C. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

1.7 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Face frame.

D. Door and Drawer-Front Style: Reveal overlay.

1. Reveal Dimension: 1/2 inch.

E. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.

F. Exposed Surfaces:

1. Plastic-Laminate Grade: VGS.
2. Edges: Grade VGS.

G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join sub fronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners,

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish.
b. Wood grains, matte finish.
c. Patterns, matte finish.

2.2 CABINET HARDWARE AND ACCESSORIES

A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."

B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch-thick metal, and as follows:

1. Semi concealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.
2. Semi concealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.

C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

D. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141

E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.

F. Drawer Slides: ANSI/BHMA A156.9.

1. Standard Duty (Grade 1 and Grade 2): Side mount.

G. Door Locks: ANSI/BHMA A156.11, E07121.

H. Drawer Locks: ANSI/BHMA A156.11, E07041.

I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

J. Grommets for Cable Passage: 1-1/4-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: Black.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
   1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
   2. Satin Stainless Steel: ANSI/BHMA 630.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Type I, waterproof type as selected by fabricator to comply with requirements.

2.4 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

C. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual."

   1. For glass in frames, secure glass with removable stops.
   2. For exposed glass edges, polish and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips

3.2 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

END OF SECTION 064116

SECTION 072000 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE: The extent of thermal insulation work is shown on the Plans, by the generic name or by its abbreviation.

1.3 APPLICATION

A. The applications of thermal insulation specified in this section include the following:

1. Blanket-type glass-fiber building insulation.
2. Polyisocyanurate rigid board insulation.

1.4 THERMAL CONDUCTIVITY: The R-Values shown are for the thermal resistance specified for each material. Provide adjusted thicknesses as directed for the equivalent use of material having a different thermal conductivity.

1.5 FIRE PERFORMANCE CHARACTERISTICS

A. Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristic: ASTM E 84.
2. Fire Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.6 SUBMITTALS

A. Submit manufacturer's specifications and installation instructions for each type of insulation required. Include data substantiating that materials comply with specified requirements. Indicate by transmittal that insulation contractor has received a copy of manufacturer's instructions.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

A. Building Thermal Insulation: Glass-Fiber Blanket Insulation, Unfaced, ASTM C665, Type I passing ASTM E136 for combustion characteristics.
   1. Provide thicknesses and R-values indicated Drawings.

B. Under-slab perimeter insulation: Polyiso. rigid cellular thermal board insulation, ASTM C1289, Type II.

1. 2 1/2" thickness, R-15.
2. Water Absorption: <1% by volume per ASTM C209.

PART 3 - EXECUTION

3.1 PRODUCT HANDLING

A. Protection from Deterioration: Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

B. Protect plastic insulation from exposure to sunlight.

3.2 FIRE HAZARD: Do not deliver plastic insulating materials to the project site ahead of installation time. Protect at all times against ignition. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

3.3 EXAMINATION OF SUBSTRATE: The Installer must examine the substrate and the conditions under which the insulation work is to be performed and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the insulation work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.4 MANUFACTURER'S INSTRUCTIONS: Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.

3.5 INSTALLATION

A. Extend insulation full thickness as shown on the Plans over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

B. Apply a single layer of insulation of the required thickness, unless otherwise shown, or required to make up the total thickness.

C. Apply insulation units to the substrate by the method indicated, complying with the manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage, to provide permanent placement and support of units.

E. Set vapor barrier faced units with vapor barrier to warm side of construction, except as otherwise shown. Do not obstruct ventilation spaces, except for fire stopping.

END OF SECTION 072000

SECTION 072140 - FOAMED-IN-PLACE MASONRY WALL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY: The extent of foamed-in-place insulation work is limited to hollow cells of exterior concrete masonry unit walls.

1.3 SUBMITTALS

A. Submit manufacturer's specifications and installation instructions. Include data substantiating that materials comply with specified requirements. Indicate by transmittal that insulation contractor has received a copy of manufacturer's instructions.

B. Submit copies of certified test reports indicating compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.

C. Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CRF 1910 1200.

1.4 QUALITY ASSURANCE

A. Provide insulation produced by a single approved manufacturer. Provide product pre-mixed to ensure consistency.

B. Engage an experienced applicator who has been trained and licensed by the product manufacturer and who has not less than five (5) years' experience with the installation of the product provided.

C. Provide one year product and installation warranty.

D. Provide insulation materials which are identical to those whose fire performance characteristic, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by a testing agency acceptable to authorities having jurisdiction.

Fire Resistance Ratings: ASTM E 119
Surface Burning Characteristics: ASTM E 84
Combustion Characteristics: ASTM E 136

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN PRODUCT AND MANUFACTURER

A. The Basis of Design product shall be "Core-Fill 500", as manufactured by Tailored Chemical Products, P. O. Drawer 4186, Hickory, NC 28663. Telephone: (800) 627-1687
B. Specifying the "Core-Fill 500" product is not meant to be proprietary. Similar insulating products as

manufactured by Air Krete, Inc. and CP Chemical Company (Tripolymer) shall be given consideration as equal products.

2.2 INSULATING MATERIALS

A. Provide insulating materials which comply with requirements for materials, compliance with referenced standards, and other characteristics.

B. Foamed-In-Place Insulation: Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow concrete masonry unit walls.

1. Surface Burning Characteristics: Maximum flame spread, smoke developed, and fuel contributed of 0, 5 and 0 respectively.
2. Combustion Characteristics: Must be noncombustible, Class A building material.
3. Thermal Values: "R" value of 4.91/inch at 32 degrees F mean; ASTM C 177.
4. Sound Abatement: Minimum Sound Transmission Class ("STC") rating of 53 and minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8-inch wall assembly (ASTM E 90-90).

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Application Assemblies: CMU Walls, 8-inch concrete masonry units.

B. Protect plastic insulation from exposure to sunlight.

3.2 INSTALLATION OF FOAMED-IN-PLACE INSULATION

A. Install foamed-in-place insulation from interior prior to installation of finish work and after all masonry and structural concrete work is in place. Comply with manufacturer's instructions.

B. Fill all open cells and voids in hollow concrete masonry unit walls. Inject foam insulation through a series of 5/8-inch to 7/8-inch holes drilled into every vertical column of block cells (every 8-inches on center), beginning at an approximate height of four (4) feet above finished floor level. Repeat this procedure at the top of the wall (approximately 8 feet above floor level) until all cells are completely filled. Patch holes with mortar and score to resemble the CMU surface.

END OF SECTION 072140

SECTION 074116 - INSULATED METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standing-seam-profile, foamed-insulation-core metal roof panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product data.

B. Shop drawings.

C. Samples: Manufacturer's standard color charts, showing full range of available colors for each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Qualification statements.

C. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of insulated metal roof panel systems that fail in materials or workmanship within specified warranty period.

   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace insulated metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide insulated metal roof panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E72:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E1680 or ASTM E283at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646 or ASTM E331at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft.

D. Watertightness: No water penetration when tested in accordance with ASTM E2140 for hydrostatic-head resistance.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

F. FM Approvals Listing: Provide insulated metal roof panels and component materials that comply with requirements in FM Approvals 4471 as part of a panel roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-90,
2. Hail Resistance: SH.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient.

H. Energy Performance:

1. Provide roof panels according to one of the following when tested in accordance with CRRC-1:
    a. Three-year, aged Solar Reflectance Index of not less than [**64**] <**Insert value**> when calculated in accordance with ASTM E1980.

2.2 INSULATED METAL ROOF PANELS, GENERAL

A. Provide factory-formed metal roof panels fabricated from two sheets of metal with insulation core foamed in place during fabrication with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Panel Performance:

    a. Flatwise Tensile Strength: 30 psi when tested in accordance with ASTM C297/C297M.
    b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for seven days at 140 deg F and 100 percent relative humidity in accordance with ASTM D2126.
    c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at 200 deg F in accordance with ASTM D2126.
    d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at minus 20 deg F in accordance with ASTM D2126.
    e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20 lbf/sq. ft. positive and negative wind load and with deflection of L/180 for 2 million cycles.
    f. Autoclave: No delamination when exposed to 2 psi pressure at a temperature of 212 deg F for 2-1/2 hours.
    g. Fire-Test-Response Characteristics: Class A in accordance with ASTM E108.

2. Insulation Core Foam: Foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.

    a. Closed-Cell Content: 90 percent when tested in accordance with ASTM D6226.
    b. Density: 2.0 to 2.6 lb/cu. ft. when tested in accordance with ASTM D1622.
    c. Compressive Strength: Minimum 20 psi when tested in accordance with ASTM D1621.
    d. Shear Strength: 26 psi when tested in accordance with ASTM C273/273M.

2.3 STANDING-SEAM-PROFILE, FOAMED-INSULATION-CORE METAL ROOF PANELS

A. Panels: Vertical ribs along one side of exterior face sheets are mechanically seamed on-site with vertical ribs of adjacent exterior face sheets. Concealed clips in the seams are anchored to supports by screws through the interior face sheet. Interior face sheets provide a tongue-and-groove interlock at joints.

1. Panel Coverage: 36 inches.

2. Panel Thickness: 3.0 inches.

3. Exterior Face Sheet:

    a. Material: Metallic-coated steel sheet.
    b. Nominal Thickness: 0.0299 inch.
    c. Texture: Manufacturer's standard.
    d. Finish: Siliconized polyester..
    e. Color: As selected by Architect from manufacturer's full range.

4. Interior Face Sheet:

    a. Material: Metallic-coated steel sheet.
    b. Nominal Thickness: 0.0239 inch.
    c. Texture: Manufacturer's standard.
    d. Finish: Siliconized polyester.
    e. Color: As selected by Architect from manufacturer's full range.

5. Insulation Core: Polyisocyanurate foam.
6. Thermal-Resistance Value (R-Value): 26.2 in accordance with ASTM C1363.
7. Clips: Manufacturer's standard clips to accommodate thermal movement.

    a. Clip Size and Spacing: As indicated on approved Shop Drawings.

2.4 PANEL FACING MATERIALS

A. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

2.5 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, minimum ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 coating designation. Provide manufacturer's standard sections as required for support and alignment of insulated metal roof panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system, including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of insulated metal roof panels unless otherwise indicated.

    1. Closures: Provide closures at eaves and ridges, fabricated of same metal as insulated metal roof panels.
    2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match insulated metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as exterior facings of insulated metal roof panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent insulated metal roof panels.

D. Gutters: Formed from same material, finish, and color as exterior facings of panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, of size and metal thickness in accordance with manufacturer's recommendations. Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels and roof fascia and rake trim.

E. Downspouts: Formed from same material, finish, and color as exterior facings of roof panels. Fabricate in 10 ft.-long sections, complete with formed elbows and offsets, of size and metal thickness in accordance with manufacturer's recommendations. Finish downspouts to match gutters.

F. Roof Curbs: Fabricated from same material, finish, and color as exterior facings of roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch-nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

1. Insulate roof curb with 1-inch-thick, rigid insulation.

G. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide EPDM or PVC sealing washers for exposed fasteners.

1. Galvanized-Steel Fasteners: Provide exposed fasteners with heads matching color of insulated metal roof panels by means of plastic caps or factory-applied coating.

H. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in insulated metal roof panels and remain weathertight; and as recommended in writing by insulated metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.6 FABRICATION

A. Fabricate and finish insulated metal roof panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate insulated metal roof panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's recommendations.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by insulated metal roof panel manufacturer.

    a. Size: As recommended by insulated metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.7 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Exterior Facings and Accessories:

1. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

D. Interior Facings:

1. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, insulated metal roof panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

B. Examine roughing-in for components and systems penetrating insulated metal roof panels to verify actual locations of penetrations relative to seam locations of insulated metal roof panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and insulated metal roof panel manufacturer's written recommendations.

3.3 INSTALLATION OF INSULATED METAL ROOF PANELS

A. General: Install insulated metal roof panels in accordance with manufacturer's written instructions and approved Shop Drawings in orientation, sizes, and locations indicated on Drawings. Anchor insulated metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal roof panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
2. Shim or otherwise plumb substrates receiving insulated metal roof panels.
3. Flash and seal insulated metal roof panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by insulated metal roof panels are installed.

4. Install screw fasteners in predrilled holes.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install flashing and trim as insulated metal roof panel work proceeds.
7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
8. Align bottoms of insulated metal roof panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
9. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners: Use galvanized steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor insulated metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by insulated metal roof panel manufacturer.

E. Lap-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full-rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or applications not true to line.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of insulated metal roof panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Provide sealant tape at lapped joints of insulated metal roof panels and between panels and protruding equipment, vents, and accessories.
5. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to weatherproof panels.

F. Standing-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so cleat, insulated metal roof panel, and factory-applied side-lap sealant are completely engaged.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete insulated metal roof panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by insulated metal panel manufacturers; or, if not indicated, provide types recommended in writing by metal roof panel manufacturer.

H. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. Provide concealed fasteners where possible and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

I. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

J. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Connect downspouts to underground drainage system indicated.

K. Roof Curbs: Install flashing around bases where they meet metal roof panels.

L. Pipe and Conduit Penetrations: Fasten and seal to metal roof panels as recommended by manufacturer.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as insulated metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of insulated metal roof panel installation, clean finished surfaces as recommended by insulated metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace insulated metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074116

SECTION 074213 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foamed-insulation-core metal wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FOAMED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

1. Basis of Design product shall be "CF Architectural Vertical Metal Wall Panel" as manufactured by Metl Span.
   a. Coverage width: 24".
   b. Thermal Value: R-17.5
   c. Exterior Face: G-90 galvanized or AZ-50 aluminum-zinc coated steel in 22 Ga.
   d. Interior Face: G-90 galvanized or AZ-50 aluminum-zinc coated steel in 26 Ga.
   e. Fluropon finish in color selected by the Architect from manufacturer's standard colors. (Arctic White, Regal Gray, or Carbon Gray for exterior color. Igloo White for interior color).
   f. Joints: Offset double tongue-in-groove with extended metal shelf for positive face fastening.
   g. Thickness: 2-inches.
2. Thermal-Resistance Value (R-Value): 17.5 in accordance with ASTM C1363.

C. Listing "CF Architectural Vertical Metal Wall Panel", as manufactured by Metl Span is not meant to be proprietary. Manufacturers who regularly engage in the manufacture / fabrication of similar products will be given consideration as equal products.

2.2 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub framing and Furring: As required by manufacturer for securing to prefabricated metal building structure.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.

2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.3 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.4 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to

exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal panel manufacturer's written recommendations.

3.2 INSTALLATION OF INSULATION-CORE METAL WALL PANELS

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.

B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.

1. Install clips to supports with self-tapping fasteners.

C. Laminated-Insulation-Core Metal Wall Panels:

1. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with manufacturer's standard gaskets.

2. Wrapped-Edge Panels: Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.
3. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.

    a. Horizontal Joints: Maintain reveal joint of consistent width. Seal joints with manufacturer's standard gaskets.
    b. Vertical Joints: Maintain reveal joint of consistent width] Seal joints with manufacturer's standard gaskets.

4. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.

D. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

E. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074213.19

SECTION 075323 – ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Mechanically fastened EPDM Membrane Roofing System.
2. Accessory roofing materials.
3. Roof insulation.
4. Insulation accessories and cover board.
5. Walkways.

1.3 PERFORMANCE REQUIREMENTS

A. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

B. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

C. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details and penetraions.
4. Tapered insulation, thickness, and slopes.
5. Roof Plan indicating orientatin of steel roof deck and orientation of roof membrane and fastening spacings and patters for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field of roof locations.

C. Samples: For each product included in the roofing system.

1. Roof membrane and flashings of color required.
2. Walkway pads or rolls, of color required.

D. Research/evaluation reports.

E. Field quality-control reports.

F. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

B. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing.

C. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

D. Materials Certification:

1. All materials shall be labeled with ASTM certification numbers or other specified product certifications or the Contractor shall give the A/E the roofing manufacturer's certification that the roofing materials being furnished comply with specified ASTM and approved standards.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.7 PRE-ROOFING CONFERENCE

A. A pre-roofing conference is required and shall be held before ordering roofing materials.

B. Representatives of the Owner, Architect, General Contractor, Roofing Contractor, Mechanical Contractor and Electrical Contractor shall attend.

C. Review of all plans, specifications, flashing details, work scheduling, and workmanship standards is required. Problems and discrepancies shall be resolved.

D. A written record of proceedings shall be prepared and made part of the job record.

1.8 WARRANTY

A. The Contractor shall furnish, as a minimum, a manufacturer's 20-year total system material and labor warranty / guarantee with no monetary limitations (NL no dollar limit).

B. The Contractor shall provide a workmanship warranty agreeing to maintain the entire roof system(s) in a completely watertight condition, at not cost to the Owner, for two (2) years from date of final acceptance. Sheet metal flashing incidental to the roofing shall be covered under the manufacturer's warranty.

C. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet.

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

a. Carlisle SynTec Incorporated, "Sure White."
b. Johns Manville, "JM White".
c. Elevate, "EcoWhite."
d. Versico Incorporated, "VersiGard White."

2. Thickness: 60 mils reinforced, nominal.

3. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.

c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesive: 80 g/L.
f. Single-Ply Roof Membrane Sealants: 450 g/L.
g. Nonmembrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.
i. Sealant Primers for Porous Substrates: 775 g/L.
j. Other Adhesives and Sealants: 250 g/L.

B. Sheet Flashing: 60-mil thick reinforced EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard.

D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.

F. Miscellaneous Accessories: Provide lap sealant, water cutoff mastic, metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 ROOF INSULATION

A. Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, ½" thick, with a minimum compressive strength of 80 psie.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

E. The installed above roof deck insulation shall be a minimum of R25 continuous insulation in accordance with VECC Table C402.2.

F. Stagger joints in roof insulation.

2.4 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening first layer of roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

B. Insulation Adhesive: Insulation manufacturer's recommended cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.

C. Flexible Walkways: Factory-formed nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16-inch thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing substrate board, roof insulation, and cover board.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Mechanically Fastened Insulation: Install base layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type. Subsequent layers may be adhered.

1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

3.3 BASE FLASHING INSTALLATION

F. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

G. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

H. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

I. Clean splice areas apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

J. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.4 FIELD QUALITY CONTROL

K. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

L. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

END OF SECTION 075323

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed steep-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.4 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to

defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

2.5 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in long seamless sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

1. Accessories: Wire-ball downspout strainer.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Fabricate from the following materials:

a. Galvanized Steel: 0.022 inch thick.
b. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, and Backer Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

B. Drip Edges: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

C. Eave, Rake, and Ridge Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim without excessive oil canning, buckling, and tool marks, true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not use torches for soldering.
2. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.2 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches on center.

D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured units for the following applications:

1. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.
5. Underlayment.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: For roof specialties.

1. Plans, expansion-joint locations, keyed details, and attachments to other work. Distinguish between factory pre manufactured- and field-assembled installation.
2. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Details of termination points and assemblies, including fixed points.
5. Details of special conditions.

C. Samples: For each type of roof specialty indicated with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Research reports.

D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. SPRI Wind Design Standard: Manufacture and install copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding **12 ft.**, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Formed Aluminum Coping Caps: Aluminum sheet, 0.063 inch thick.

a. Surface: Smooth, flat finish.
b. Finish: Clear anodic.

2. Corners: Factory mitered and mechanically clinched and sealed watertight.
3. Coping-Cap Attachment Method: As recommended by manufacturer.

a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
b. Face-Leg Cleats: Concealed, continuous **stainless steel**.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

A. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.

1. Metallic-Coated Steel Sheet: Nominal 0.028-inch thickness.
2. Formed Aluminum Sheet: 0.032 inch thick.
3. Size: As indicated on Drawings.

B. Finishes:

1. Aluminum: Clear anodic.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Roof specialty manufacturer's recommended fasteners, designed to meet performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Metallic-Coated Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

D. Elastomeric Sealant: ASTM C920, elastomeric [**polyurethane**] [**silicone**] polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION OF UNDERLAYMENT

A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

1. Lap horizontal joints not less than 4 inches.

B. Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

C. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer's written installation instructions.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

D. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

E. Seal concealed joints with butyl sealant as required by roof specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.2 INSTALLATION OF COPINGS

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch centers or at manufacturer's required spacing that meets performance requirements.

3.3 INSTALLATION OF ROOF-EDGE DRAINAGE SYSTEMS

A. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Seal or solder exterior wall scupper flanges into back of conductor head.

3.4 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

A. Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.5 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

C. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured units for the following applications:
   1. Equipment supports.
   2. Roof hatches.
   3. Heat and smoke vents.
   4. Underlayment.
   5. Miscellaneous materials.

1.2 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: For roof accessories.

   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Delegated Design Submittals: For [**roof curbs**] [**and**] [**equipment supports**] indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

   1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
   2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

D. Samples: For each type of roof accessory indicated with factory-applied color finishes.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items.

B. Qualification statements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in the Commonwealth of Virginia where Project is located and who is experienced in providing engineering services of the type indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design roof curbs and equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF CURBS

A. Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, stepped integral metal cant to raise the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported

D. Steel: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.

1. Finish: Factory prime coating,
2. Color: Selected by Architect from manufacturer's full range.

E. Aluminum: 0.125 inch.

1. Finish: Factory prime coating.
2. Color: As selected by Architect from manufacturer's full range.

F. Construction:

1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
3. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange or by use of leveler frame.
5. Sloping Roofs: Where roof slope exceeds 1/4 inch per 12 inches, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
6. Insulation: Factory insulated with 1-1/2-inch thick glass-fiber board insulation.
7. Liner: Same material as curb, of manufacturer's standard thickness and finish.
8. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.
9. Wind-Restraint Straps and Base Flange Attachment: Provide wind-restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to comply with wind-uplift requirements.

2.3 EQUIPMENT SUPPORTS

A. Refer to Mechanical Specifications on Drawing MPE101 and MPE102.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

D. Construction:

1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
4. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.
5. Wind-Restraint Straps and Base Flange Attachment: Provide wind-restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to comply with wind-uplift requirements.
6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch-thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.

9. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
10. Sloping Roofs: Where roof slope exceeds 1/4 inch per 12 inches, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.4 ROOF HATCHES

A. Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, stepped integral metal cant to raise the thickness of roof insulation,] and integrally formed deck-mounting flange at perimeter bottom.

B. Type and Size:

1. Single-leaf lid, 30 by 36 inches.

C. Hatch Material, Steel: Zinc-coated (galvanized) steel sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.
2. Finish: Factory prime coating.
3. Color: As selected by Architect from manufacturer's full range.

D. Construction:

1. Insulation: 2-inch-thick, polyisocyanurate board.

   a. R-Value: 12.0 in accordance with ASTM C1363.

2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
6. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
7. Sloping Roofs: Where slope or roof deck exceeds 1/4 inch per 12 inches, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

E. Hardware: Spring operators, hold-open arm, stainless steel spring latch with turn handles, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

2.5 METAL MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheer complying with minimum ASTM A653/A653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet

complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality.

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.

B. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
3. Clear Anodic Finish: AAMA 611, or thicker.

C. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

D. Steel Shapes: ASTM A36/A36M, hot-dip galvanized in accordance with ASTM A123/A123M unless otherwise indicated.

E. Steel Tube: ASTM A500/A500M, round tube.

F. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized in accordance with ASTM A123/A123M.

G. Steel Pipe: ASTM A53/A53M, galvanized.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install roof accessories in accordance with manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended in writing by manufacturer's written installation instructions.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

3.2 INSTALLATION OF ROOF ACCESSORIES

A. Roof Curb: Install each roof curb so top surface is level.

B. Equipment Support: Install equipment supports so top surfaces are level with each other.

C. Roof-Hatch:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post in accordance with manufacturer's written instructions.

D. Seal joints with elastomeric or butyl]sealant as required by roof accessory manufacturer.

3.3 CLEANING AND PROTECTION

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 099113 "Exterior Painting."

C. On completion of installation, clean exposed surfaces in according with manufacturer's written instructions. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as roof accessories are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 077200

SECTION 079200 – JOINT SEALANTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 COLORS: To match adjoining materials unless otherwise specified or indicated.

1.3 Locations of caulking and sealants shall be generally at intersections of dissimilar materials, expansion joints, control joints.

1.4 QUALITY ASSURANCE: Prepare sample installation before proceeding with each major type of sealant work. Match project conditions as nearly as possible. Schedule sample installation well in advance of the work, to allow ample time for sealant cure, and review by Architect for adjustment of specified requirements.

PART 2 – MATERIALS

2.1 ELASTOMERIC SEALANT COMPOUNDS

A. One Component Polyurethane Sealant

1. ASTM C 920, Class A, Type I (self-leveling) except Type II for joints which are not horizontal.
2. Provide bituminous-modified product where recommended by manufacturer.

B. Mildew-Resistant Silicone Sealant: 1 part, ASTM C 920, Class A, recommended by manufacturer for use in interior wet areas, acid type, except non-acid type where one or both joint surfaces are porous.

2.2 CAULKING COMPOUNDS: Provide one component polyurethane caulking - ASTM C 920, Class A, Type I (self leveling), except Type II if joints are not horizontal.

2.3 JOINT FILLERS AND SEALANT BACKERS

A. Bituminous/Fiber Joint Filler: ASTM D 1751, Type I, and AASHO M 213.

B. Closed-Cell Semi-Rigid Plastic Joint Filler: Non-staining, compressible, low modulus of elasticity but recommended by manufacturer for retaining poured concrete slabs.

C. Sealant Backer Rod: Non-absorptive closed-cell (or jacketed open cell) compressible/flexible plastic/rubber rod stock which is compatible with sealant per manufacturer's recommendation (polyethylene, butyl, neoprene, polyurethane, PVC).

D. Oakum Joint Filler: Hemp or jute, free of oil and tar.

E. Bond Breaker Tape: Polyethylene or other plastic tape which will not bond to sealant, self-adhesive.

2.4 TRAFFIC JOINTS

A. Polyurethane based, 2-part elastomeric sealant, modified with bituminous compound, recommended by the manufacturer for the surface and service indicated.

B. For foot traffic provide manufacturer's non-tracking variation of specified sealant with sufficiently high modulus of elasticity to withstand indention by stiletto heels.

2.5 CONCRETE FLOOR SEALER: Section 096723, "Resinous Flooring."

PART 3 - EXECUTION

3.1 JOINT SURFACE PREPARATION:

A. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.

B. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

C. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance.

D. Roughen joint surfaces on vitreous coated and similar non-porous materials, where sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive to produce a dull sheen.

3.2 INSTALLATION:

A. Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Prime or seal joint surfaces where shown or recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

D. Install sealant backer rod for liquid sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.

E. Install bond breaker tape where shown and where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

F. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

G. Install sealants to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead.

1. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, and neither more than 5/8" deep nor less than 3/8" deep.
2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75% to 125% of joint width.

H. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces including exposed aggregate panels and similar rough textures. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either primer/sealer or the sealant/caulking compound.

I. Remove excess and spillage of compounds promptly as the work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.

3.3 CURE AND PROTECTION:

A. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner which would significantly alter material's modulus of elasticity or other characteristics.

B. Installer shall advise Contractor of procedures required for curing and protection of sealants and caulking compounds during construction period, so that they will be without deterioration or damage at time of Owner's acceptance.

3.4 TESTS FOR PERFORMANCE:

A. After nominal cure of exterior joint sealants which are exposed to weather, test for water leaks. Flood joint exposure with water directed from a 3/4" garden hose held perpendicular to wall face,

2'-0" from joint, connected to a water system with 30 psi minimum static water pressure at the nozzle. Move stream of water along joint at an approximate rate of 20 ft. per min.

B. Repair sealant installation at leaks or, if leakage is excessive, replace sealant installation as directed.

END OF SECTION 079000

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.1 RELATED DOCUMENT: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 STANDARD: Comply with the requirements of Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" (SDI-100), and as herein specified.

1.3 SUBMITTALS: With Manufacturer's standard details and specifications for hollow metal work, submit complete shop drawings including hollow metal work and accessories, showing application to project.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. A recognized producer of hollow metal work complying with the requirements, including, but not limited to, any one of the following:

1. Ceco Door Products
2. Republic Builders Prod. Co.
3. Steelcraft Mfg. Co.

2.2 MATERIALS

A. Steel doors and frames; hot-rolled, pickled and oiled per ASTM A 569 and A 568; cold-rolled per ASTM A 366 and A 568.

B. Galvanized sheets, ASTM A 526 and ASTM A 525, G 60 zinc coating, mill phosphatized. Provide steel doors and frames fabricated from galvanized sheets where indicated.

2.3 ANCHORS AND ACCESSORIES: As shown or detailed or required for proper installation. Use galvanized items for units built into exterior walls, complying with ASTM A 153.

2.4 FABRICATION

A. Fabricate units to be rigid, neat in appearance, and free from defects, warp or buckle. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible.

B. Prepare hollow metal units to receive mortise and concealed finish hardware, including cutouts, reinforcing, drilling and tapping, complying with ANSI A 115 "Specifications for Door and Frame Preparation for Hardware".

C. Reinforce units to receive surface-applied finish hardware to be field applied. 10 gauge hinge reinforcements, and 14 gauge lock reinforcements.

D. Locate finish hardware as indicated or, if not indicated, per DHI "Recommended Locations for Builder's Hardware".

E. Shop paint exposed surfaces of hollow metal units, including galvanized surfaces, using manufacturer's standard baked-on rust inhibitive primer.

2.5 DOORS

A. Comply with SDI-100, of the types and styles indicated, for materials quality, metal gages, and construction details unless otherwise indicated.

B. Provide 20 gauge cold rolled steel construction, with reinforcing at hardware locations, as indicated above.

C. Exterior doors shall be galvanized and insulated to provide a "U" factor of .24 at 70°F and an STC rating of 32 decibels.

D. Provide doors with flush tops and bottoms. Recessed tops and bottoms are not acceptable.

2.6 FRAMES

A. Comply with SDI-100, of the types and styles indicated, for materials quality, metal gages, and construction details.

B. Provide standard hollow metal frames for doors, sidelights, borrowed lights, and other openings as indicated. Provide 16 gauge frames for interior work and 14 gauge for exterior frames or frames exposed to the weather.

C. Prepare frames to receive 3 silencers on strike jambs of single swing frames and on heads of double swing frames. Omit silencers on frames to be weatherstripped.

D. Provide 26 ga. steel plaster guards or mortar boxes, welded to frame, at back of hardware cutouts where installed in concrete, masonry or plaster openings.

E. Protect inside faces of frames in plaster or masonry wall construction using high-build fibered asphalt emulsion coating.

F. Provide 14 gauge metal frame anchors, 3 per jamb, 2 per head.

G. Provide drywall returns for frames to be installed in walls and partitions of drywall construction.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install hollow metal units in accordance with manufacturer's instructions and final shop drawings. Fit doors to frames and floors with clearances specified in SDI-100.

B. Finish hardware is specified in Section 087000, “Door Hardware.”

3.2 ADJUST AND CLEAN:

A. Final Adjustments: Check and readjust operating finish hardware items in hollow metal work prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise damaged.

B. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

END OF SECTION 081000

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. RELATED SECTIONS

1. 081113 Hollow Metal Doors and Frames
2. 087100 Door Hardware

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For factory-finished doors.

1. Submit factory finishes applied to actual door face materials, approximately 8” x 10”, for each material and finish. Provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.3 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. SUBSTITUTIONS
1. All substitution requests must be submitted within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the architect and his consultant.

C. MANUFACTURER QUALIFICATIONS
1. Manufacturer shall be a member in good standing of the Window and Door Manufacturer’s Association (WDMA).
2. Obtain wood doors from a single manufacturer to ensure uniformity in quality of appearance and construction. All material supplied for this project to conform to WDMA I.S. 1A-97 for custom grade wood doors.

D. DELIVERY, STORAGE, AND HANDLING
1. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Doors are to be shipped from manufacturer in individual polybags, and shall be inspected immediately upon arrival at jobsite for any damage of defects.
2. Identify each door with individual opening numbers that correlate with designation system used on shop drawings and contract drawings for door, frames and hardware. Use only temporary, removable, or concealed markings.
3. Do not deliver or install doors until building is enclosed and weather tight, wet-work is complete and dry, and HVAC system is operating and maintaining ambient temperature and relative humidity at occupancy level in storage and installation areas.

1.4 WARRANTY

A. Warranties shall be in addition to, and not a limitation of other rights the owner may have under the contract documents.

B. Submit written warranty on manufacturer’s standard form signed by the manufacturer agreeing to replace or repair defective doors which have:
1. Delamination in any degree.
2. Warp or twist of 1/4” or more in any 3’ x 6” x 7’ plane of door face.
3. Telegraphing of stile, rail or core through face to cause surface variation in excess of 1/100” in any 3” spans.

C. Contractor shall replace or refinish doors where contractor’s work contributed to rejection or voiding of manufacturer’s warranty.

D. Solid core interior doors shall be warranted for the life of their installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with "Architectural Woodwork Standards."

1. Provide labels and certificates from AWI certification program indicating that doors comply with requirements of grades specified.

2.3 SOLID-CORE, FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:
1. Performance Grade: ANSI/WDMA I.S. 1A Standard Duty.

2. Architectural Woodwork Standards Grade: Custom.
3. Faces: Single-plywood veneer not less than 1/50 inch thick.

a. Species: Cherry
b. Cut: Plain sliced (flat sliced).
c. Match between Veneer Leaves: Book match.
1) Provide door faces of compatible color and grain within each separate room or area of building.

4. Exposed Vertical and Top Edges: Same species as faces.

a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.

b. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

5. Core for Non-Fire-Rated Doors:

a. ANSI A208.1, Grade LD-1 particleboard.

1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

6. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

    a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

2.5 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Custom.
2. Staining: As selected by Architect from manufacturer's full range.
3. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

C. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.
2. Fire-rated access doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of access door and frame and for each finish specified.

C. Product Schedule: For access doors and frames.[**Use same designations indicated on Drawings.**]

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.4 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies meets the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

Retain subparagraph below if requiring fire door inspectors to be certified under DHI's certification program. Verify, with authorities having jurisdiction, if other DHI certifications are acceptable, such as Architectural Hardware Consultant (AHC), Certified Door Consultant (CDC), and Architectural Openings Consultant (AOC).

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

Manufacturers and products listed in this Section are neither recommended nor endorsed by the AIA or Deltek. Before selecting manufacturers and products, verify availability, suitability for intended applications, and compliance with minimum performance requirements. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

Product options commonly available from manufacturers are included in square brackets throughout the Section Text. Not every manufacturer listed can provide every option offered; verify availability with manufacturers. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

2.1 PERFORMANCE REQUIREMENTS

Retain this article if fire-rated units are required. Retain option if temperature-rise assemblies are required.

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection[**and temperature-rise limit**] ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

Copy first paragraph below and re-edit for each product.

Insert drawing designation. Use these designations on Drawings to identify each product.

A. Flush Access Doors with Exposed Flanges <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Description: Face of door flush with frame, with exposed flange and concealed hinge.

Revise "Optional Features" Subparagraph below to include optional features or construction. Consult manufacturers for availability.

3. Optional Features: [**Gasketing**] [**Double-leaf doors**] [**Piano hinges**] [**Louvers**] [**Masonry anchors**] [**Removable doors**] <**Insert feature**>.
4. Locations: [**Wall**] [**Ceiling**] [**Wall and ceiling**] <**Insert location or substrate**>.

Retain "Uncoated Steel Sheet for Door," "Metallic-Coated Steel Sheet for Door," or "Stainless Steel Sheet for Door" Subparagraph below. Because gage thickness is not defined by industry standards, decimal thickness must be indicated. Thicknesses shown are examples only; revise to suit Project.

5. Uncoated Steel Sheet for Door: [**Nominal 0.060 inch (1.52 mm), 16 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
6. Metallic-Coated Steel Sheet for Door: [**Nominal 0.064 inch (1.63 mm), 16 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].

Revise "Stainless Steel Sheet for Door" Subparagraph below for other finishes; ASTM A480/A480M No. 4 is typical.

7. Stainless Steel Sheet for Door: [**Nominal 0.062 inch (1.59 mm), 16 gage**] <**Insert thickness**>, ASTM A480/A480M No. 4 finish.
8. Frame Material: [**Same material, thickness, and finish as door**] <**Insert material, thickness, and finish**>.

Revise "Latch and Lock" Subparagraph below for other hardware offered by some manufacturers; options include commonly available choices.

9. Latch and Lock: [**Cam latch, screwdriver operated**] [**Cam latch, key operated**] [**Cam latch, hex-head wrench operated**] [**Cam latch, pinned-hex-head wrench operated**] [**Cam latch, spanner-head wrench operated**] [**Latch bolt, knurled-knob operated**] [**Latch bolt, key operated**] [**Prepared for mortise cylinder**] [**As indicated on Drawings**] [**As indicated in schedule**] <**Insert operator**>[**with interior release**].

Copy first paragraph below and re-edit for each product.

Insert drawing designation. Use these designations on Drawings to identify each product.

B. Flush Access Doors with Concealed Flanges <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Description: Face of door flush with frame; with concealed flange for [**gypsum board**] [**plaster**] installation and concealed hinge.

Revise "Optional Features" Subparagraph below to include optional features or construction. Consult manufacturers for availability.

3. Optional Features: [**Gasketing**] [**Double-leaf doors**] [**Piano hinges**] [**Louvers**] [**Masonry anchors**] [**Removable doors**] <**Insert feature**>.
4. Locations: [**Wall**] [**Ceiling**] [**Wall and ceiling**] <**Insert location or substrate**>.

Retain "Uncoated Steel Sheet for Door," "Metallic-Coated Steel Sheet for Door," or "Stainless Steel Sheet for Door" Subparagraph below. Because gage thickness is not defined by industry standards, decimal thickness must be indicated. Thicknesses shown are examples only; revise to suit Project.

5. Uncoated Steel Sheet for Door: [**Nominal 0.060 inch (1.52 mm), 16 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
6. Metallic-Coated Steel Sheet for Door: [**Nominal 0.064 inch (1.63 mm), 16 gage**] <**Insert thickness**> factory [**primed**] [**finished**].

Revise "Stainless Steel Sheet for Door" Subparagraph below for other finishes; ASTM A480/A480M No. 4 is typical.

7. Stainless Steel Sheet for Door: [**Nominal 0.062 inch (1.59 mm), 16 gage**] <**Insert thickness**>, ASTM A480/A480M No. 4 finish.
8. Frame Material: [**Same material and thickness as door**] <**Insert material, thickness, and finish**>.

Revise "Latch and Lock" Subparagraph below for other hardware offered by some manufacturers; options include commonly available choices.

9. Latch and Lock: [**Cam latch, screwdriver operated**] [**Cam latch, key operated**] [**Cam latch, hex-head wrench operated**] [**Cam latch, pinned-hex-head wrench operated**] [**Cam latch, spanner-head wrench operated**] [**Latch bolt, knurled-knob operated**] [**Latch bolt, key operated**] [**Prepared for mortise cylinder**] [**As indicated on Drawings**] [**As indicated in schedule**] <**Insert operator**>[**with interior release**].

Copy first paragraph below and re-edit for each product.

Insert drawing designation. Use these designations on Drawings to identify each product.

C. Lightweight Flush Access Doors <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Description: Face of door flush with exposed flange, with exposed piano hinge; frameless for surface installation.

Revise "Optional Features" Subparagraph below to include optional features or construction. Consult manufacturers for availability.

3. Optional Features: [**Gasketing**] [**Double-leaf doors**] [**Piano hinges**] [**Louvers**] [**Masonry anchors**] [**Removable door**] <**Insert feature**>.
4. Locations: [**Wall**] [**Ceiling**] [**Wall and ceiling**] <**Insert location or substrate**>.

Retain "Uncoated Steel Sheet for Door" or "Metallic-Coated Steel Sheet for Door" Subparagraph below. Because gage thickness is not defined by industry standards, decimal thickness must be indicated. Thicknesses shown are examples only; revise to suit Project. Confirm material thicknesses, which vary widely by manufacturer. Confirm frame material; some manufacturers provide aluminum frames.

5. Uncoated Steel Sheet for Door: [**Nominal 0.018 inch (0.46 mm), 26 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
6. Metallic-Coated Steel Sheet for Door: [**Nominal 0.022 inch (0.56 mm), 26 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
7. Frame Material: [**Aluminum, nominal 0.045 inch (1.15 mm), mill finish**] <**Insert material, thickness, and finish**>.

Revise "Latch and Lock" Subparagraph below for other hardware offered by some manufacturers; options include commonly available choices.

8. Latch and Lock: [**Cam latch, screwdriver operated**] [**Cam latch, key operated**] [**Cam latch, hex-head wrench operated**] [**Cam latch, pinned-hex-head wrench operated**] [**Cam latch, spanner-head wrench operated**] [**Latch bolt, knurled-knob operated**] [**Latch bolt, key operated**] [**Prepared for mortise cylinder**] [**As indicated on Drawings**] [**As indicated in schedule**] <**Insert operator**>[**with interior release**].

Copy paragraph below and re-edit for each product.

Insert drawing designation. Use these designations on Drawings to identify each product.

D. Interior Flush GFRG Access Doors with Concealed Flanges <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Description: Face of [**drop-in**] [**concealed-hinge**] door flush with frame, with concealed flange for gypsum board installation.

Revise "Optional Features" Subparagraph below to include optional features or construction. Consult manufacturers for availability.

3. Optional Features: [**Gasketing**] [**Piano hinges**] <**Insert feature**>.
4. Locations: [**Wall**] [**Ceiling**] [**Wall and ceiling**] <**Insert location or substrate**>.
5. Door Size: <**Insert door size**>.
6. Door Type [**Drop in, radius corner**] [**Drop in, square corner**] [**Concealed-hinge, radius corner**] [**Concealed-hinge, square corner**].
7. Door and Frame Material: Unpainted glass-fiber-reinforced gypsum, with frames reinforced for hardware and fastenings.

Revise "Latch and Lock" Subparagraph below for other hardware offered by some manufacturers; options include commonly available choices.

8. Latch and Lock: [**Cam latch, screwdriver operated**] [**Cam latch, key operated**] [**As indicated on Drawings**] [**As indicated in schedule**] <**Insert operator**>.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

Copy first paragraph below and re-edit for each product.

Insert drawing designation. Use these designations on Drawings to identify each product.

A. Fire-Rated, [**Flush**] [**Recessed**] Access Doors with Exposed Flanges <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

Retain first option in "Description" Subparagraph below for access doors requiring temperature-rise ratings.

2. Description: Door face flush with frame, [**with a core of mineral-fiber insulation enclosed in sheet metal**] [**uninsulated**]; with exposed flange, self-closing door, and concealed hinge.

Revise "Optional Features" Subparagraph below to include optional features or construction. Consult manufacturers for availability.

3. Optional Features: [**Upward-opening doors for ceilings**] [**Gasketing**] [**Double-leaf doors**] [**Piano hinges**] [**Masonry anchors**] <**Insert feature**>.
4. Locations: [**Wall**] [**Ceiling**] [**Wall and ceiling**] <**Insert location or substrate**>.
5. Fire-Resistance Rating: Not less than [**that indicated**] [**that of adjacent construction**] [**45 minutes**] [**1 hour**] [**1-1/2 hours**] [**2 hours**] [**3 hours**] <**Insert requirement**>.

Retain "Temperature-Rise Rating" Subparagraph below if required; verify availability with manufacturer.

6. Temperature-Rise Rating: [**450 deg F (250 deg C)**] [**250 deg F (139 deg C)**] at the end of 30 minutes.

Retain "Uncoated Steel Sheet for Door," "Metallic-Coated Steel Sheet for Door," or "Stainless Steel Sheet for Door" Subparagraph below. Because gage thickness is not defined by industry standards, decimal thickness must be indicated. Thicknesses shown are examples only; revise to suit Project. Uninsulated access doors require thicker steel sheet.

7. Uncoated Steel Sheet for Door: [**Nominal 0.036 inch (0.91 mm), 20 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
8. Metallic-Coated Steel Sheet for Door: [**Nominal 0.040 inch (1.02 mm), 20 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].

Revise "Stainless Steel Sheet for Door" Subparagraph below for other finishes; ASTM A480/A480M No. 4 is typical.

9. Stainless Steel Sheet for Door: [**Nominal 0.038 inch (0.95 mm), 20 gage**] <**Insert thickness**>, ASTM A480/A480M No. 4 finish.
10. Frame Material: [**Same material, thickness, and finish as door**] <**Insert material, thickness, and finish**>.

Revise "Latch and Lock" Subparagraph below for other hardware offered by some manufacturers; options include commonly available choices. The IBC requires rated doors to be self-closing and self-latching.

11. Latch and Lock: Self-latching door hardware, [**operated by knurled-knob**] [**operated by key**] [**prepared for mortise cylinder**] [**as indicated on Drawings**] [**as indicated in schedule**] <**Insert operator**>[**with interior release**].

Copy paragraph below and re-edit for each product.

Insert drawing designation. Use these designations on Drawings to identify each product.

B. Fire-Rated, [**Flush**] [**Recessed**] Access Doors with Concealed Flanges <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

Retain first option in "Description" Subparagraph below for access doors requiring temperature-rise ratings.

2. Description: Door face flush with frame, [**with a core of mineral-fiber insulation enclosed in sheet metal**] [**uninsulated**]; with concealed flange for [**gypsum board**] [**plaster**] installation, self-closing door, and concealed hinge.

Revise "Optional Features" Subparagraph below to include optional features or construction. Consult manufacturers for availability.

3. Optional Features: [**Upward-opening doors for ceilings**] [**Gasketing**] [**Double-leaf doors**] [**Piano hinges**] [**Masonry anchors**] <**Insert feature**>.
4. Locations: [**Wall**] [**Ceiling**] [**Wall and ceiling**] <**Insert location or substrate**>.
5. Fire-Resistance Rating: Not less than [**that indicated**] [**that of adjacent construction**] [**45 minutes**] [**1 hour**] [**1-1/2 hours**] [**2 hours**] [**3 hours**] <**Insert requirement**>.

Retain "Temperature-Rise Rating" Subparagraph below if required; verify availability with manufacturer.

6. Temperature-Rise Rating: [**450 deg F (250 deg C)**] [**250 deg F (139 deg C)**] at the end of 30 minutes.

Retain "Uncoated Steel Sheet for Door," "Metallic-Coated Steel Sheet for Door," or "Stainless Steel Sheet for Door" Subparagraph below. Because gage thickness is not defined by industry standards, decimal thickness must be indicated. Thicknesses shown are examples only; revise to suit Project. Uninsulated access doors require thicker steel sheet.

7. Uncoated Steel Sheet for Door: [**Nominal 0.036 inch (0.91 mm), 20 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].
8. Metallic-Coated Steel Sheet for Door: [**Nominal 0.040 inch (1.02 mm), 20 gage**] <**Insert thickness**>, factory [**primed**] [**finished**].

Revise "Stainless Steel Sheet for Door" Subparagraph below for other finishes; ASTM A480/A480M No. 4 is typical.

9. Stainless Steel Sheet for Door: [**Nominal 0.038 inch (0.95 mm), 20 gage**] <**Insert thickness**>, ASTM A480/A480M No. 4 finish.
10. Frame Material: [**Same material, thickness, and finish as door**] <**Insert material, thickness, and finish**>.

Revise "Latch and Lock" Subparagraph below for other hardware offered by some manufacturers; options include commonly available choices. The IBC requires rated doors to be self-closing and self-latching.

11. Latch and Lock: Self-closing, self-latching door hardware, [**operated by knurled-knob**] [**operated by key**] [**prepared for mortise cylinder**] [**as indicated on Drawings**] [**as indicated in schedule**] <**Insert operator**>[**, with interior release**].

2.4 MATERIALS

Retain materials in this article or revise to suit Project.

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

Retain the more expensive "Type 316" option in "Stainless Steel Plate, Sheet, and Strip" or "Stainless Steel Flat Bars" Paragraph below for more corrosion resistance; verify availability with manufacturers.

D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, [**Type 304**] [**Type 316**]. Remove tool and die marks and stretch lines, or blend into finish.

E. Stainless Flat Bars: ASTM A666, [**Type 304**] [**Type 316**]. Remove tool and die marks and stretch lines, or blend into finish.

F. Frame Anchors: Same material as door face.

G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

Retain "Mortise Cylinder Preparation" Subparagraph below if lock is not provided by access door and frame manufacturer.

3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in [**Section 087100 "Door Hardware."**] [**Section 087111 "Door Hardware (Descriptive Specification)."**]

2.6 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.

a. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from full range of industry colors**] <**Insert color**>.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

3.2 FIELD QUALITY CONTROL

Retaining second option in "Inspection Agency" Paragraph below is typical. If retaining second option in "Inspection Agency" Paragraph, retain "Field quality-control reports" Paragraph in "Informational Submittals."

A. Inspection Agency: [**Owner will engage**] [**Engage**] a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in [**NFPA 80**] [**and**] [**NFPA 101**].

END OF SECTION 083113

SECTION 083613 – SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with provisions in the U.S. Department of Transportation's "ADA Standards for Transportation Facilities" the United States Access Board's "Architectural Barriers Act (ABA) Standards", 41 CFR, Appendix A to Subpart 101-19.6, "Uniform Federal Accessibility Standards" and ICC A117.1applicable to sectional doors.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: As indicated on Drawings.

C. Windborne-Debris Impact Resistance: Provide sectional doors complying with the following requirements:

1. Glazed Openings: Pass ASTM E1886 Large Missile Test and cyclic-pressure tests in accordance with ASTM E1996 for basic protection and Wind Zone applicable to basic design wind speed indicated on Drawings.
2. Garage-Door Glazed Openings: Pass DASMA 115.

D. Seismic Performance: Provide sectional doors that withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. Component Importance Factor: 1.5.

2.2 SECTIONAL-DOOR ASSEMBLY (Door type D-6).

A. Aluminum Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.

D. U-Value: 0.028 Btu/sq. ft. x h x deg F

E. Aluminum Sections: ASTM B221 extruded-aluminum stile and rail members of alloy and temper standard with manufacturer for type of use and finish indicated; in minimum thickness required to comply with requirements; with rail and stile dimensions and profiles indicated on Drawings; and with overlapped or interlocked weather- and pinch-resistant seal at meeting rails.

1. Door-Section Thickness: 1-3/4 inches.
2. Section Reinforcing: Continuous horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.

    a. Hardware Locations: Provide reinforcement for hardware attachment.

3. Insulated Stiles and Rails: Fill stiles and rails with manufacturer's standard polyurethane expanding foam.
4. Glazed Panels: Manufacturer's standard, aluminum-framed section with glazing sealed with glazing tape and aluminum glazing bead. Glazing as follows:
    a. Insulating Glass Units: Manufacturers' standard unit with tempered glass lites of same tint as insulating glass units in windows and storefront.

F. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

    a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle attached to track and wall.
    b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

G. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.

H. Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing:
1. Insulating Glass Units: Grey-tinted to match other glazing on the project with a low-E costing on the #3 surface.

I. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.

   a. Roller-Tire Material: Manufacturer's standard.

3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.

J. Locking Device:
1. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

   a. Lock Cylinders: Cylinders complying with Section 087100 "Door Hardware" requirements.
   b. Keying: Keyed to building keying system.
   c. Keys: Six (6) for each cylinder.
2. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

K. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.

   a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.

3. Cables: Galvanized-steel, multistrand, lifting cables.
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

L. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.

2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use.
4. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
5. Operator Type: Manufacturer's standard for door requirements.
6. Motor: Reversible-type with controller (disconnect switch) for exterior, dusty, wet, or humid motor exposure. Use adjustable motor-mounting bases for belt-driven operators.

    a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor1 hp.
    b. Electrical Characteristics:

        1) Phase: Three phase.
        2) Volts: 208 V.

7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

    a. Monitored Entrapment Protection: Photoelectric sensor designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.

9. Control Station: Flush mounted, [three-position (open, close, and stop) control.

    a. Operation:[Push button interior and key exterior.
    b. Exterior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof type, NEMA ICS 6, Type 4 enclosure.
    c. Features: Provide the following:

        1) Vehicle detection operation.
        2) Radio-control operation.
        3) Card-reader control.
        4) Photocell operation.
        5) Door-timer operation.
        6) Explosion- and dust-ignition-proof control wiring.
        7) Audible and visual signals that comply with regulatory requirements for accessibility.

10. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf
11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

M. Metal Finish:

1. Anodized Aluminum Finish:

a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTAL

A. Product data.

B. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
3. Point-to-point wiring diagrams.

C. Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

E. Delegated Design Submittals: For aluminum-framed entrance and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Fabricator of products.
2. Entity that employs installers and supervisors who are trained and approved by manufacturer.
3. Authorized representative who is trained and approved by manufacturer.
4. Entity that is certified under the North American Contractor Certification Program (NACC) and that employs installers and supervisors who are trained and approved by manufacturer.

B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in the Commonwealth of Virginia where Project is located and who is experienced in providing engineering services of the type indicated.

C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated.

D. Egress Door Inspector Qualifications:

1. Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
2. Inspector for field quality-control inspections of egress door assemblies to be certified under DHI's certification program as a Fire and Egress Door Assembly Inspector (FDAI) or a Certified Fire and Egress Door Assembly Inspector (CFDAI).

E. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrance and storefront systems.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to [amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. The IECC and ASHRAE/IES 90.1 require that all fenestration be certified and labeled by manufacturer for energy performance for thermal transmittance (U-factor), Solar Heat-Gain Coefficient (SHGC), air leakage, and visible transmittance (VT). Energy performance for fenestration products is typically determined for the whole fenestration product or system, which includes the framing, glazing, and the spacer. Coordinate the values selected for energy performance with the glazing selections in Section 088000 "Glazing," and confirm that manufacturer can meet the specified energy performance and can provide certification and labeling. Verify requirements of authorities having jurisdiction.

G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

   a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
   b. Entrance Doors: U-factor of not more than [0.68 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

   a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.25 to 0.35 as determined in accordance with NFRC 200.
   b. Entrance Doors: SHGC of not more than 0.25 to 0.45 as determined in accordance with NFRC 200.

3. Air Leakage:

   a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential when tested in accordance with ASTM E283.
   b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

4. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 50 as determined in accordance with AAMA 1503.
b. Entrance Doors: CRF of not less than 68 as determined in accordance with AAMA 1503.

H. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.

1. Large-Missile Test: For glazing located within 30 feet of grade.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-overall thickness, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior

2. Door Design: Medium stile; 3-1/2-inch nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

2.3 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware.".

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required widt].
b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

B. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
1. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

C. Pivot Hinges: BHMA A156.4, Grade 1.

1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

D. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
2. Exterior Hinges: Stainless steel, with stainless steel pin.
3. Quantities:

a. For doors up to **87 inches** high, provide three hinges per leaf.

E. Continuous-Gear Hinges: BHMA A156.26.

F. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

G. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.

H. Cylinders:

1. As specified in Section 087100 "Door Hardware."
2. BHMA A156.5, Grade 1.

a. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE" to be furnished by Owner.

I. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

J. Operating Trim: BHMA A156.6.

K. Removable Mullions: BHMA A156.3 extruded aluminum.

1. When used with panic exit devices, provide[**keyed**] removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305. Use only mullions that have been tested with exit devices to be used.

L. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

M. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.

N. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

O. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

P. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

Q. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.4 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

2.5 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018** or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

K. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

L. Install glazing as specified in Section 088000 "Glazing."

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Tests: Perform the following test on representative areas of aluminum-framed entrance and storefront systems.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect to be tested in accordance with AAMA 501.2 and to not evidence water penetration.

   a. Perform a minimum of two tests in areas as directed by Architect.

2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

   a. Perform a minimum of two tests in areas as directed by Architect.

3. Water Penetration: ASTM E1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft, and to not evidence water penetration.

C. Inspection Agency: Engage a qualified inspector to perform inspections.

D. Inspections:

1. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."

E. Aluminum-framed entrance and storefront systems will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 084113

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum windows.

1.2 COORDINATION

A. Finish Matching: Coordinate all exposed exterior aluminum components and trim to ensure uniform and consistent color and appearance. Use products specified in this Section as a benchmark. Architect's decision will be final as to whether a proposed product matches.

1.3 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings:

1. Plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

E. Delegated Design Submittals: For reinforcing mullions, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field quality-control reports.

C. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by aluminum window manufacturer.

B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in the Commonwealth of Virginia where Project is located and who is experienced in providing engineering services of the type indicated.

C. Testing Agency Qualifications: An FGIA-accredited testing agency for testing indicated.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.
c. Hardware: Three years from date of Substantial Completion.
d. Aluminum Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: FGIA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: LC.
2. Minimum Performance Grade: 30.
3. Mulled Window Systems: Evaluate and rate combination assemblies as single systems as determined by AAMA 450 in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 requirements.

C. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:

a. Fixed Windows: Not more than 0.29 Btu/sq. ft. x h x deg F.
b. Operable Windows: Not more than 0.32 Btu/sq. ft. x h x deg F.

2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200:

a. Fixed Windows: Not more than 0.40.
b. Operable Windows: Not more than 0.36 as determined in accordance with NFRC 200.

3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of 55-60 or higher.

D. Thermal Movements: Provide aluminum windows, including anchorage, which allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F ambient.

E. Outdoor-Indoor Transmission Class (OITC): Rated for not less than 26 OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

F. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1for basic protection.

1. Large-Missile Test: For glazing located within 30 ft. of grade.

2.2 ALUMINUM WINDOWS

A. Provide manufacturer's standard aluminum window assemblies consisting of frames, sashes, glass, hardware, fasteners, and all components and accessories as required for a complete installation.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Projected, awning.
2. Fixed.

C. Frames and Sashes: Aluminum extrusions of alloy, temper, and strength complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Broken Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

D. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.

E. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C1172, with two plies of float glass.

1. Float Glass: Annealed.
2. Inner Ply: Clear.

3. Outer Ply: Gray tint.
4. Low-E Coating: Sputtered on third surface.

F. Insulating-Glass Units: ASTM E2190.

1. Glass: ASTM C1036, Type 1, Class 1, q3.

a. Tint: Gray tint.

2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on third surface.

G. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190, with two lites and complying with impact-resistance requirements in "Performance Requirements" Article.

1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.

a. Tint: Gray tint.
b. Kind: Heat strengthened.

2. Interior Lite: ASTM C1172, clear laminated glass with two plies of float glass.

a. Float Glass: Annealed.

3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on third surface.

H. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

I. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's.

J. Window Hardware: Projected.

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.

a. Type and Style: As selected by Architect from manufacturer's full range of types and styles.

2. Hinges: Non-friction type, not less than two per sash.
3. Lock: Concealed multipoint lock operated by single lever handle or lift-type throw.
4. Limit Devices: Concealed friction adjustor, adjustable stay bar limit devices designed to restrict sash opening.

a. Limit clear opening to 6 inches for ventilation; with custodial key release.

K. Weather Stripping: Provide manufacturer's standard full-perimeter weather stripping for each operable sash unless otherwise indicated.

L. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Avoid exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.3 ACCESSORIES

A. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

B. Panning Trim: Profiles in sizes and configurations indicated on Drawings.

2.4 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Full, inside for projected, awning sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

C. Aluminum Wire Fabric: 18-by-16 mesh of 0.011-inch-diameter, coated aluminum wire.

1. Wire-Fabric Finish: Charcoal gray.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, air and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Mullions: Install combination and reinforcing mullions for combination assemblies in accordance with manufacturer's written instructions.

D. Install windows and components to drain water passing joints and condensation to the exterior.

E. Separate aluminum from sources of corrosion or electrolytic action at points of contact with other materials.

F. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

3.3 CLEANING AND PROTECTION

A. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Avoid damaging finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 085113

-SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following:
      a. Swinging doors.

B. Related Sections include the following:
   1. Division 08, Section 0811113, "Hollow Metal Doors and Frames."

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1.3 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Qualification Data: For Architectural Hardware Consultant.

C. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

D. Warranty: Special warranty specified in this Section.

E. Other Action Submittals:
   1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
      b. Content: Include the following information:
         1) Identification number, location, hand, and material of each door and frame.
         2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
         3) Complete designations of every item required for each door or opening including name and manufacturer.
         4) Fastenings and other pertinent information.

5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) Door and frame sizes and materials.

c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

A. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service.

1.6 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of operators and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, except as follows:
   a. Manual Closers: Ten years from date of Substantial Completion.
   b. Locksets: Seven years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products complying with BHMA standard referenced.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.

   2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.2 HINGES

A. Quantity: Provide the following, unless otherwise indicated:
   1. Three Hinges: For doors with heights 61 to 90 inches.

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Basis of Design Manufacturer for Hinges:
   1. Interior Doors: Standard-weight hinges – Ives 5BB1-WT- 4 ½” x 4 ½” steel ball-bearing hinges.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Interior Hinges: Steel, with steel pin.
   2. Exterior Hinges: Stainless steel, with non-removable stainless steel pin.

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
   1. Bored Locks: BHMA A156.2.

B. Bored Locks: BHMA A156.2, Grade 1; Series 4000.

1. Basis of Design Manufacturer for Extra Heavy Duty Cylindrical Lockset:
   a. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH) Extra Heavy Duty Cylindrical Locks ND Series, with Athens (ATH) lever design, 626 satin chrome finish.

2.4 LOCK CYLINDERS

A. High-Security Lock Cylinders: BHMA A156.30**,** Grade 1.

B. Cylinders: Schlage Everest C123 keyway, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
   1. Number of Pins: Six.

   2. Bored-Lock Type: Cylinders with tailpieces to suit locks.
      a. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A).

2.5 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
   1. Master Key System: Cylinders are operated by a change key and a master key.
   2. New cylinders shall be keyed into the existing master key system so that all locksets operate from same master key.

B. Keys: Nickel silver.
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
      a. Notation: "DO NOT DUPLICATE**."**
   2. Quantity: In addition to one extra key blank for each lock, provide the following:
      a. Cylinder Change Keys: Three.
      b. Master Keys: Five.

2.6 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the Department of Justice's "2010 ADA Standards for Accessible Design (ASAD)" and ANSI A117.1.
   1. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

B. Door Closers for Means of Egress Doors: Opening force allowable by authorities having jurisdiction. The force for pushing or pulling open a door or gate other than fire doors shall be as follows:
   1. Interior, hinged doors: 5 lbs. maximum.

C. Surface Closers: BHMA A156.4**,** Grade 1, provide arm required for closer to be located on non-public side of door, and for doors opening to the exterior of the building the closers shall be type that allows installation on the interior side of the door.

1. Basis of Design closers are as scheduled in the Hardware Schedule at the end of this section.

D. Provide closers on the following doors: As indicated in the Hardware Schedule.

2.7 PROTECTIVE TRIM UNITS

A. Size: 2 inches less than door width on push side and 8 inches high.

B. Provide kick plates on doors where scheduled in the Hardware Schedule.

C. Fasteners: Manufacturer's standard machine or self-tapping screws.

D. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
   1. Material: 0.050-inch- thick stainless steel.

   2. Manufacturers: Provide kick plates model number 8400 in 630 finish as manufactured by the following:
      a. Ives. (IVE): Basis of Design.

2.8 STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16.

B. Provide the door stops at interior doors where indicated in the Hardware Schedule.
   1. Provide wall stops for doors unless other type stops are scheduled or indicated.

C. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 3/8 inch; fabricated for drilled-in application to frame.

D. Manufacturers:
   1. Ives (IVE) FS444- Basis of Design.

2.9 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." And ANSI A117.1.
   1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101 and with the ADA. Maximum 1/2 inch high.

D. Provide products by one of the following:

1. Pemko – 171A.
2. Reese Enterprises (RE) – S205A.
3. Zero International (ZRO) – 544A.

2.10 PERIMETER GASKETING AND WEATHER STRIPPING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with flexible seal strips that are easily replaceable and readily available from stocks maintained by manuf.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hager Companies.
      b. National Guard Products.
      c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
      d. Zero International.

B. Door Sweeps: Neoprene or Silicone gasket material held in place by flat aluminum housing or flange; surface mounted to face of door with screws.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Installation: Note that the labor for the installation of door hardware is to be carried out within the scope of Section “Finish Carpentry”.

B. Mounting Heights: Mount door hardware units at heights indicated on Drawings and as follows unless otherwise required to comply with governing regulations.
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

3.3 CLEANING AND PROTECTION.

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

D. Provide manufacturers' catalog cut sheets and maintenance manual sheets of all hardware items that have moving or operating parts to the Owner for his maintenance manuals.

PART 4 – DOOR HARDWARE SCHEDULE

A. Door hardware sets will be issued by Bid Addendum #1.

END OF SECTION 087000

SECTION 088000 – GLASS & GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors.

1.2 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glazing Schedule: Use same designations indicated on Drawings.

1.3 QUALITY ASSURANCE

A. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.

B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council.

1.4 WARRANTY

1. Manufacturer's Special Warranty: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. AGC Flat Glass, North America.
2. PPG Industries, Inc.
3. Pilkington North America, Inc.

2.2 GLASS PRODUCTS

A. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
3. For uncoated glass, comply with requirements for Condition A.
4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).

5. Provide Kind HS (heat-strengthened) float glass where safety glass is indicated.
6. Where located: Interior (non-fire-rated) door glazing.

2.3 GLAZING GASKETS

A. Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.

2.4 GLAZING TAPES

A. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

2.6 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.7 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units: Class 1 (clear) Kind HS (heat strengthened) float glass.

1. Thickness: 1/4-inch.

PART 3 - EXECUTION

3.1 GLAZING

A. General: Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

1. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
2. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
3. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
4. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
5. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

6. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

1. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
2. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

3. Apply heel bead of elastomeric sealant.
4. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

5. Apply cap bead of elastomeric sealant over exposed edge of tape.

C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

1. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
2. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
3. Install gaskets so they protrude past face of glazing stops.

3.2 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 088000

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Interior moisture-resistant gypsum board.
3. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Gypsum board.
2. Moisture-resistant gypsum board.
3. Cementitious backer units.
4. Interior trim.
5. Exterior trim.
6. Joint treatment materials.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. Moisture-Resistant Gypsum Board: ASTM C630. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8-inch, regular type.
2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
1. Thickness: 1/2 inch.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. Expansion (control) joint.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.

E. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840 and GA-216.

C. Provide gypsum wallboard of the thickness indicated complying with manufacturer’s recommendations for the application indicated.

D. Install gypsum wallboard in lengths and directions that will minimize the number of end joints and avoid end joints in central areas of ceilings.

E. Nail or screw gypsum wallboard to supports as recommended by manufacturer, unless otherwise noted.

F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

G. Provide casing bead at exposed edges of gypsum wallboard and wherever wallboard abuts with other wall or ceiling finishes.

H. Provide flush joint treatment and nail or screw-head treatment for exposed drywall work. Apply tape and compound in not less than three applications, sanding smooth after last two. Final gypsum finish shall be a smooth, uniform, plaster-like finish free of pop outs, depressions, ghosting of wallboard joints, and other surface irregularities.

I. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

J. Prefill open joints, rounded or beveled edges, and damaged surface areas.

K. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

L. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

M. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093000 – CERAMIC TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Glazed porcelain wall tile.
   2. Crack-suppression membrane for thin-set tile installations.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints.

C. Samples:
   1. Each type, composition, color, and finish of tile.
   2. Grout joints for each type, composition, color, and finish of tile.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 TILE PRODUCTS

A. Available Manufacturers:
   1. American Olean; Div. of Dal-Tile International Corp.
   2. Daltile; Div. of Dal-Tile International Inc.
   3. Florida Tile Industries, Inc.
   4. ROCA Tile USA.
   5. Summitville Tiles, Inc.

B. ANSI Porcelain Tile Standard: Provide Standard grade tile that complies with ANSI A137.3, "Specifications for Porcelain Tile," for types, compositions, and other characteristics indicated.

C. Glazed Wall Tile: Flat tile as follows:
   1. Module Size: 3 by 12 inches.
   2. Thickness: 1/4 inch.
   3. Face: Plain with modified square edges or cushion edges.

4. Finish: Mat, opaque glaze.
5. Color: As selected by Architect from manufacturer's full range.

D. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing where applicable.

1. Base: Coved 2 by 12 inches. Total height 6 inches.
2. Wainscot Cap: Bullnose, module size 2 by 2 inches, except at wet wall.
3. External Corners: 2 x 2 inches bullnose corner.
4. Internal Corners: Field-butted square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.
5. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORY MATERIALS

A. Crack-Suppression Membranes for Thin-Set Tile Installations: Manufacturer's standard product that complies with ANSI A118.10**,** selected from the following.

1. Fabric-Reinforced, Fluid-Applied Product: Liquid-latex rubber with fabric reinforcement.
   a. Available Products:
      1) LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
      2) MAPEI Corporation; PRP M19.
      3) Summitville Tiles, Inc.; S-9000.
2. Latex-Portland Cement Product: Flexible mortar with acrylic-latex additive.
   a. Available Products:
      1) MAPEI Corporation; PRP 315.
      2) Southern Grouts & Mortars, Inc.; Southcrete 1100.
      3) TEC Specialty Products Inc.; TA-324, Triple Flex.

2.4 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:
1. DAP, Inc.
2. LATICRETE International Inc.
3. MAPEI Corporation.
4. Summitville Tiles, Inc.
5. TEC Specialty Products Inc.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
1. Prepackaged dry-mortar mix containing dry additive to which only water must be added.
2. Prepackaged dry-mortar mix combined with liquid-latex additive.

3. For wall applications, provide nonsagging mortar.

C. Polymer-Modified Tile Grout: ANSI A118.7, color as as selected from manufacturer's standards.

2.5 MISCELLANEOUS MATERIALS

A. Elastomeric Sealants: Elastomeric sealants of base polymer and characteristics indicated.
   1. One-Part, Mildew-Resistant Silicone: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for in-service exposures of high humidity and extreme temperatures.

      a. Available Products:
         1) Dow Corning Corporation; Dow Corning 786.
         2) GE Silicones; Sanitary 1700.
         3) Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
         4) Tremco, Inc.; Tremsil 600 White.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials.

C. Metal Edge Strips: Angle or L-shape, half-hard brass exposed-edge material.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions.

C. Remove protrusions, bumps, and ridges by sanding or grinding.

D. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

E. Field-Applied Temporary Protective Coating: Where needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.2 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish, or built-in items. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Grout tile to comply with requirements of ANSI A108.10, unless otherwise indicated.

H. Install tile on walls with the following joint widths:
   1. Glazed Wall Tile: 1/16 inch.

I. Apply grout sealer to grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer that has gotten on tile faces by wiping with soft cloth.

3.3 WALL TILE INSTALLATION SCHEDULE

A. Interior wall installation; thin-set mortar; TCA W202
   1. Thin-Set Mortar: Latex-portland cement mortar.
   2. Grout: Polymer-modified grout.

END OF SECTION 093000

SECTION 104000 – FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.

1. Fire Extinguishers: Include rating and classification.

B. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

C. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to wall, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 PORTABLE FIRE EXTINGUISHERS

A. Available Manufacturers:

1. JL Industries, Inc.
2. Kidde Fyrnetics.
3. Larsen's Manufacturing Company.

B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet indicated.

1. Valves: Manufacturer's standard.
2. Handles and Levers: Manufacturer's standard.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3A-40BC, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguisher in location and at mounting height indicated below:

1. Fire extinguisher: Mount 48 inches above finished floor to top of mounting bracket.

3.3 SCHEDULE

A. Fire Extinguishers in cabinets in Rooms 101, 103, 104, and Corridor 112.

B. Fire Extinguishers bracket hung in Rooms 105, 109 (4), 110, 115, 116, 117, and 118.

END OF SECTION 104000

SECTION 104400 - SPECIALTY SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Samples: Submit samples of each color and finish of exposed materials and accessories required for specialty signs. Architect's review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

B. Shop Drawings: Submit shop drawings and schedules for fabrication and erection of specialty signs. Show anchorages and accessory items. Provide location template drawings for items supported or anchored to permanent construction.

1.3 MANUFACTURERS:

A. Provide specialty signs as manufactured by one of the following:
1. Architectural Graphics, Inc.
2. Andco Industries Corporation
3. Best Manufacturing Company
4. Matthews Architectural Division
5. Mohawk Sign Systems

PART 2 - PRODUCTS

2.1 INTERIOR SIGNS

A. Plastic Sand-Carved Signs: Use two-color laminated ES plastic sheets, approximately 1/8" thick. Sand carve to expose contrasting inner core color, producing raised tactile and braille characters and border. Provide ½” radius corners. Stroke width and depth shall meet the requirements of ADA (Americans with Disabilities Act). Colors to be selected by Architect from manufacturer's standards.

1. Room sign shall be approximately 6” x 6” (6” x 8” at toilets) and show the name of the space and appropriate braille symbols. On signs at toilets, also include picture symbol and the handicapped accessibility symbol. Provide one sign as scheduled on Drawing A603.

2.2 EXTERIOR SIGNS

A. Provide accessible parking signs and posts where indicated. The signs shall comply with ADA requirements.

PART 3 - EXECUTION

3.1 INSPECTION: Installer must examine the substrates and conditions under which the specialty signs are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION

A. Install sign units and components as directed by Architect, securely mounted with concealed fasteners, unless otherwise shown. Attach signs to substrates in accordance with the manufacturer's instructions.

B. Door signs shall be mounted on the wall on the latch side of the doors, 4" from the door frame. The top of the sign shall be mounted 64" above the finished floor.

C. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by the Architect.

END OF SECTION 10440

SECTION 105723 - WIRE SHELVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes wire shelving.

B. Related Sections include the following:

1. Division 06 Section 061000, “Rough Carpentry.”
2. Division 09 Section 09500, “Gypsum Board.”

1.3 SUBMITTALS

A. Submit under provisions of Section 013000, “Submittals”.

B. Product Data: Manufacturer's data sheets on each product to be used, including: Preparation instructions and recommendations, Storage and handling requirements and recommendations, and Installation methods.

C. Shop Drawings: Prepared specifically for this project; show dimensions of shelving and interface with other products.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience of the same type and scope as specified.

B. Installer Qualifications: Company specializing in the installation of the products specified in this section with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.

1.5 WARRANTY

A. At project closeout, provide to Owner or Owner's Representative an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: ClosetMaid Corp.

B. Requests for substitutions will be considered in accordance with provisions of Section 016000, “Product Requirements”.

C. Provide all storage shelving and accessories from a single manufacturer.

2.2 MATERIALS

A. Steel Wire: Basic cold drawn, Grade C-1006; average tensile strength over 100,000 psi; coated.

B. Wire Coating: Heavy-duty polyvinyl chloride (PVC) formula resin, plasticizers, stabilizers, pigments, and other additives.

1. Thickness: 7 to 17 mil.

2. Classification: No ingredients listed as hazardous per OSHA 29CFR1910.0017.

C. Hang Track: Hot-rolled sheet metal, Grade C-1008/C-1010; epoxy-coated.

D. Standards: Sheet metal, Grade C-1006; epoxy coated.

E. Ventilated Shelf Bracket: Sheet metal, High strength steel; epoxy coated.

2.3 ADJUSTABLE SHELFTRACK HARDWARE SYSTEM

A. Hang Track, Standards and Brackets:

1. Hang Track: Use to hang standards. Creates one step leveling and eliminates the need to install each standard separately

   a. Part # 2836 80-inch length.

2. Standard: Attaches to hang track. Provides adjustable height options for hanging shelving. Space standards no more than 24 inches apart and no more than 4 inches from each end of shelf.

   a. Part # 2800, 2801, 2008, 2804, or 2012 as required for installation as described on drawings.

3. Bracket: Attaches to standard to support shelving. Use a bracket that is the same depth as your shelving.

   a. Part # 2853, 2854, or 2855 as required for installation as described on drawings.

4. Color: Epoxy coated.

   a. White

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verification of Conditions:

1. Prepared spaces are sized and located in accordance with shop drawings.

2. Framing, reinforcement, and anchoring devices are correct type and are in accordance with shop drawings.

D. Installer's Examination:

1. Examine conditions under which installation is to be performed; submit written notification if such conditions are unacceptable.

2. Installation activities started before unacceptable conditions have been corrected is prohibited.

3. Installation indicates installer's acceptance of conditions.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with approved shop drawings and manufacturer's printed instructions.

B. Cut shelves 1/2 inch to 1 inch shorter than actual wall measurements; cap all exposed ends.

C. Install shelving plumb and level at heights indicated in accordance with shop drawings and manufacturer's printed installation instructions.

D. Drill holes where required using sharp bit; do not punch.

3.4 CLEANING

A. As work proceeds, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris related to this work.

B. Upon completion of installation, clean all surfaces that have become soiled during installation.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 SCHEDULE

A. Locate basic wire shelving in Laundry Room # 111.

END OF SECTION 105723

SECTION 107300 - METAL CANOPIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Hanger Rod Supported Metal Canopy Systems

1.2 RELATED SECTIONS

A. Section 042000 – Concrete Unit Masonry

B. Section 042613 – Masonry Veneer

1.3 SUBMITTALS

A. Submit under provisions of Section 013300 - Submittals.

B. Product Data:
1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.

C. Verification Samples: Two representative units of each type, size, pattern and color.

D. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction including structural component locations / positions, material dimensions and details of construction and assembly.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.5 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions i.e. temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

A. Manufacturer's Warranty: Aluminum frames are warranted against defects in workmanship for five years from date of installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with the project requirements, available manufacturers offering products that may be incorporated into the work include but are not limited to the following:

1. Basis of Design Manufacturer: Mapes, Inc., Lincoln Nebraska

2. Requests for substitutions will be considered in accordance with provisions of Section 016000 - Product Requirements.

2.2 METAL AWNINGS AND CANOPIES

A. Performance and Design Requirements:

1. Standards Compliance: Comply with local building codes.

B. Basis of Design: “Lumashade” Hanger Rod Canopy as manufactured by Mapes, Inc., Lincoln, Nebraska.

1. Decking shall consist of an interlocking roll-form 2 ½ W style pan (0.40” aluminum).
2. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in Mapes brochures.
3. Hanger Rods and attachment hardware shall be a standard finish.
4. Fascia shall be standard extruded 8-inch “J” style.

C. Finishes

1. Finish type shall be a clear anodized aluminum.

D. Fabrication

1. Factory preassemble sections for ease of installation.

2. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb.

3. Concealed drainage: Water shall drain from covered surfaces into

intermediate trough and be directed to downspout from rear gutter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly constructed and prepared.

B. Confirm dimensions and elevations prior to preparation of shop drawings.

C. Verify that wall structure can support canopy loads.

D. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

3.4 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer's recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 107300

SECTION 122123 - MANUAL ROLLER SHADE SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Manually operated sunscreen shades.

1.2 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   3. Storage and handling requirements and recommendations.
   4. Mounting details and installation methods.

B. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, and relationship to adjacent work.
   1. Include coverage patterns and physical dimensions of each item.

C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

D. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade cloth samples and aluminum finish sample as selected. Mark face of material to indicate interior faces.

E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

F. Warranty: Provide manufacturer's warranty documents as specified in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years' experience manufacturing products comparable to those specified in this section. This includes, but is not limited to, all required extrusions, accessories and fabricated roller shades.

B. Shadecloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, and ATCC9645.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver components in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.6 WARRANTY

A. Warranty: Provide manufacturer's standard warranties, including the following:
   1. Roller Shade Hardware, and Shadecloth: Manufacturer's standard non-depreciating twenty-five-year limited warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer for Window Shade System: Products by MechoSystems; 42-03 35th Street, Long Island City, NY 11101.

2.2 SHADE BANDS

A. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
   1. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:
      a. Hembar shall be heat sealed on all sides.
      b. Open ends shall not be accepted.
   2. Shade Band and Shade Roller Attachment:
      a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
      b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
      c. Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
      d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the

performance requirements of this specification and shall not be accepted.

2.3 ROLLER SHADE FABRICATION

A. Fabricate shade cloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch in either direction per 8 feet of shade height due to warp distortion or weave design.

B. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shade bands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

2.4 ROLLER SHADE COMPONENTS

A. Access and Material Requirements:
   1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
   2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive, or operating support brackets.

B. Manually Operated Chain Drive Hardware and Brackets:
   1. Provide for universal, regular, and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
   2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
   3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
   4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
   5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
   6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable.

7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
8. Drive Bracket / Brake Assembly:
   a. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.
   b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8-inch steel pin.
   c. The brake shall be an over running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. in the stopped position.
   d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
   e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
9. Drive Chain: #10 qualified stainless-steel chain rated to 90 lb. minimum breaking strength. Nickel plate chain shall not be accepted.

2.5 ROLLER SHADE SCHEDULE

A. Roller Shade Schedule: Refer to the Drawings for locations.
   1. Shade Type WT-1: Manual operating, chain drive, sunscreen roller shades in all exterior windows of rooms and spaces shown on the Drawings.

2.6 SHADECLOTH

A. Visually Transparent Single-Fabric Shadecloth: MechoSystems, ThermoVeil® group, single thickness, opaque non-raveling 0.030-inch-thick vinyl fabric, woven from 0.018-inch diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range.

   1. Dense Linear Weave: "1000 series", 3 percent open, dense linear-weave pattern.
   2. Color: Selected from manufacturer's standard colors.

2.7 ROLLER SHADE ACCESSORIES

A. Fascia:

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Do not begin installation until the substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION OF ROLLER SHADES

A. Contractor Furnish and Install Responsibilities:
1. Window Covering Contractor (WC) shall provide an on site, Project Manager, and shall be present for all related jobsite scheduling meetings.
2. WC shall supervise the roller shade installation and setting of intermediate stops of all shades to assure the alignment of the shade bands within a single EDU group, which shall not exceed +/- 0.125 inches, and to assure the alignment between EDU groups, which shall not exceed +/- 0.25 inches.
3. WC shall be responsible for field inspection on an area-by- area and floor-by-floor basis during construction to confirm proper mounting conditions per approved shop drawings.
4. Verification of Conditions: examine the areas to receive the work and the conditions under which the work would be performed and notify General Contractor and Owner of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation shall constitute acceptance of substrate conditions by the installer.
5. WC shall provide accurate to 0.0625 inch; field measurements for custom shade fabrication on the Roller Shades manufacturers input forms.
6. WC Installer shall install roller shades level, plumb, square, and true according to manufacturer's written instructions, and as specified here in. Blocking for roller shades installed under the contract of the interior General Contractor shall be installed plumb, level, and fitted to window mullion as per interior

architect's design documents and in accordance with industry standard tolerances. The horizontal surface of the shade pocket shall not be out-of-level more than 0.625 inch over 20 linear feet.

7. Shades shall be located so the shade band is not closer than 2 inches to the interior face of the glass. Allow proper clearances for window operation hardware.
8. Adjust, align and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
9. Installer shall set Upper, Lower and up to 3 intermediate stop positions of all motorized shade bands and assure alignment in accordance with the above requirements.
10. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
11. WC shall train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.
12. Protect installed products until completion of project.
13. Touch-up, repair or replace damaged products before Substantial Completion.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 122123

SECTION 123661 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Type: Provide Standard type.
2. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: 1-1/2-inch laminated bullnose
2. Backsplash: Radius edge with 3/8-inch radius.
3. End Splash: None.

C. Countertops: 3/4-inch thick, solid surface material with front edge built up with same material.

D. Backsplashes: 3/4-inch thick, solid surface material.

E. Joints: Fabricate countertops without joints.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200, "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.

B. Install backsplashes and end splashes by adhering to countertops with adhesive.

C. Install aprons to backing and countertops with adhesive.

D. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

E. Apply sealant to gaps at walls; comply with Section 079200, "Joint Sealants."

END OF SECTION 123661

SECTION 311000 – SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work consists of clearing, grubbing, removing, and disposing of trees, vegetation, and debris. This Section also provides for stripping and stockpiling of topsoil.

B. All site excavation, filling, and grading shall comply with applicable provisions of Section 301 – Clearing and Grubbing in the most recent edition of the VDOT Road and Bridge Specifications for work within the limits of construction.

1.2 RELATED SECTIONS

A. The drawings, all other applicable/related technical specifications, and general provisions of the agreement, including the general conditions and supplemental conditions apply to this section.

1.3 REFERENCES

A. Virginia Department of Highways (VDOT) "Road and Bridge Specifications," current edition.

B. Virginia Department of Conservation and Recreation "Virginia Erosion & Sediment Control (ESC) Handbook," current edition.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Refer to the most recent editions of the VDOT Road and Bridge Specifications for applicable provisions of Section 244(b) – Roadside Development Materials: Topsoil.

PART 3 -EXECUTION

1.1 PROCEDURES

A. Refer to the most recent editions of the VDOT Road and Bridge Specifications for applicable provisions of Section 310.02 – Procedures.

END OF SECTION 311000

SECTION 311000 – SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

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1.3 REFERENCES

A. Virginia Department of Highways (VDOT) "Road and Bridge Specifications," current edition.

B. Virginia Department of Conservation and Recreation "Virginia Erosion & Sediment Control (ESC) Handbook," current edition.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Refer to the most recent editions of the VDOT Road and Bridge Specifications for applicable provisions of Section 244(b) – Roadside Development Materials: Topsoil.

PART 3 -EXECUTION

1.1 PROCEDURES

A. Refer to the most recent editions of the VDOT Road and Bridge Specifications for applicable provisions of Section 310.02 – Procedures.

END OF SECTION 311000

SECTION 312000 – EARTHWORK FOR UTILITIES

PART 1 - GENERAL

1.1 SCOPE - This section covers the excavation and backfill for all water, sanitary sewer, and storm sewer pipelines.

PART 2 - MATERIALS

2.1 INITIAL BACKFILL - Initial backfill is defined as that material placed from the bottom of the trench excavation to the minimum required depth over the top of the pipe, as shown on the standard detail plan sheets. Initial backfill shall be consolidated using a hand operated vibratory compactor. Initial backfill material is classified based upon the Unified Soil Classification System (USCS). The soil classifications are defined as follows:

USCS Soil Classification System (FHA Bulletin No. 373)as shown on the

Plans. Class I - Angular, crushed (1/4 to 1 inch – i.e. VDOT #26 stone)

Class II - Coarse sands and gravel with maximum particle size of 25 mm (1 inch) including variously graded sands and gravel containing small percentages of fine, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class (i.e. VDOT #78 stone).

Class III - Fine sand and clayey gravel less than 1 inch, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types GM, GC, SM, and SC are included in this class (i.e. VDOT #10 stone).

2.2 FINAL BACKFILL - Final backfill is that material placed from the top of the initial backfill to the top of the trench. In general, material excavated from the trench may be used as final backfill with the following exceptions:

1. Unsuitable soils shall not be used for final backfill. Unsuitable soils include mud, muck, organic matter, and construction debris.

2. Rock over 5" in size shall not be used for final backfill.

3. In paved areas which are to be repaved following pipeline construction, trench backfill shall be Class I, full depth.

PART 3 - EXECUTION

3.1 EXCAVATION

3.1.1 General - All excavation shall be open-cut unless designated otherwise on the plans. All excavation shall be unclassified, regardless of the nature of material encountered. The cost for excavation shall be included in the contractor's bid for pipeline as no separate payment will be made for excavation. It is the Contractor's responsibility to determine what protective measures (shoring, sheet piling, trench box, etc.) are required to execute the work and provide safety to the workers and the general public.

3.1.2 Trench Excavation - Trenches for pipeline utilities are to be excavated by the Contractor using equipment/procedures necessary to complete the work. Trench width shall be as required to meet the minimum pipe bedding requirements shown on the plan sheets and to comply with OSHA safety requirements. Trenches are to be excavated to the design grade depth and width. Minimum trench width for all pipelines 2 inches and larger shall be no less than the outside diameter of the pipe plus 8 inches. Small diameter (1" and smaller) water service lines may be installed using a narrower trench width. It is the Contractor's responsibility to excavate trenches at the design depth. Over excavation shall be replaced with suitable compacted fill material at the Contractor's expense. In no case shall pipe bear upon bedrock in the trench.

When the utility trench lies in bedrock, the trench shall be over excavated a minimum of 6" below the design grade and backfilled to the design grade with crushed stone. In locations where the excavated trench is unsuitable to support the pipe due to wet or unstable material, the unsuitable material shall be removed and replaced with suitable material. The cost for all excavation and replacement of unsuitable materials shall be included in the Contractor's bid for pipeline installation as no separate payment will be made.

3.1.3 Pipe Bedding - Bedding requirements for pipelines are dependent upon the type of pipe material utilized. Refer to the Standard Detail plan sheets for the type of bedding and backfill material required (Class I, II, or III as described in Part 2) and for the type of trench preparation (Class A, B, or C) as described herein. Bedding requirements shall be as follows:

A. PVC Pipeline Material - Bedding for all material lines (gravity or pressure) shall be a minimum of Class B as described in ASCE Manual No. 37 and as shown on the standard detail plan sheets - unless otherwise specified.

B. Metal Pipeline Material (Ductile Iron, steel, copper) - Bedding for all metal material lines (gravity or pressure) shall be a minimum of Class C as described in ASCE Manual No. 37 and as shown on the standard detail plan sheets - unless otherwise specified.

C. Reinforced Concrete Pipeline Material - Bedding for all reinforced concrete material lines (gravity or pressure) shall be a minimum of Class C as described in ASCE Manual No. 37 and as shown on the standard detail plan sheets - unless otherwise specified.

D. Exceptions - The bedding requirements and bedding details as specified herein and as shown on the standard detail plan sheets have been developed to cover most situations. There may be instances when more or less stringent bedding requirements are warranted. In these special cases, the Engineer and Contractor shall work together to resolve a mutually agreeable solution.

3.2 BACKFILLING - Trenches shall be backfilled as the work progresses. No more than 500 linear feet of trench shall be open at any time. All trenches shall be backfilled at the end of the work day as exposed trenches shall not be left unattended. Initial backfill material shall be Class I, II, or III material as defined in Section 2.1 and as shown on the standard detail plan sheets. Final backfill material shall generally consist of that material excavated from the trench except that unsuitable materials shall not be used. Unsuitable final backfill material would include mud, stumps, organic matter, trash, frozen material, or rock larger than 5". All backfill materials shall contain a moisture content that will facilitate compaction. The initial backfill shall be brought up in layers not exceeding 6 inches in compacted depth for the full length of pipe. Each layer shall be thoroughly compacted by hand operated tamping equipment. The remainder of the trench shall be backfilled. Final backfill shall be brought up and compacted in layers not exceeding 8 inches. Backfill in open areas shall be compacted to a density equal to that of the existing ground. Backfill under roadways or other areas subjected to vehicular traffic shall be compacted to a minimum density of 95 percent of maximum density. It is the Contractor's responsibility to dispose of excess trench excavation material in a lawful acceptable manner. It is the Contractor's responsibility to repair any backfill settlement which occurs during the term of the construction contract and warranty period.

3.3 FILL - Fill material shall be provided where required to raise the subgrade to the elevations shown on the plan sheets or to replace unsuitable materials. Fill material placed below the design subgrade elevation shall comply with the requirements for initial backfill material. Fill material placed above the design subgrade elevation shall comply with the requirements for final backfill material. Fill material shall be free of trash, roots, organic matter or frozen materials. No fill shall be placed on muddy or frozen ground. Fill material shall be placed in successive 6" vertical lifts and compacted until the desired grade is achieved.

3.4 BORROW - When satisfactory material is not available from required trench excavations, the Contractor shall obtain suitable borrow material. It is the Contractor's responsibility to locate suitable borrow site(s) and to restore the property to the satisfaction of the property owner when complete. No separate payment will be made for furnishing and placing borrow material as the cost for borrow material is to be included in the Contractor's bid for pipe installation.

3.1 CONCRETE ENCASEMENT - Where called for on the plan sheets, pipe shall be concrete encased. Concrete used for concrete encasement shall have a minimum 28-day compressive strength of 2500 psi. Concrete used for crossings designated as "river crossing" shall include reinforcing steel. The dimensions of the encasement shall conform to the dimensions shown on the plans. No concrete shall be placed directly in water. The Contractor shall not backfill over concrete encasement until 24 hours after pouring, unless directed otherwise by the Engineer. Concrete encasement will be paid for using a linear foot unit price.

3.2 BLASTING - The Contractor may use blasting to assist in trench excavation when conventional excavating equipment alone will not perform the job. Blasting operations shall be in strict accordance with all applicable existing ordinances, OSHA, and state regulations. It is the responsibility of the Contractor to protect all persons and property from damage. Blasts will be secured in a manner to prevent the escape of flying material. The Contractor is strongly encouraged to conduct pre-blast investigations of adjacent properties for his protection. In the event that blast damage occurs, it shall be repaired by the Contractor at his expense. No blasting operations shall be performed without prior written permission from those authorities having jurisdiction.

3.2.1 Blasting on VDOT Right-of-Way – VDOT has indicated that special terms and conditions must be complied with before any blasting will be allowed on VDOT r/w. First, VDOT requires that all means of excavation be exhausted prior to blasting operations, including for primary routes, attempting to trench with a minimum 350 hp, minimum 70,000 lbs gross weight rock trencher, Vermeer Model T858, or equivalent. If indeed, the need for blasting is the only remaining option to facilitate the permitted work at a specific location, the following stipulations must be met:

- The contractor shall conduct an on-site review of the work involved and develop a plan of operations for performing the excavation work which shall include a blasting plan detailing the blasting techniques to be used. This operation plan is to be submitted to VDOT prior to blasting operations for review; and approval. Items to be provided in the plan are to include, but not limited to, are:

  - the certified blaster information, with his/her project history
  - the number of holes and amount of explosive per hole
  - the time and location, including the proposed length of each blast (at station from and to and off- set based on the approved plans will suffice)

- Temporary Traffic Control Measures set up according to the Virginia Work Area Protection Manual for Blasting Operations. A note shall be included in the blasting plan that states the traffic control will be according to the Virginia Work Area Protection Manual and MUTCD.

- Explosives must be stored and utilized in a secure manner in compliance with federal, state, and local laws and ordinances.

- Notification to VDOT must occur at least two business (Monday-Friday) days prior to the blast.

In addition, the Permittee and their agents/designees shall be responsible for damage resulting from the use of explosives, and a note to this affect shall be included with the blasting plan. The Permittee shall notify each property and utility owner having a building, structure, or other installation above or below ground in proximity to the site of the work of his intention to use explosives. Notice shall be given sufficiently in advance of the start of blasting operations to enable the owners to take steps to protect their property. The review of the Permittee's plan of operations, blasting plan and the notification of property/utility owners shall in no way relieve the Permittee of his responsibility for damage resulting from the blasting operations.

Please note that special care must be taken in proximately to any and all VDOT structures within the impact area. No damage to the traveling surfaces, causing lane shut-down, will be tolerated; and such damage will be grounds for the suspension of all remaining operations. NO EXCEPTIONS.

3.3 AGGREGATE AND PAVING - All open cuts through pavement shall be backfilled with crushed stone. Paved public roadways shall be repaved using asphalt base course (greater of 3" or 1.5x existing thickness) and asphalt surface (greater of 2" or existing thickness). Disturbed gravel roads, driveways and shoulders shall be replaced with aggregate stone a minimum depth of six inches or equal to the original thickness, whichever is greater. Existing paved driveways that are disturbed shall be repaved to original thickness using local plant mix asphalt – but in no case less than 2" thickness.

END SECTION 312000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for [**slabs-on-grade**] [**walks**] [**pavements**] [**turf and grasses**] [**and**] [**plants**].
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete [**walks**] [**pavements**].
6. Subbase course[**and base course**] for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

Consider revising "Drainage Course" Paragraph below and throughout this Section to suit Project or office standard.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, will be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at [**Project site**] <**Insert location**>.

1.4 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.5 FIELD CONDITIONS

Retain "Utility Locator Service" Paragraph below if required and not specified in Section 311000 "Site Clearing"; revise to suit Project.

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

Retain paragraph below if protection zones and protection-zone fencing are required.

B. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

Revise "Satisfactory Soils" and "Unsatisfactory Soils" paragraphs below and identify soil materials according to geotechnical engineer's written recommendations. Revise soil groups and size of stone to suit

Project. Most soils are classified according to ASTM D2487. Heavy civil or highway projects may use AASHTO M 145.

B. Satisfactory Soils: Soil Classification [**Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487**] [**Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145**], or a combination of these groups; free of rock or gravel larger than [**3 inches (75 mm)**] <**Insert dimension**> in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

Retain "Liquid Limit" and "Plasticity Index" subparagraphs below if required to further qualify satisfactory soil groups.

1. Liquid Limit: <**Insert value**>.
2. Plasticity Index: <**Insert value**>.

C. Unsatisfactory Soils: Soil Classification [**Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487**] [**Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145**], or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

Terms, descriptions, and gradations of granular soil materials in remaining paragraphs are examples only. Revise to comply with local practices and to suit Project. For example, granular materials may be referenced by state or local highway designations rather than by ASTM classifications.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of [**washed**]crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.

2.2 ACCESSORIES

Retain one or both of "Warning Tape" and "Detectable Warning Tape" paragraphs in this article to suit Project. Use of warning tapes may be mandatory for underground hazardous utilities.

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

Retain "Unclassified Excavation" Paragraph below if excavation is unclassified and no changes in the Contract Sum or the Contract Time will be authorized for rock excavation.

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

Revise tolerances in this article to suit office practice if applicable.

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

Revise "Excavations for Footings and Foundations" Subparagraph below if footings and foundations are placed on engineered fill.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

Retain "Pile Foundations" Subparagraph below if required.

2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

Retain "Excavations at Edges of Tree- and Plant-Protection Zones" Paragraph below if required.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

Coordinate this article with utility Sections in other Divisions.

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: [**12 inches (300 mm) each side of pipe or conduit**] [**As indicated**].

Revise "Trench Bottoms" Paragraph below to suit Project conditions, requirements of authorities having jurisdiction, type of pipe or conduit, and manufacturer's installation requirements.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 SUBGRADE INSPECTION

Revise locations for proof-rolling in first paragraph below if required; revise type of vehicle and minimum weight to suit Project.

A. Proof-roll subgrade [**below the building slabs and pavements**] <**Insert locations**> with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

Revise subparagraphs below to suit Project.

1. Construction below finish grade.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within [**18 inches (450 mm)**] <**Insert dimension**> of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide [**4-inch- (100-mm-)**] <**Insert dimension**> thick, concrete-base slab support for piping or conduit less than [**30 inches (750 mm)**] <**Insert dimension**> below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of [**4 inches (100 mm)**] <**Insert dimension**> of concrete before backfilling or placing roadway subbase course. Concrete is specified in **S**ection 033000 "Cast-in-Place Concrete."

E. Initial Backfill: Place and compact initial backfill of [**subbase material**] [**satisfactory soil**], free of particles larger than [**1 inch (25 mm)**] <**Insert dimension**> in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

Revise tape depths in "Warning Tape" Paragraph below to suit office practice if applicable.

G. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

Revise soil materials in subparagraphs below to suit Project. Other soil materials, such as a drainage course or subbase or base courses, may still be required over fill.

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.

Retain subparagraph below if backfill or fill beneath footings and foundations is required. Coordinate material selection with geotechnical engineer's written recommendations.

5. Under footings and foundations, use engineered fill.

3.12 SOIL MOISTURE CONTROL

Revise percentages in this article according to geotechnical engineer's written recommendations.

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

Revise depth of layers in first paragraph below to suit Project.

A. Place backfill and fill soil materials in layers not more than [**8 inches (200 mm)**] <**Insert dimension**> in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

Retain one option in paragraph below based on ASTM laboratory-test method required. Replace the term "unit weight" with "density" if preferred.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to [**ASTM D698**] [**ASTM D1557**]:

Retain applicable subparagraphs below. Percentages of maximum dry unit weight are examples only; revise to suit Project. Delete scarifying and recompacting existing subgrade when proof-rolling will suffice.

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at [**95**] <**Insert number**> percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at [**92**] <**Insert number**> percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at [**85**] <**Insert number**> percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at [**85**] <**Insert number**> percent.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

Revise "Turf or Unpaved Areas," "Walks," and "Pavements" subparagraphs below to suit Project.

1. Turf or Unpaved Areas: Plus or minus [**1 inch (25 mm)**] <**Insert dimension**>.
2. Walks: Plus or minus [**1 inch (25 mm)**] <**Insert dimension**>.
3. Pavements: Plus or minus [**1/2 inch (13 mm)**] <**Insert dimension**>.

C. Grading inside Building Lines: Finish subgrade to a tolerance of [**1/2 inch (13 mm)**] <**Insert dimension**> when tested with a 10-foot (3-m) straightedge.

3.15 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

Revise this article to suit Project and for installations of subbase and base courses other than under pavements and walks.

A. Place subbase course[**and base course**] on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course[**and base course**] under pavements and walks as follows:

Retain option in three subparagraphs below if retaining "and base course" option in paragraphs above.

1. Shape subbase course[**and base course**] to required crown elevations and cross-slope grades.
2. Place subbase course[**and base course**] that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
3. Compact subbase course[**and base course**] at optimum moisture content to required grades, lines, cross sections, and thickness to not less than [**95**] <**Insert number**> percent of maximum dry unit weight according to [**ASTM D698**] [**ASTM D1557**].

3.16 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than [**95**] <**Insert number**> percent of maximum dry unit weight according to ASTM D698.

3.17 FIELD QUALITY CONTROL

Retain "Special Inspections" Paragraph below if special inspections are required by code and revise to suit requirements of authorities having jurisdiction.

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections:

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

Retain first paragraph below if applicable; revise to suit Project.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

Retain "Footing Subgrade" Paragraph below if applicable; revise to suit Project. If retaining, add other field tests, such as California bearing ratio of subgrades, subbases, and bases for paving, if required.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 313000 – SITE GRADING

PART 1 - GENERAL

1.1 SCOPE - This section covers excavation, construction of embankments, preparation of subgrade and grading for all areas more than 5 feet beyond the outside edge of buildings or structures.

1.2 MATERIAL CLASSIFICATION - All material excavated shall be defined as "unclassified excavation".

Soils classified as unsuitable materials will also be considered unclassified excavation and shall be paid for at the same unit price as unclassified excavation. Excavation, hauling, and placement of suitable material that replaces unsuitable material, shall be paid for at the unit price for unclassified excavation. Unsuitable materials will be determined by the Geotechnical Engineer. In general, soils containing more than 5% by weight of fibrous organic materials, having a Plasticity Index greater than 20, or of improper moisture content are considered unsuitable materials for fill. There shall be no additional payment made if unsuitable materials are encountered.

PART 2 - PRODUCTS

2.1 SPOT SUBGRADE REINFORCEMENT - The material to be used for spot subgrade reinforcement shall consist of one of the following types with necessary filler: crushed stone, gravel, or other approved material. The gravel or crushed stone shall consist of pieces varying from 1 inch to 3-1/2 inches in diameter. When a finer material is necessary for filler, broken stone chips, screened gravel, or sand may be used to completely fill all voids. All spot subgrade reinforcement material shall be subject to approval of the Engineer.

2.2 RIP RAP - Rip Rap utilized for this project shall conform to the VDOT Road and Bridge Specifications. Rip Rap shall conform to size and shape requirements of VDOT Class I, Class II, Class III, Type I, or Type II as shown on the plans.

PART 3 - EXECUTION

3.1 BLASTING - Blasting operations, if proposed to be utilized by the Contractor, shall be completed in accordance with all applicable local ordinances and OSHA guidelines.

3.2 CLEARING AND GRUBBING - Clearing and grubbing shall be done in the areas where grading and excavating operations are required. Clearing and grubbing shall include the removal of swamp grass, brush, shrubs, loose stones and trees. This material shall be disposed of off-site at a location approved by the Engineer.

3.3 BACKFILL ADJACENT TO STRUCTURES - Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structure, and all slopes bounding or within the areas to be backfilled shall be stepped or serrated to prevent such wedging action. During backfilling operations, and in the formation of embankments, care shall be exercised that the equipment used will not overload the structure in passing over and compacting these fills. Backfill for buildings, structures and underground utilities shall conform to the additional requirements elsewhere, under "Excavation", "Filling" and "Backfilling" for Structures, and "Excavation" and "Backfilling" for Underground Utilities, and Roadways.

3.5 PREPARATION OF GROUND SURFACE FOR FILL

3.5.1 The existing ground surface of all areas upon which embankment for roads, parking lots, walks, structures or other construction is to be placed shall be cleared of all surface vegetation, grass, rubbish, topsoil and other unsuitable material.

3.5.2 The existing ground surface of all other areas (except those called out in the preceding paragraph, 3.5.1) upon which embankment is to be placed, shall be cleared of vegetation by mowing to 2 inches or less and removing the mowed material. The ground surface shall then be plowed, such that the first lift of embankment material will be mixed with the existing surface. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed, shall be plowed, stepped or broken up in such a manner that the fill material will bond with the existing surface, as directed or approved by the Engineer.

3.5.3 Prepared surfaces shall be wetted and compacted when directed by the Engineer.

3.6 FILL - Fills, or embankments herein designated as fills, shall be constructed at the locations and to the lines and grades indicated on the Plans and as directed by the Engineer. The completed fill shall correspond to the shape of the finished contours shown on the plans. All suitable materials removed from required excavation shall be utilized in the formation of embankments as required. All trash, frozen material, and stones having a maximum dimension greater than 6 inches shall be removed from the fill material. Stones larger than 4 inches maximum dimension will not be permitted in the upper 6 inches of fill or embankment. The material shall be placed in successive vertical layers of 6 inches to 8 inches in loose depth, for the full width of the cross section.

3.7 TOPSOIL - Existing topsoil shall be stripped from all areas where excavation or grading is to be performed, prior to the commencement of such excavation, grading or filling. The topsoil shall be carefully removed so as not to include muck or soils other than topsoil, and shall be placed in stockpiles conveniently located to the areas which are subsequently to receive application of topsoil.

3.8 COMPACTION

3.8.1 Overall Areas - Each layer of all fills and embankments, constructed under this Section below the 4 inch topsoil layer shall be compacted at a moisture content from 3 percent below to 3 percent above optimum moisture to 95 percent of the maximum density, determined by ASTM-698. Generally, compaction of cohesive soils shall be accomplished by rollers or mechanical tampers, and compaction of granular materials shall be accomplished by rubber-tired rollers or vibratory equipment. The contractor shall provide soil information and performance of compaction tests.

3.8.2 Areas including Roadway and Walkway Embankments - All fills or embankment for roadways and walkways shall be compacted as specified in the preceding paragraph, 3.8.1, with the exception that the upper layer forming the subgrade shall be compacted as specified below, and elsewhere under "Roadway".

3.8.2.1 Subgrade Preparation - After the subgrade has been shaped to line, grade, and cross section, it shall be rolled with an approved power roller until thoroughly compacted as determined by the Engineer. This operation shall include any reshaping and wetting required (moisture content between 2 percent below and 3 percent above optimum) along with the rolling of the subgrade, to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material from excavation or borrow, or with the materials specified for spot subgrade reinforcement, as approved by the Engineer. The resulting area and all other low sections, holes, and cross section and shall be thoroughly compacted as herein provided. Subgrade compaction shall be extended to include the shoulders. The subgrade shall in every area be compacted to 95 percent of the maximum density as determined by ASTM-698 obtained at optimum moisture content.

3.8.2.2 Field Control - The Contractor shall provide at his own expense a geotechnical testing service under the direction of a professional engineer registered in the state of Virginia. The testing service shall evaluate and monitor placement of and provide compaction testing of fills. Test results shall be provided to the Engineer as requested. The Geotechnical Engineer shall provide a minimum testing frequency in accordance with the following:

- a minimum of three (3) field density tests required per every 2 feet (vertical) of compacted fill material placed.

3.9 FINISHED EXCAVATION, FILLS AND EMBANKMENTS - Uniformly smooth grade all areas covered by the project, including excavated and filled sections and adjacent transition areas. The finished surface shall be reasonably smooth, compacted and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified. The finished surface shall not vary more than 0.10 foot above or below the established grade or approved cross section. All ditches shall be finished so as to drain readily. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. The surface of embankments or excavated areas for road construction, on which a base course or pavement is to be placed, shall not vary more than 0.05 foot from the established grade and approved cross section.

3.10 SUBGRADE AND EMBANKMENT PROTECTION - During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along the subgrade shall be maintained in such manner as to drain effectively at all times. When ruts occur in the subgrade, the subgrade shall be brought to grade, reshaped if required, and recompacted prior to the placing of base course or surfacing. The storage or stockpiling of materials on the subgrade will not be permitted. No aggregate course shall be laid until the subgrade has been checked and approved, and in no case shall any aggregate course be placed on a muddy subgrade or on one containing frost.

END SECTION 313000

SECTION 313116 – TERMITE CONTROL

PART 1 – GENERAL

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

1.2 SUMMARY: Provide soil treatment for termite control, as herein specified.

1.3 SUBMITTALS: Product Data: Submit manufacturer's technical data and application instructions for Architects approval.

1.4 QUALITY ASSURANCE

A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for work and application.

B. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

C. Use only termiticides which bear a Federal registration number of the U.S. Environmental Protection Agency.

1.5 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating and filling are completed, except as otherwise required in construction operations.

B. To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 SPECIFIC PRODUCT WARRANTY

A. Furnish written warranty certifying that applied soil termiticide treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation at no cost to the Owner. Provide warranty for a period of 5 years from date of treatment, signed by Applicator and Contractor.

PART 2 – PRODUCTS

2.1 SOIL TREATMENT SOLUTION

A. Use an emulsible concentrate termiticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements and concentrations:

1. Chloropyrifos ("Dursban TC"); 1.0 percent in water emulsion.
2. Permathrin ("Dragnet", "Torpedo"); 0.5 percent in water emulsion.

B. Other solutions may be used as recommended by Applicator if also acceptable to the Architect and approved for intended application by jurisdictional authorities. Use only soil treatment solutions which are not injurious to planting.

PART 3 – EXECUTION

3.1 INSPECTION: Applicator must examine the areas and conditions under which soil treatment for termite control is to be installed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Applicator.

3.2 APPLICATION

A. Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placement of compacted fill under slabs, if acceptable to the Architect.

B. Application Rates: Apply soil treatment solution as follows:

1. Within building area, with or without slabs-on-grade, at the rate of 1 gal. per 10 sq. ft.
2. Under foundations and footings, including horizontal and vertical surfaces of excavations, at the rate of 1 gal. per 10 sq. ft.3. Outside building perimeter in a strip at least 2' wide, and under porches, areaways, aprons, pads, stair landings or paved extensions, at a rate of 1 gal. per 5 sq. ft.
4. At pavement structures, limit treatment under pavement to a 2' wide strip adjacent to structure, at the rate of 1 gal. per sq. ft.
5. In absorbent soil or fill (sand, sand and gravel mix, etc.) increase the application rate to 1-1/2 gal. per 10 sq. ft. where 1 gal. per 10 sq. ft. is specified.
6. At hollow masonry foundations or grade beams, treat voids at the rate of 1 gal. per 5 lin. ft., poured directly into the hollow spaces.

C. Allow not less than 12 hours for drying after application, before beginning concrete placement or other construction activities.

D. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION 313116

SECTION 314000 – EARTHWORK FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section covers excavating, filling and backfilling for buildings and structures. Work under this Section extends to a point 5 feet (unless noted otherwise on drawings) beyond the enclosing walls or foundations of appurtenances of a building or structure.

B. All excavation will be categorized as unclassified, regardless of the nature of the material.

When unsuitable material is encountered at design subgrade elevation, the unsuitable materials shall be undercut under the directions of the Geotechnical Engineer and backfilled with compacted structural fill to original design subgrade elevation.

No compensation will be given due to overexcavation of the contractor's fault.

C. Additional test borings or other exploratory operation may be made by the Contractor at his expense.

D. During the life of the contract, utility lines constructed shall be protected from damage.

1.3 SUBMITTALS

A. Submit three (3) copies of the following reports directly to the Architect/Engineer from the Geotechnical Engineer and testing laboratory.

1. Test report on borrow material.
2. Verification of foundation subgrade (rock when applicable) by a registered Geotechnical Engineer.
3. Compaction test reports
4. Any additional exploration for sinkhole activity.
5. Test Report on structural fill.

All test reports and correspondence shall bear the approved Geotechnical Engineers seal and signature.

1.4 QUALITY ASSURANCE

A. The Contractor shall employ a Geotechnical Engineer and testing laboratory licensed to practice in the state in which construction of this project occurs and, acceptable to the Architect/Engineer to perform soils testing and inspection service for quality control.

B. All excavations shall conform to current applicable OSHA regulations.

C. Dewatering operations shall conform to all applicable regulations.

PART 2 - PRODUCTS

2.1 DEFINITIONS

A. Satisfactory Soil shall be determined by the registered Geotechnical Engineer.

B. Compacted Structural Fill and backfill material shall be considered suitable when it conforms to the following requirements unless specified otherwise on the plans or in the specifications (as determined by the Geotechnical Engineer).

-- Classify as SC, SM, SP, SW, GC, GM, GP, GW in accordance with ASTM D-2487.
-- Less than 25 percent by weight passing the No. 200 sieve.
-- Maximum Particle Diameter of 3 inches.
-- Shall be compacted to at least 95 percent of maximum dry density per ASTM D-1557, Modified Proctor.
-- Shall be free of waste, frozen materials, vegetation and other deleterious matter.

C. Suitable Natural Soil - Suitable natural soil is that subgrade which has been determined by the Geotechnical Engineer to be capable of the bearing pressures given on drawings and also determined to be acceptable for further construction by the Geotechnical Engineer.

D. Volume of Unsuitable Subgrade Material - Shall be defined as the volume of the material in place below design subgrade elevation prior to disturbance or removal.

E. Drainage Fill Material - (Crushed stone or gravel) - Washed uniformly graded mixture of crushed stone with 100% passing a 1-1/2" sieve and not more than 5% passing a No. 4 sieve.

F. Lean Concrete Fill - Concrete with 2500 psi (min) 28-day compressive strength, and meeting requirements of Concrete Section of these Specifications.

PART 3 - EXECUTION

3.1 TOPSOIL/SURPLUS SOILS/UNSUITABLE SOILS

A. Topsoil shall be stripped and stockpiled at a location agreed to by the Architect/Engineer.

B. Surplus soils materials or unsuitable soils materials from excavation on the site shall be disposed of at waste areas arranged by the Contractor, and approved by the Architect/Engineer. Adequate siltation and erosion control as determined by the authority having jurisdiction, shall be provided at the disposal site, as well as revegetation where required.

C. Void, Cavities - Where voids or cavities are encountered at subgrade elevation, fill the voids or cavities with lean concrete or controlled fill as directed by the Geotechnical Engineer.

3.2 EXCAVATION

A. Design subgrade elevation is defined as the bottom (bearing) elevation for footings, mat foundations, and caissons for structures and the bottom of concrete "turndown" or bottom of base aggregate (whichever is lower) for concrete slabs and grade beams on base aggregate.

B. The excavation shall conform to the dimensions and elevations indicated on the Plans for each building and structure, and shall include trenching for drainage systems occurring within the enclosing walls or appurtenances of the building structures, and to a point 5 feet (unless noted otherwise on the drawings)

beyond the building line of each building and/or structure. In areas where the proximity of the structures and buildings is such that it would be impractical to excavate for the individual structures and buildings, the entire area may be excavated to the required depth as indicated on the Plans and a safe, stable slope shall be constructed to the ground surface.

C. Drainage - Excavation shall be performed under dry conditions. The excavation and the area immediately surrounding each excavation for a distance of 25 feet, including slopes and ditches, shall be continually and effectively drained away from the excavation. The excavation for inlet, outlet, and diversion ditches, and the furnishing and operating of dewatering equipment, as necessary, shall be performed as indicated elsewhere in these Specifications. Suitable precautions shall be taken to prevent any erosion from undercutting previously concreted footings and slabs. Excavations shall be kept free from ponding until the permanent work in the excavations has been completed and accepted, and the excavations have been completely backfilled.

D. Sheeting, shoring and underpinning, including steel sheet piling, shall be installed during excavation, where required for protection of workmen, tanks, adjacent paving, structures and utilities as shown on Plans, or as required by the Architect/Engineer.

E. Buildings and Structures - Excavation shall extend a sufficient distance from walls and footings, to maintain for placing and removing shoring and forms, to ensure the performance of all work in the excavations, and to allow inspection of the work, except where the concrete for walls and footings is authorized by the Architect/Engineer to be deposited directly against excavated surfaces.

F. Minimum allowable bearing pressures shall be as noted on the drawings.

G. Where the excavation is made below the elevations indicated on the Plans due to the fault of the Contractor, the over excavation shall be filled as specified in Paragraph 3.5, "Fill" and with material as described in this section, as directed by the Geotechnical Engineer. No additional payment will be made to the Contractor for over excavating and filling.

H. All topsoil and unsuitable natural soils at design subgrade elevation shall be undercut based on the observations of the Geotechnical Engineer. The area so excavated shall be filled with Compacted Structural Fill to original design subgrade elevation. In addition shallow hand anger probes shall be excavated by the Geotechnical Engineer in natural soils at the design subgrade elevation to ensure that no rock exists within one foot below the design subgrade elevation. Rock existing above this level shall be removed and replaced with fill as described above.

I. Observation of subgrades, rock and soil cut and fill slopes and testing of the compacted fill shall be carried out by the Geotechnical Engineer to determine that satisfactory soils are present and that compacted fill has been adequately placed.

J. PROOFROLLING - Following removal of topsoil, all subgrades below structures and areas to receive compacted fill shall be proofrolled with tandem - axle dump truck. Proofrolling shall be carried out under the inspection of the Geotechnical Engineer to verify that unsuitable material is not present. Where proofrolling reveals weak unsuitable material, under cut and replace with structural fill under the direction of the Geotechnical Engineer.

K. PROTECTION OF SUBGRADE - Site drainage shall be provided to maintain subgrades free of water and to avoid saturation and disturbance of the subgrade soils prior to pouring foundations or placing fill. Any subgrade soils which have been weakened due to saturation and disturbance shall be removed and replaced with compacted fill at the Contractor's expense.

L. EXCAVATION ADJACENT TO EXISTING FOOTINGS - During excavation adjacent to existing footings, the Contractor shall provide temporary shoring and/or incrementally excavate and backfill in short segments or use other approved means to insure that lateral or vertical movement of the existing footings and walls is prevented. In no case shall the Contractor undermine or disturb soil beneath the

existing foundations.

M. BLASTING - Blasting operations shall be in strict accordance with all existing ordinances and regulations. It is the responsibility of the Contractor to protect the public, workmen, and existing structures, both exposed and subsurface from injury. The blast will be secured in a manner that will prevent the escape of flying material. Care shall be taken to protect existing structures. In the event damage occurs, it shall be promptly repaired by the Contractor at no expense to the Owner. Where there are no local ordinances governing blasting and the storage of explosives, all blasting supplies shall be stored in a manner approved by the Architect/Engineer, and watchman shall be stationed at all times at the place of storage. In no case shall caps or other exploders be kept at the place where dynamite or other explosives are stored. The Contractor shall be solely responsible for the safe storage and use of all explosive materials. No blasting shall be permitted near existing structures unless approved by the Architect/Engineer in writing. No blasting operations shall be performed without prior written permission from authorities having jurisdiction.

N. Required Overexcavation - Where rock is encountered at design elevation, overexcavate a minimum of 1'-0", backfill with controlled fill under grade beams and slab to act as a cushion between the foundations and rock.

O. Removal of Rock where Encountered - The Contractor will not be compensated for the removal of rock above design subgrade elevations.

P. Excavation for Piping within Building Areas - Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room.

Excavate trenches to the depth indicated or required. Beyond the building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.

Trenches for underground utilities and drainage lines shall be excavated to the required depths. The bottoms of trenches shall be graded to secure the required fall for pipelines. Where wet or otherwise unstable material is incapable of properly supporting the pipe or utility line, (as determined by the Geotechnical Engineer) encountered in the bottom of the trench, such soil shall be removed to firm bearing. Overdepth excavation shall be performed for the full width of the trench, and the backfilled to the proper grade and compacted in accordance with Backfilling or this Specification. Pipe beds shall be rounded to accommodate the bottom quadrant of pipes, and bell holes shall be excavated so that pipe will be uniformly supported for its entire length. Pipe beds shall be taped when necessary to provide uniform, firm support.

Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for the entire body of the pipe.

3.3 FILL

A. Minimum allowable bearing pressures shall be as noted on the drawings.

B. SLABS-ON-GRADE - Slabs-on-grade shall be supported on suitable natural soil or compacted structural fill. Recompact slab subgrades immediately prior to placing moisture barrier materials as described below.

A 4 inch (minimum) moisture barrier consisting of VDOT No. 57 stone shall underlie all floor slabs on grade. Compact aggregate with at least 2 passes with suitable vibratory compaction equipment. Floor slab subgrades shall be proofrolled to meet the requirements set forth herein.

C. Compacted Structural Fill shall extend at least 10 feet beyond the limits of the structures where slope is steeper than 1.5H:1V to meet existing grades. Fill shall extend a minimum of 5 feet horizontally beyond structures when slopes are 3H:1V or flatter.

D. Fill shall be provided where required to raise the subgrade to the elevations shown on the Plans. The

material used, the maximum thickness of each layer prior to compaction, and the percent of maximum density required at optimum moisture content shall be as stated in this Section. Fill material shall meet the requirements set forth in Paragraph 2.1. No fill shall be placed until the subgrade has been checked and approved, and in no case shall fill be placed on a subgrade that is muddy, frozen, or that contains frost. Each layer shall be uniformly spread, moistened, or dried by aeration, when required, to within 3% of the optimum moisture content for the required degree of compaction, and uniformly compacted by approved equipment. the surface, presented by the completed fill shall be brought to a reasonably true and even plane, and shall be approved by the Architect/Engineer prior to further construction operations thereon.

E. Borrow - Where satisfactory materials are not available in sufficient quantity from required excavations, materials approved by the Architect/Engineer and the Geotechnical Engineer shall be obtained from borrow areas. No separate payment will be made for furnishing and placing approved borrow material. Compensation in full is included in the lump sum price paid under this Contract. All soil materials brought on-site shall be tested and certified as suitable by the Geotechnical Engineer prior to use. Adequate siltation and erosion control, as determined by the authority having jurisdiction, shall be maintained at the borrow site, as well as revegetation where required, at no additional cost to the Owner.

F. Placing - The approved materials shall be placed in the successive horizontal layers of loose material not more than 8 inches in loose thickness where compaction is by rollers or vibrators and 4 inches thick where mechanical tamping is required. During fill placement, density tests shall be performed, at regular intervals, (one per lift) by a qualified soil technician.

G. Compaction - Where gravel are used for fill, the material shall be compacted to maximum possible density obtainable with a plate-type vibrating compactor of standard manufacture consisting of a variable speed power unit attached to a vibratory plat. The vibrator may be single or multiple type and shall provide sufficient unit pressure on the vibratory plate to obtain maximum density. Upon completion of the subgrade, the applicable moisture density relations shall be maintained until placement of the concrete.

H. Any subgrade soils which have been weakened due to saturation or disturbance should be recompacted or removed and replaced as recommended by the Geotechnical Engineer.

I. Prior to concrete placement, remove all loose or soft soils from bottom of excavation. Place concrete on the same day as excavation of foundations.

J. Moisture Control - Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value outlined above.

3.4 BACKFILLING - Backfilling shall be performed after the permanent work in the excavation has been inspected and approved by the Architect/Engineer. Shoring, including sheet piling, shall be removed in a manner to avoid damage or disturbance to the work, and the excavations shall be free of forms and cleaned of trash. The material used and the maximum thickness of each layer prior to compaction shall be stated in Paragraph 3.3 "Fill", of this Section. Backfill shall not be placed on surfaces that are muddy, frozen, or contain frost. Backfill shall be brought to final grade unless otherwise shown or specified, and shall be brought up evenly on each side of each wall and pipe. Care shall be exercised to avoid any wedging action or eccentric action upon or against the structure, and to avoid any disturbance or damage to the work. Each layer shall be uniformly spread, moistened or dried by aeration, when required, to within 3% of the optimum moisture content for the required degree of compaction, and uniformly compacted by hand or machine tampers or by other suitable equipment. Heavy equipment for spreading and compacting backfill shall not be operated closer to the wall than a distance equal to the height of the backfill above the top of footing or as noted on the drawings. Compaction equipment used adjacent to the walls shall not exceed 3000 pounds static weight. Backfill shall be brought to a suitable elevation above grade to provide for anticipated settlement and

shrinkage thereof. Backfill shall not be placed against foundation walls prior to 28 days after completion of wall construction and then only after approval by the Architect/Engineer.

3.5 GRADING - Areas required to be graded outside of each building and structure line shall be constructed true to grade, shall be shaped to drain, and shall be maintained free from extraneous accumulations until final inspection has been completed, and the work has been accepted.

END SECTION 314000

SECTION 315000 – EROSION & SEDIMENT CONTROL

PART 1 - GENERAL

1.1 This Section shall consist of temporary control measures as directed by the Engineer's or the Owner's construction representative during the life of the Contract to control erosion and water pollution through the use of berms, dikes, dams, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other control devices.

1.2 This work shall be performed in accordance with the erosion and sediment control plan narrative and the details provided therein, and as described, detailed and required by the Virginia Department of Conservation and Recreation's Division of Soil and Water Conservation's most recent edition of the Virginia Erosion and Sediment Control Handbook.

1.3 The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features, to assure economical, effective, and continuous erosion control throughout the construction and post-construction period.

1.4 It shall be the Contractor's responsibility to meet the requirements of installing and maintaining adequate erosion and sediment control measures to protect all disturbed and adjacent areas from erosion during the term of the construction contract. The Contractor shall install and maintain those measures required by the Engineer, Inspector, or Local Building Official.

1.5 The Owner shall secure approval of the Erosion & Sediment Control Plan from the Russell County Building Inspector's Office. The Contractor shall be required to obtain a Land Disturbing Permit from the County prior to starting construction – including payment of any applicable fees required to issue the Permit.

1.6 The Owner shall secure Registration for the project under the Construction Stormwater VPDES Permit from DEQ, including payment of the Permit Registration fee. The Contractor shall comply with the Permit's requirements.

PART 2 - PRODUCTS

2.1 The Contractor shall install and maintain the following erosion and sediment control measures as applicable (all measures are to be implemented as described in the Virginia Erosion and Sediment Control Handbook):

2.2 TEMPORARY SAFETY FENCE (VESCH PRACTICE 3.01) - The proposed building pad and staging areas shall be enclosed using a temporary chain-link safety fence material, have a nominal height of at least 6 feet. Lockable access gates shall be provided as indicated. The temporary fencing shall be removed following project completion.

2.3 TEMPORARY CONSTRUCTION ENTRANCE (VESCH PRACTICE 3.02) - A temporary construction entrance shall be installed near the proposed entry point from the construction stie to the existing back entrance road (Wolfpack Way). All construction traffic is required to be directed to use this entrance. The temporary construction entrance is to be removed following project completion.

2.4 TEMPORARY SILT FENCE (VESCH PRACTICE 3.05) - Temporary silt fence shall be used downgradient of all fill slopes, as needed adjacent to streams, and as needed to control runoff in ditches. Silt fence is temporary and shall be removed as directed by the Engineer upon establishment of suitable stabilization.

2.5 STORM DRAIN INLET PROTECTION (VESCH PRACTICE 3.07) – Existing storm drain inlets subject to sedimentation from the proposed work shall be protected by using silt fence and/or rip-rap inlet protection.

2.6 CULVERT INLET PROTECTION (VESCH PRACTICE 3.08) – Existing culvert inlets subject to sedimentation from the proposed work shall be protected by using silt fence and/ or rip-rap inlet protection.

2.7 TEMPORARY SEEDING (VESCH PRACTICE 3.31) - All areas of disturbed vegetation shall be restored. Those disturbed areas which will not be brought to final grade within 30 days following disturbance shall be temporarily seeded.

2.8 PERMANENT SEEDING (VESCH PRACTICE 3.32) - All areas of disturbed vegetation shall be restored. Permanent stabilization shall include permanent seeding as necessary to establish a stand of vegetation that will adequately protect disturbed areas from erosion. Disturbed areas may require seeding more than once to establish adequate ground cover.

2.9 MULCHING (VESCH PRACTICE 3.35) - All disturbed areas to be revegetated shall also be mulched with straw or other suitable material to protect the ground surface until vegetation is established.

2.10 SOIL STABILIZATION BLANKETS & MATTING (VESCH PRACTICE 3.36) – The Contractor shall utilize soil stabilization blankets and matting as necessary to help reduce erosion of slopes and/or ditches until permanent vegetation is established.

2.11 DUST CONTROL (VESCH PRACTICE 3.39) - The Contractor shall take measures as necessary to minimize the amount of airborne dust caused by construction. Areas of particular concern include work areas adjacent to roadways and existing structures. The preferred methods of dust control include irrigation, application of crushed stone, and application of mulch (outside of traffic areas).

2.12 CLEANING OF ROADWAYS - The Contractor shall take measures as necessary to minimize the amount of dust, sediment, and/or mud on paved roads, parking lots, and driveways. Where practical, excavated material shall not be placed on these paved surfaces. When necessary to place excavated material on paved surfaces, a layer of crushed rock dust shall first be applied. Following pipe installation, the excavated material shall be removed and the pavement swept and/or washed. On gravel roads, parking lots, and driveways, a new surface of crushed stone shall be applied following construction to cover any residual excavated material.

PART 3 - EXECUTION

3.1 PROJECT REVIEW - During the pre-construction conference, the Contractor shall meet with the Engineer and go over in detail the expected problem areas in regard to the erosion control work. Different solutions should be discussed so that the best method might be determined. It is the responsibility of the Contractor to implement erosion control measures acceptable to the Engineer.

No work shall be started until the erosion control measures have been implemented and accepted by the Engineer.

All disturbed areas that have no construction activity in close proximity shall be temporary seeded within 30 days of completion of the disturbing activities.

All siltation and erosion control devices installed during the course of construction shall be maintained in proper working order at all times, and shall not be removed until final stabilization of all disturbed areas or at the direction of the Engineer.

3.2 CONSTRUCTION REQUIREMENTS - The Engineer has the authority to limit the surface area of erodible earth material exposed by construction and to direct the Contractor to provide immediate permanent or temporary control measures to prevent erosion.

The Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practical time as outlined in his accepted schedule. Temporary pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during the design state; that were needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project. All erosion control measures shall be constructed in accordance with the Virginia Erosion and Sediment Control Handbook.

The Engineer reserves the right to limit the area of construction in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding and other such permanent erosion control measures current in accordance with the accepted schedule.

The proposed project is anticipated to disturb over 1 acre, therefore the project is required to file a Registration Statement with DEQ under the Construction Stormwater VPDES Permit requirements. The Owner will file the Registration Statement with DEQ and pay the General Permit fee to DEQ. The Contractor shall serve as the Owner's Agent for the project and is required to complete all inspections, reporting, and recordkeeping that is required by the Permit.

3.3 MAINTENANCE - The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense.

3.3.1 Erosion Control Outside Project Area – The Engineer has prepared the Erosion & Sediment Control Plan for only those designated work areas as shown on the plans. If the Contractor disturbs other locations (i.e. off-site storage lots, borrow pits, waste disposal sites, etc.), it is the Contractor's responsibility to independently obtain regulatory approval for those sites. Temporary pollution control shall include construction work outside the project area where such work is necessary as a result of construction such as borrow pit operations, haul roads, and equipment storage sites.

END SECTION 315000

SECTION 321216 - ROADWAY

PART 1 - GENERAL

1.1 This section details all necessary excavation, backfill, subbase, paving, sidewalks and curb and gutter installation to the lines and grades as shown on the construction drawings. All construction shall conform to the most recent edition of the Virginia Department of Transportation Road and Bridge Specifications and Road Designs and Standards.

1.2 MATERIAL CLASSIFICATION - All material excavated shall be defined as "unclassified excavation". Unclassified excavation includes the required undercut excavation, or unsuitable soil excavation.

PART 2 - PRODUCTS

2.1 Street Subbase and Base - The street subbase and base shall confirm with Section 208, 308, 309 and any applicable sections as stated in the V.D.O.T. Road and Bridge Specifications to the compacted thicknesses shown on the typical cross sections on the construction drawings. All subbase and base material shall be compacted to 100% of the theoretical maximum density as determined by ASTM D-698, within plus or minus 3% of optimum moisture for the full width of the cross section.

2.2 PRIME COAT - The prime coat shall conform to Section 311 and any applicable sections as stated in the V.D.O.T. Road and Bridge Specifications.

2.3 Bituminous Concrete Paving - The bituminous concrete paving shall conform with Section 211 and any applicable sections as stated in the V.D.O.T. Road and Bridge Specifications, the type and the compacted thicknesses specified on the typical sections of the construction drawings.

2.4 Concrete - The concrete shall conform with Section 404 and any applicable sections as stated in the V.D.O.T. Road and Bridge Specifications.

PART 3 - EXECUTION

3.1 The execution for construction shall be in accordance with Sections 1A of these specifications.

3.2 Testing and Inspection Services - The Contractor, at the Contractor's expense, shall retain a geotechnical engineer registered in the State of Virginia and testing laboratory to perform soils testing, concrete testing, aggregate base and asphalt testing.

Submittals - Submit two copies of the following reports directly to the engineer from geotechnical engineer and testing laboratory, with copy to the contractor prior to surfacing: 1) test report on borrow material; 2) verification of subgrade before filling and prior to applying base stone and rock when applicable; and 3) verification of fills, concrete test reports, aggregate base compaction, and asphalt density test. Test results must have approval of the geotechnical engineer and have his seal and signature.

Prior to the spreading of base aggregate, the Contractor shall submit to the engineer, certification from the quarry from which the aggregate is to be purchased that states that the stone meets all V.D.O.T. requirements for the size and type specified.

3.3 Filling - Areas to be rolled shall be cleared and grubbed and topsoil removed. All depressions or holes below the ground surface, whether caused by grubbing or otherwise, shall be backfilled with suitable material and compacted to the ground surface before the construction of the embankment will be permitted to start.

All roots, debris, large stones, or objectional material that would cause interference with compaction or fill shall be removed from the area and disposed of as directed.

All subgrades shall be proof rolled and prepared as directed by the Engineer.

Embankments shall be formed of satisfactory materials placed in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross section. All materials entering the embankment shall be reasonably free of organic matter such as leaves, grass, roots, and other objectionable material. Soil, granular material, shale, and any other material permitted for use in embankments shall be spread in successive layers as specified.

The operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained on account of rain, freezing weather, or unsatisfactory conditions of the field. At all times the Contractor shall drag, blade, or slope the embankment to provide proper surface drainage.

The material in layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Wetting or drying of the material and manipulation to secure a uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. Sufficient equipment to furnish the required water shall be provided at all times.

Rolling operations shall be continued until the embankment is compacted to not less than 95 percent of the maximum density as determined by the ASTM D-698, at + or - 3% of optimum moisture. Any areas inaccessible to a roller shall be consolidated and compacted by mechanical tampers.

During construction, unless otherwise recommended by the Engineer, the contractor shall route his equipment at all times both when loaded and when empty over the layers as they are placed and shall distribute the travel evenly over the entire width of the embankment. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

In the construction of the embankments, starting layers shall be placed in the deepest portion of the fill, and as placement progresses, layers shall be constructed approximately parallel to the finished pavement grade line.

Frozen material shall not be placed in the embankment, nor shall the embankment be placed upon frozen material.

The Contractor shall be responsible for the stability of all embankments and shall replace any portion which, in the opinion of the Engineer, has become displaced due to carelessness or negligence on the part of the Contractor.

3.4 SUBGRADE AND AGGREGATE BASE MATERIAL - All base aggregate material shall be VDOT No. 21B.

Unless otherwise specified, base course material shall be mixed in an approved central mixing plant of the pugmill type. The mixed material shall be placed by means of an approved aggregate spreader. When specified on the plans or in the contract, the material may be mixed after placing and prior to compaction with a rotor-type mixer to ensure uniformity.

Where the required thickness is more than 6 inches, the material shall be spread and compacted in 2 or more layers of approximately equal thickness, the maximum compacted thickness of any one layer not to exceed 6 inches.

In cut areas, the subgrade shall be scarified 12" and recompacted to 95% Standard Proctor maximum density, as determined by ASTM-698.

3.5 TACK COAT - Shall be in accordance with VDOT Section 310 requirements and shall be Type RC-70.

3.6 BITUMINOUS CONCRETE PAVEMENT - The bituminous concrete pavement shall be constructed in accordance with Section 315 and any other applicable sections as stated in the VDOT Road and Bridge Specifications. This work shall consist of constructing one or more courses of bituminous concrete on the

prepared foundation in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross-sections shown on the plans or established by the Engineer.

3.6.1 Materials - Bituminous concrete shall conform to Section 211 for the type specified on the plans or in the contract. In the event Marshall design densities begin to exceed 98 percent of the theoretical maximum density during construction, the Contractor shall alter the grading of the aggregate, or otherwise shall obtain the aggregate from a different source.

3.6.2 Placing Limitations - Bituminous mixtures shall not be placed when weather or surface conditions are such that the material cannot be properly handled, finished, or compacted. The surface upon which the bituminous mixtures are to be placed shall be reasonably free of standing water at the time the materials are spread. The VDOT Road and Bridge Specifications shall be consulted as a guide to determine the minimum laydown temperature and application rates of the bituminous concrete.

3.7 FINAL GRADING

3.7.1 The Contractor shall do all grading required to bring the rough graded ground to the finished grades as shown on the drawings, allowing for depth of topsoil, or pavement materials. The Contractor shall grade to provide adequate positive drainage to preclude the ponding of water.

3.7.2 The Contractor shall uniformly distribute topsoil to the required depth over the entire area to be seeded. Where topsoil is spread directly over rock or gravel surfaces, depth of the topsoil shall be a minimum of eight (8) inches thick.

3.7.3 FINISHED EXCAVATION, FILLS AND EMBANKMENTS - Uniformly smooth grade all areas covered by the project, including excavated and filled sections and adjacent transition areas. The finished surface shall be reasonably smooth, compacted and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified. The finished surface shall not vary more than 0.10 foot above or below the established grade or approved cross section. All ditches shall be finished so as to drain readily. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. The surface of embankments or excavated areas for road construction, on which a base course or pavement is to be placed, shall not vary more than 0.05 foot from the established grade and approved cross section.

3.8 All clearing, grubbing, excavation, backfilling, filling, stripping of topsoil, erosion controls, planting, and restoration shall be in strict accordance with the specifications.

3.9 CONCRETE CURB AND GUTTER - Curb and gutter shall be installed to the lines, grades, and cross-sections shown on the drawings and in accordance with Section 502 and any other applicable sections of the most current VDOT Road and Bridge Specifications and as detailed in Road and Bridge Standards and any applicable sections therein. The Contractor shall use care in backfilling to avoid disturbing the curb alignment. Curb and gutter shall be placed on compacted base material in accordance with the typical street cross-sections, if shown, or with a minimum of 3" 21-B aggregate base.

3.10 CONCRETE SIDEWALK – Concrete sidewalk shall be installed to the specified width, grades, and cross section as shown on the drawings and in accordance with section 504 and any other applicable sections of the most current VDOT Road and Bridge Specifications.

3.11 CONCRETE ENTRANCES – Concrete entrances shall be installed to the specified width, grade, and locations as shown on the drawings and in accordance with the applicable entrance type as detailed in the most current VDOT Road and Bridge Standards.

END SECTION 321216

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt overlay.
3. Cold milling of existing asphalt pavement.
4. Hot-mix asphalt patching.
5. Asphalt curbs.

B. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

1. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
2. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Herbicide.

B. Hot-mix asphalt designs.

C. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:[**Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.**]

1. Aggregates.
2. Asphalt binder.
3. Tack coat.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of <**Insert applicable standards**> of <**Insert name of state or local DOT**> for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

PART 2 - PRODUCTS

2.1 AGGREGATES

Uncured or improperly cured slag aggregates have caused serious problems. Delete slag aggregates in paragraphs below if not recommended for local use.

A. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

B. Fine Aggregate: [**ASTM D1073**] [**or**] [**AASHTO M 29**], sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

Retain "Mineral Filler" Paragraph below if common in local paving mixtures.

C. Mineral Filler: [**ASTM D242/D242M**] [**or**] [**AASHTO M 17**], rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

Use of performance-graded asphalt binders developed by "Superpave" has generally replaced asphalt cement. Asphalt binders graded by performance may contain polymer modifiers. Performance grade options in "Asphalt Binder" Paragraph below are examples only. In fourth option, "PG" is performance grade, "58" is the average seven-day maximum pavement temperature in deg C, and "-28" is the probable minimum temperature in minus deg C. Consult AI or state or local DOT for asphalt-binder recommendations.

A. Asphalt Binder: [**ASTM D6373**] [**or**] [**AASHTO M 320**] binder designation [**PG 58-28**] [**PG 64-22**] [**PG 70-22**] <**Insert performance grade**>.

Retain "Asphalt Cement" Paragraph below with option for viscosity- or penetration-graded asphalt cement if these materials are available and required. Viscosity testing measures properties more accurately than penetration testing. Insert viscosity or penetration grades below if required.

B. Asphalt Cement: [**ASTM D3381/D3381M for viscosity-graded material**] [**ASTM D946/D946M for penetration-graded material**].

Retain "Tack Coat" Paragraph below if required. Tack coat is usually diluted in equal amounts of water and emulsified asphalt. It is usually applied to vertical surfaces of curbs, gutters, cold pavement joints, and structures in the pavement that will be in contact with hot-mix asphalt. Tack coat is also applied to existing pavement surfaces to bond new hot-mix asphalt overlays.

C. Tack Coat: [**ASTM D977**] [**or**] [**AASHTO M 140**] emulsified asphalt, or [**ASTM D2397/D2397M**] [**or**] [**AASHTO M 208**] cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 AUXILIARY MATERIALS

Generally, retain "Recycled Materials for Hot-Mix Asphalt Mixes" Paragraph below for recycled-materials content, which is standard practice. Consult authorities having jurisdiction and local hot-mix plants on materials acceptable for recycled content.

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled [**tires**] [**asphalt shingles**] [**or**] [**glass**] from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

Retain "Herbicide" Paragraph below for weed control if required. Some herbicides may be mixed with asphalt prime coats. Restricted-use herbicides may only be applied by certified applicators or under the direct supervision of a certified applicator.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

2.4 MIXES

A. <Double click to insert sustainable design text for recycled content.>

Insert subparagraph(s) below for specific content limits of recycled tires, asphalt shingles, glass, or other reclaimed material in base and surface courses if required. "Surface Course Limit" Subparagraph below is an example only.

1. Surface Course Limit: Recycled content no more than [**10**] <**Insert number**> percent by weight.

Retain first option in "Hot-Mix Asphalt" Paragraph below if specifying state or local DOT standard paving mixes or for approval of mixes by state or local DOT if approval of mixes for private work is the practice of authorities having jurisdiction. DOT standard paving mixes will usually be required for public roads. Same paving mixes may also be used for private work. Generally, retain second option below for private work, with or without first option, and for state or local DOT if that is the practice of authorities having jurisdiction. If specifying a "Superpave" hot-mix asphalt, revise paragraph by inserting details of

aggregate gradations and hot-mix asphalt. If porous paving is required, revise paragraph to specify an open-graded mix or mixes in lieu of dense-graded mixes.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes [**approved by authorities having jurisdiction**] [**; designed in accordance with procedures in AI MS-2, "Asphalt Mix Design Methods";**] and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

Retain "Base Course," "Binder Course" if applicable, and "Surface Course" subparagraphs below to identify state or local DOT specifications for each course.Terms used to identify hot-mix asphalt courses may differ regionally. Revise below to match terms used by state and local DOTs.

2. Base Course: <**Insert mix designation**>.
3. Binder Course: <**Insert mix designation**>.
4. Surface Course: <**Insert mix designation**>.

PART 3 - EXECUTION

3.1 COLD MILLING

Retain this article if removing a course or layer from an existing asphalt pavement.

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

Revise first subparagraph below to suit Project if a variable depth is required, such as for deformed pavement or for correcting pavement slope or crown.

1. Mill to a depth of [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] [**3 inches (75 mm)**] <**Insert dimension**>.
2. Patch surface depressions deeper than 1 inch (25 mm) after milling, before wearing course is laid.

3.2 PATCHING

Retain this article if patching existing pavement. Retain "Asphalt Pavement" Paragraph below if existing pavement is asphalt.

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

Retain "Portland Cement Concrete Pavement" Paragraph below if existing pavement is portland cement concrete.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

Retain "Tack Coat" Paragraph below for coating vertical surfaces abutting hot-mix asphalt patches.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.3 SURFACE PREPARATION

A. Ensure that prepared subgrade is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

Retain "Herbicide Treatment" Paragraph below if weed control is required.

B. Herbicide Treatment: Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

Retain subparagraph below unless full-depth asphalt pavement is proposed.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

Retain "Tack Coat" Paragraph below if tack coating an existing hot-mix asphalt pavement before placing a hot-mix asphalt overlay.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 HOT-MIX ASPHALT PLACEMENT

Retain this article for new paving and hot-mix asphalt overlay on existing asphalt or concrete pavements.

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

Revise first two subparagraphs below to suit Project. AI recommends that the minimum compacted thickness of hot-mix asphalt paving lift exceed three times the maximum nominal aggregate size.

1. Place hot-mix asphalt base course[**and binder course**] in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.

Revise first subparagraph below to higher temperature if thin lifts in cool weather are likely. See National Asphalt Pavement Association recommendations.

3. Spread mix at a minimum temperature of 250 deg F (121 deg C).
4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations**.**

3.6 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

Revise average density and range of acceptable densities in "Average Density, Rice Test Method" Subparagraph below if required.

1. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 ASPHALT CURBS

Retain this article if hot-mix asphalt curbs are required.

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread hot-mix asphalt at a minimum temperature of 250 deg F (121 deg C).

Revise "Hot-Mix Asphalt" Subparagraph below to insert designations of state or local DOT if mixes are different.

1. Hot-Mix Asphalt: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

Retain thickness tolerances in "Base Course(and Binder Course)" and "Surface Course" subparagraphs below or revise to suit Project.

1. Base Course[**and Binder Course**]: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

Revise "Base Course(and Binder Course)" or "Surface Course" Subparagraph below to suit Project.

1. Base Course[**and Binder Course**]: [**1/4 inch (6 mm)**] <**Insert dimension**>.
2. Surface Course: [**1/8 inch (3 mm)**] <**Insert dimension**>.

Retain "Crowned Surfaces" Subparagraph below if required.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Replace and compact hot-mix asphalt where core tests were taken.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 WASTE HANDLING

Retain this article if repairs, patching, or cold milling of existing pavement is required.

A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Provide pavement marking in the arrangement shown on the Plans, as specified herein, as required by VDOT, and as needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

A. General: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. General: Within 30 calendar days after receipt of the OWNER's Notice to Proceed, submit:

1. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

2. Manufacturer's recommended installation procedures which, when approved by the OWNER, shall become the basis for accepting or rejecting actual installation procedures used on the work.

PART 2 - PRODUCTS

2.1 PAVEMENT MARKING PAINT

A. General: Provide white paint specifically formulated for use as pavement marking in automobile traffic areas. Paint shall be equal to highway marking paint specified by the Virginia Department of Transportation.

2.2 OTHER MATERIALS

A. General: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the CONTRACTOR subject to the approval of the OWNER.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONING

A. General: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Curing: Verify that the asphalt concrete paving has cured such that the pavement marking paint may be properly applied.

3.2 APPLICATION

A. General: Provide proper masking and spray application equipment recommended for this use by the

manufacturer of the paint material provided. Apply the paint in strict accordance with the recommendations of the paint manufacturer.

B. Markings: Pavement markings shall be spray applied, in neat, straight lines, 4 inches in width. Lines shall stop 6 inches short of curb and sidewalk edge.

3.3 PROTECTION AND CLEANUP

A. General: Provide traffic cones, barricades, and other devices needed to protect the paint until it is sufficiently dry to withstand traffic.

B. Inspection: When paint is sufficiently dry, visually inspect the entire application, and touchup as required to provide uniform opaque color and clean, straight lines and surfaces throughout. Where required, provide permanent opaque paint in color matching the asphalt concrete paving to block out overspray. Eliminate all traces of splashed, tracked or spilled paint from all adjacent surfaces.

END OF SECTION 321723

SECTION 329200 - TOPSOILING AND SEEDING

PART 1 - GENERAL

1.1 DESCRIPTION - All vegetated areas disturbed by construction shall be revegetated. This section covers the furnishing of all plants, seeds, labor, equipment and materials, and in performing all operations in connection with topsoiling and seeding the disturbed areas. Topsoiling and seeding practices shall be conducted in accordance with the procedures outlined in the Virginia Erosion and Sediment Control Handbook.

PART 2 - PRODUCTS

2.1 SEED - All seed used shall be labeled to meet the requirements of the Virginia State Seed Law. Seed label shall indicate the vendor, type of seed mixture, percent purity, percent germination, and test date. All seed shall be furnished in sealed standard containers. Seed which has been damaged in any manner will not be acceptable. The permanent seed mix shall conform to the following minimum application rates:

MINIMUM SEED APPLICATION RATES

Slopes 3:1 or Less		Slopes Greater than 3:1	
Kentucky 32 Fescue	128 lb/ac	Kentucky 31 Fescue	108 lb/ac
Annual Ryegrass	20 lb/ac	Crown Vetch	20 lb/ac
Red Top Grass	2 lb/ ac	Annual Rye Grass	20lb/ac
		Red Top Grass	2 lb/ac
	150 lb/ac		150 lb/ac

2.2 FERTILIZER - Fertilizer shall be 10-20-10 grade, uniform in composition, free flowing, delivered to the site in bags, each fully labeled. Fertilizer shall be stored in dry locations protected from moisture.

2.3 LIME - Lime shall be pulverized agricultural grade limestone and shall be ground to such fineness that at least 50 percent will pass through a 100-mesh sieve and at least 90 percent will pass through a 20-mesh sieve.

2.4 TOPSOIL - Topsoil to be used shall be topsoil removed and stockpiled as required for this project and/or supplemental topsoil from off site. The topsoil shall be reasonably free from clay lumps, stones, stumps, roots or other objects larger than 2 inches in diameter, weeds, toxic substances, or any other material or substance which might be harmful to plant growth or be a hindrance to grading and maintenance operations. All topsoil utilized for surface preparation shall be acceptable to the Engineer.

2.5 MULCH - Mulching material shall consist of dry straw or any acceptable type as listed in the Virginia Erosion and Sediment Control Handbook. Mulch shall not be molded, caked or decayed, and be reasonably free of weeds or seeds.

PART 3 - EXECUTION

3.15 SPREADING OF TOPSOIL - On areas to be seeded, the exposed soil surface shall be scarified to a depth of 2 inches for the bonding of topsoil with subsoil. Topsoil is then to be evenly spread, compacted, and graded to the desired final contour. Topsoil shall be applied to all areas which are not favorable for establishment of vegetation (hardpan, shallow rocky soils, clay).

3.2 PREPARATION OF SEED BED - Fertilizer shall be distributed uniformly at a minimum application rate of 1,000 pounds per acre over the areas to be seeded, and shall be incorporated into the soil to a depth of at least 3 inches by discing, raking, or other methods. Fertilizer may be spread by broadcasting, spreader, seed drill, or other acceptable means. Following the application of fertilizer, lime shall be applied over the area at a minimum application rate of 4,000 pounds per acre. The lime shall also be incorporated into the soil to a depth of at least 3 inches. The scarified soil/lime/fertilizer mixture shall have a uniform minimum depth of 3.5 inches

in all areas.

3.3 PLANTING SEED - Seeding shall be done as soon as possible following final grading. Seed shall be broadcast either by hand or approved sowing equipment at or above the previously designated minimum application rates. Hydroseeding is also an acceptable seeding procedure. The seed shall be uniformly distributed over the designated areas. The seed shall be covered to an average depth of 1/4 inch by means of a harrow, cultipacker, rake, or other approved device. Seeding shall not be done during windy weather.

3.4 COMPACTING - Immediately after the seeding step has been completed, the entire area shall be compacted by means of a cultipacker, roller, or other approved equipment. When a cultipacker or similar equipment is used, the final rolling shall be across the slope instead of up and down the slope to prevent erosion.

3.5 RAKING - In all areas seeded, all large (>3") stones and roots shall be removed. In lawns or other areas subject to mowing, greater care shall be taken to rake and remove all stones which could be hit by a lawnmower. The exposed areas shall be raked as needed to provide a smooth uniform surface prior to mulching.

3.6 MULCHING - Mulch shall be spread over all seeded areas at the rates listed in the Virginia Erosion and Sediment Control Handbook. Mulch shall be applied to a uniform depth in a manner as discussed in the Virginia Erosion and Sediment Control Handbook. Mulch anchoring with jute mesh or other similar matting may be required on steep slopes or ditches.

3.7 PROTECTION AND MAINTENANCE - The seeded area shall be protected against traffic or other use after seeding is completed until a suitable stand of vegetation is established. It is the Contractor's responsibility to establish an acceptable stand of vegetation on all disturbed areas. This may require multiple attempts at seeding to establish suitable growth. During dry weather, the Contractor may have to water the seeded areas. No additional compensation will be made to the Contractor for multiple seeding attempts or other measures required to establish suitable vegetation.

END OF SECTION 329200

SECTION 330100 – WATER LINE CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION - This section of the specifications covers materials of construction, installation procedures, and testing of all proposed potable water lines included in the project.

1.2 RELATED SPECIFICATIONS - The following specification sections include other information relevant to water line construction:

Section 312000 - Earthwork for Utilities.

1.3 QUALITY ASSURANCE - All construction materials and installation procedures shall comply with all applicable AWWA requirements and the Virginia Department of Health's Waterworks Regulations. All piping utilized shall be stamped with the "NSF-PW" seal, designating that the material is approved for use in potable water systems.

Prior to final acceptance, all water lines installed in this project shall be subjected to and pass pressure and bacteriological test procedures detailed herein.

1.4 SUBMITTALS - Provide shop drawings for all construction materials. Provide test reports for all tests conducted.

1.5 CONSTRUCTION LAYOUT - Construction quantities shown on the plans and designated in the bid schedule are estimated based upon field surveying.

The Contractor is responsible for construction stakeout required to build the project.

During design of the project, the Engineer has performed field surveys to determine the location of existing utilities which could conflict with the proposed construction. The plans depict the Engineer's best representation of existing conditions. The exact location of all existing utilities may not be known and is not guaranteed to be shown on the plans. It is the Contractor's responsibility to field locate all existing utilities prior to start of construction. The Contractor shall be responsible for repair of any utilities damaged by construction.

The plans indicate those portions of the work which are located on private property. Easements for the proposed construction have been obtained by the Owner. It is the Contractor's responsibility to construct the work as shown on the plans and to limit his encroachment on private property to within the easements' boundaries. It is the Contractor's responsibility to replace any property corners damaged by construction using a licensed surveyor.

All valve boxes, fire hydrants, blow-off valves, air release valves, meters, sample hydrants, and other appurtenances on VDOT right-of-way shall be located as required by the VDOT inspector.

The Contractor is responsible for identifying paved, concrete, unpaved roads and parking lots prior to bidding the project. The cost of surface restoration shall be included in the Contractor's unit price bid for pipeline. All property disturbed by construction shall be restored to its original condition to the property owner's satisfaction at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 PIPE - Unless specifically called for on the plans or specified herein, it shall be the Contractor's option to select the type of pipe material for each application from those acceptable materials shown in the Pipe Schedule.

2.1.1 Ductile Iron Water Pipe - All ductile iron pipe shall be manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. Push-on joints and mechanical joints shall be in accordance with ANSI/AWWA C111/A21.11. Pipe thickness shall be in accordance with ANSI/AWWA C150/A21.50 based on laying conditions and internal pressure as specified on the project plans. Ductile iron pipe shall have an interior cement mortar lining and exterior asphaltic seal coating in accordance with ANSI/AWWA C104/A21.4.

2.1.2 Polyvinyl Chloride Water Pipe - PVC pipe 4" and larger, shall meet the requirements of AWWA C900, be U.L. approved, and shall have dimensions as described in AWWA C900 Table 2, "Outside Diameters of Cast Iron Pipe". Pipe joints shall be rubber gasketed and be of either push on or mechanical type in accordance with ANSI/AWWA Specification C111/A21.11. All PVC pipe shall be stamped with the NSF-PW certification. PVC in sizes less than 4" diameter shall meet the requirements of ASTM D-2241 and be SDR 17.

2.1.3 Galvanized Steel Water Pipe - Pipe shall conform to the requirements of ASTM A120-63T. All galvanized steel water pipe shall be NSF-PW certified and shall be stamped as such. Galvanized steel pipe is approved for use only inside vaults and other similar structures and is not allowed for direct burial.

2.1.4 Polyethylene Service Lines - All 3/4" and 1" service lines shall be polyethylene material, in compliance with AWWA C901-88. Service lines shall be 200 psi pressure class, Copper Tube Size (CTS) SIDR-9 per ASTM D-2239. All polyethylene service lines shall meet NSF Standard No. 61 and shall be stamped with the NSF-PW certification. Pipe stiffeners shall be stainless steel only.

2.2 PIPE FITTINGS

2.2.1 Ductile Iron Fittings - All fittings for ductile iron and PVC pipe shall be compatible with the pipe specified herein and comply with ANSI/AWWA Specification C110/A21.10. Unless shown or specified otherwise, ductile iron fittings for direct-burial pipelines may be either push-on or mechanical joint type (Contractor's option). All push-on fittings shall conform with ANSI/AWWA C153/A21.53 or ANSI/AWWA C110/A21.10 and all mechanical joint fittings shall conform to ANSI/AWWA C111/A21.11. Ductile iron pipe inside buildings and vaults shall be flange fitted unless shown otherwise.

2.2.2 Galvanized Pipe Fittings - All galvanized steel fittings shall be standard weight block malleable or cast iron, threaded, and with a pressure rating equal to or greater than the pipe pressure requirements.

PIPE SCHEDULE

SIZE	WORKING PRESSURE (PSI)	ACCEPTABLE MATERIAL
3/4" to 1"	150, 200	Polyethylene CTS SIDR 9
1-1/2" to 3"	150, 200	PVC(SDR 17), Galvanized Steel Schedule 40
4"	150, 200, 250, 300, 350	Ductile Iron Class 51
4"	150	PVC-C900 150 (SDR 18)
4"	200	PVC-C900 200 (SDR 14)
6" and larger	150, 200, 250, 300, 350	Ductile Iron Class 350 WP
6" and larger	150	PVC-C900 150 (SDR 18)
6" and larger	200	PVC-C900 200 (SDR 14)

2.3 GATE VALVES AND ACCESSORIES

2.3.1 Gate Valves - Gate valves 2" and larger shall conform to AWWA Specifications C-509. Valves shall be ductile iron body, bronze-mounted, Nitrile encapsulated disc, non-rising stem, and capable of withstanding the working pressure to which they are subjected. All valves shown to be located in valve boxes shall have 2" square operating nuts. Valves not buried shall be equipped with handwheels. Valves shall not leak when subjected to the appropriate line test pressure on one side and zero pressure on the other side. Gate valves shall be American Flow Control (Model 2500), Mueller (Model A-2360), Kennedy (Model KS-FW), or Clow (Model 2639) on lines with working pressures 200-250 psi. Valves on lines with working pressures in excess of 250 psi shall be Kennedy Model KS-300.

2.3.2 Valve Boxes - All buried gate valves shall be equipped with a valve box. Valve boxes shall be Tyler 562-S or an approved equal. The valve box shall be of two piece cast iron construction with the cover marked "WATER". Valve boxes shall be threaded to allow the height to be adjusted. All valve boxes shall be installed flush with grade. Valve boxes in areas not paved shall be installed with a concrete collar.

2.3.3 Valve Indicator Posts - Where indicated on the plans, buried gate valves shall be installed with an adjustable-height indicator post assembly. The assembly shall be of two piece steel construction so that the post height can be adjusted to grade. The lower bell end shall mount on top of the buried gate valve with a coupling attached to the valve nut and stem extending to the upper barrel's wrench operator. The wrench operator shall be used to manually open or close the gate valve. The upper barrel's window shall clearly display whether the gate valve is "Open" or "Closed". Wrench operator shall include provisions for mounting an external lock. Indicator Post assemblies shall be UL789 Listed and FM 1110 Approved. Indicator post assemblies shall be manufactured by Mueller, American Flow Control, Kennedy, or approved equal.

2.4 FIRE HYDRANTS - Fire hydrants shall be cast iron body, bronze mounted, suitable for a working pressure indicated on the drawings, and shall be in accordance with ANSI/AWWA specification C502. Hydrants shall be constructed so as to allow withdrawal of internal working parts without disturbing the barrel. Hydrants shall be traffic type, that will not geyser, should the upper barrel and stem section be broken off. The main valve opening shall be 5-1/4" in diameter. The main valve shall be made of neoprene. Hydrants shall open left (counter clockwise). Hydrants shall have two 2-1/2" threaded hose nozzles and one 4-1/2" threaded pumper nozzle. Nozzle caps shall be securely chained to the barrel. Operating and cap nuts shall be 1-1/2" pentagon, unless otherwise specified. Hydrants shall have 6" mechanical joint inlet connections and a 6" gate valve installed between the hydrant and the distribution system. Hydrants installed on mains with working pressures of 250 psi or less shall be American Flow Control Model B-84-B, Kennedy Model 81D, or Mueller Super Centurian (Model #A-423).

2.4.1 Hydrant Painting - Following installation, all hydrants shall be painted with one coat of zinc chromate primer and two finish coats of Yellow OSHA Industrial Enamel. Paint shall not foul or obstruct nozzle threads, cap chains, or any lubrication fittings. Hydrant tops shall be color code painted to indicate flow capacity. Hydrant caps shall be color code painted to indicate pressure rating. Color coding of hydrants to be in accordance with the following:

Hydrant Top - Flow Capacity	Hydrant Caps - Static Pressure
Red: <500 Gallons/Minute	Red: <50 psi
Orange: 500 - 999 Gallons/Minute	Orange: 50-120 psi
Green: 1,000 - 1,499 Gallons/Minute	Green: >120 psi
Blue: >1,500 Gallons/Minute	

2.5 AIR RELEASE VALVES - All air release valves shall be combination air/vacuum release valves. Combination air/vacuum release valves shall allow air to escape from the distribution system during pipeline filling and normal operation and also open to allow air to enter the system during vacuum conditions such as during a line break. The valve shall have an internal float assembly to prevent leakage. Combination air/vacuum release valves shall be Val-Matic Series 200C, Apco, or approved equal.

2.6 COMPOUND METER WATER SERVICE CONNECTION - Large diameter (>2") Service connections generally include individual compound water service meters and all related items required to make a complete functioning assembly as shown on the standard detail plan sheets.

2.6.1 Compound Water Service Meters - Unless shown or specified otherwise, all compound water service meters shall be of the size indicated on the plan sheets. All compound water service meters shall comply with AWWA C702 and shall include a positive displacement measuring chamber for low flows and a turbine chamber for high flows with a single register assembly. All meters shall be new and shall be manufactured by Sensus Technologies to match the Owner's existing equipment inventory and Touchread billing system. All compound water meters shall be Sensus Model SRH.

Register - The register must be of the straight reading type and shall read in gallons and be capable of direct visual reading at the meter and by remote reading through a touch pad located external to the meter. All reduction gearing shall be contained in a permanently hermetically sealed, tamper-proof enclosure made of a corrosion resistant material. The register is to be secured to the upper maincase by means of a tamper-resistant locking device so that the register cannot be removed by the utility customer. The register shall be warranted for ten (10) years from date of shipment against defects in material and workmanship.

The meter register shall be provided with three terminal connections. The connection between the meter register and external touchpad shall be accomplished using two of the three terminals and two conductor non-polarized cable. The register shall be capable, with the use of all three terminal connections, of transmitting the meter reading and customer identification number directly to an automatic meter reading transponder or interface device.

Register output data format for automatic meter reading shall be 7-bit ASCII (American Standard Code for Information Interchange) digital, plus an even parity bit. The first character is ASCII "R" followed by a 4-digit meter reading (most significant data first), followed by an 8-digit meter ID number. The register's ASCII digital output is to be capable of interfacing directly to an automatic meter reading transponder to transmit data via radio signal.

Main case shall be of ductile iron construction consisting of an outer case so that measuring chamber can be removed without disconnecting the meter from the coppersetter and shall withstand 200 psi operating pressures.

2.6.2 TOUCHPAD/PITLID REGISTER (TR/PL) AND MODULE

The Touchpad shall be housed in a separate enclosure with sealed connections between the register and the Touchpad. The cable which connects the Touchpad Pitlid Module to the register shall be 3-conductor. The Pitlid Module shall be of a sturdy and tamperproof construction. The module shall allow for ease of installation on any Pitlid (plastic, cast iron or concrete) by cutting an appropriately placed 1-3/4" hole in the lid. The entire Pitlid Module shall be constructed of a suitable synthetic polymer for long service life under normal operating conditions. The module shall be compatible with the touch probe of either the solid state or visual reader.

2.6.3 All components of the meter system (water meter, touch read, meter reading device, etc.) shall be manufactured by Sensus Technologies and shall be current production equipment. All components shall have been in production for a minimum of two (2) years.

Guarantees - All meters shall be guaranteed against defects in material and workmanship for one year from date of shipment. Touchread pitlid modules and electronic registers shall have a ten year guarantee.

2.7 TAPPING VALVE AND TAPPING SLEEVE - Main line connections to lines which cannot be temporarily deadened shall be accomplished with tapping sleeves and valves as indicated on the plans. Tapping valves shall meet requirement of AWWA Standard C500 and shall have flange on one end for bolting to tapping sleeve (per MSS-SP60) for all sizes through 12" and outlet connection compatible with connecting pipe. Tapping sleeve shall be compatible with size and type of pipe to be tapped and flanges to mate all tapping valves through 12".

Tapping valves and sleeves shall be as manufactured by American Flow Control, Mueller, or approved equal. Sleeves shall be all stainless steel with carbon steel flange as manufactured by Ford Meter Box Company or equal.

2.8 PRECAST MANHOLES and VAULTS - Unless indicated otherwise, all manholes and valve vaults shall be precast reinforced concrete. Shop drawings showing dimensions, reinforcing, and material specifications shall be submitted to the Engineer for approval. All submittals shall be stamped by a Virginia Registered Professional Engineer. Manholes shall be manufactured in accordance with the latest edition of ACI Standard 318. Manhole or vault joints shall be made watertight using flexible butyl mastic sealant. All manholes and vaults shown to have a concrete bottom shall be provided with a floor drain to daylight. All lift rings shall be removed and all lift holes sealed following installation of the structure.

2.9 MANHOLE FRAMES AND COVERS - Manholes and vaults shall be provided with covers of the type shown on the plans. Iron castings shall conform to the standard specifications for Grey Iron Castings ASTM Specification A-48-41, Class 20. The manhole frame and cover shall be a true 24"minimum opening diameter. One approved model is Dewey No. 3000.

Hinged lids shall be equal to Bilco Type J-AL or Type JD-AL, Halliday, aluminum construction, sized as shown on the drawings. Provide H-20 loading where required. Aluminum hatches shall be coated with a bituminous sealant on all surfaces in direct contact with concrete.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION - All pipe shall be installed using sound construction techniques in compliance with the pipe manufacturer's recommendations, AWWA standards, Virginia Department of Health's Waterworks Regulations, and the Engineer's requirements. A general overview of installation requirements is included herein:

1. All pipe shall be bedded in accordance with the pipe bedding details shown on the plan sheets and/or as specified in Section 02215, Earthwork for Utilities.

   The trench bottom shall be constructed to provide a firm, stable and uniform support for the full length of the pipe. Bell holes shall be provided at the proper location for each pipe joint to permit proper joint assembly and pipe support. When an unstable subgrade condition is encountered which will provide inadequate pipe support, the trench shall be overexcavated a minimum of 6" or as required and refilled with suitable foundation material. Unstable subgrade conditions include mud, organic matter, bedrock, or other conditions which would result in unsatisfactory pipe support. In all cases, trench excavation shall be sufficient to provide pipe bedding as shown and/or specified. Trenches shall be excavated as the work progresses and are to be backfilled as the pipe is installed. Trenches shall be fully backfilled at the end of each day and open trenches shall not be left unattended. It is the Contractor's full responsibility to excavate and protect utility trenches in a manner that is safe both to his workers and the general public.

2. Trenches for pipelines shall be excavated using suitable equipment/means for each particular installation. Pipeline trenches are to be excavated to the required width and grade in a manner to minimize the disturbance to adjacent areas. Excavated trench bottoms are to be firm and stable prior to the installation of the required pipe and bedding. Trenches shall be reasonably dry prior to pipe installation. In locations where water occurs in the trench, the trench shall be dewatered prior to pipe installation. Dewatering may include pumping, diversion, or installation of underdrains.

3. The Contractor shall provide all new materials for construction and shall store and install the materials in a manner which does not result in damage to the material. All materials shall be stored in a manner which will prevent the entry of dirt, mud, animals, or other foreign materials. All PVC pipe shall be stored under a roof or cover to prevent damage from sunlight. Damaged materials will be rejected and the Contractor required to provide materials free of defects at no additional charge. Any dirt, mud, or

other foreign matter shall be cleaned from all materials prior to installation.

4. All water lines and related appurtenances shall be laid in compliance with the manufacturer's recommendations, Virginia Department of Health's Waterworks Regulations, the plans and specifications and all applicable AWWA requirements. All blisters, excess pipe coatings, or foreign matter shall be removed from the ends of each fitting and piece of pipe. Particular care shall be taken to properly clean and lubricate the pipe interior and exterior at joints to ensure proper connection. Joint gaskets shall be inspected to ensure proper positioning and alignment. In locations where pipe must be cut to install fittings, valves, or to join other lines, the pipe shall be carefully cut using a pipe saw. Cutting of pipe with a torch shall not be allowed. Following pipe cutting, the cut surface shall be filed or sanded to remove any burrs.

5. Pipe lines shall generally be installed in a continuous manner corresponding to plan line numbers as designated on the plans. The Contractor shall not install lines in a manner to purposefully skip sections which would require later completion. Pipe shall be strung daily in amounts equal to the amount anticipated to be installed on that day. Pipe shall not be allowed to be left lying along the proposed line route overnight. Trench excavation and pipe installation shall be in compliance with the VDOT inspector's recommendations or requirements. The Contractor shall fully comply with VDOT's requirements and any shutdowns or delays caused by the Contractor's noncompliance shall be at the Contractor's expense.

6. All fittings in water mains shall be provided with reaction backing. Reaction backing will be accomplished by installing either concrete thrust blocks or mechanical joint restraints. Concrete thrust blocks shall conform to the dimensions given on the plan sheets. When concrete thrust blocks are used, the water line shall not be pressurized until after the concrete has cured for at least seven days. Fittings anchored by tie rods shall have at least two 3/4" steel rods fastened with clamps around the fitting and around the main. Pipes installed on slopes greater than 20% shall require ductile iron pipe and concrete anchor blocks. Anchor blocks shall be installed no further than 20 feet apart and there shall be at least one anchor block per individual pipe segment.

7. Pipe shall be installed with straight horizontal and vertical alignment at the proper design grade. In locations where bends in the pipe are necessary, the bends shall be accomplished using either fittings or the manufacturer's permissible joint deflection. In no case shall the pipe be bent to achieve alignment changes.

8. The Contractor shall take necessary measures to prevent foreign material from entering the pipe while it is being installed. Pipe trenches shall be dewatered during pipe installation. Special protection shall be provided at open pipe ends to prevent entry of any foreign material. At all times when the pipe is left unattended, the pipe ends shall be plugged to prevent entry of material.

9. As the pipe is installed, the trench shall be backfilled and bedded in accordance with the standard detail plan sheets and the specifications. Pipe bedding and trench backfill material shall be installed in layers and fully compacted. Excess excavated and unsuitable backfill material shall be disposed of by the Contractor at location(s) determined by the Contractor, and using disposal methods in full compliance with all applicable laws. The Contractor shall take measures to clean up/repair damage as the work progresses. The Engineer reserves the right to shut down the Contractor's pipe laying until sufficient progress is made toward cleanup/repair. Any loss of time due to shutdown as a result of improper cleanup/repair shall not be considered for time extension.

10. Following main line installation, the water line shall be thoroughly flushed, disinfected, pressure tested, and bacteriologically tested. The water line shall not be placed in service until all required tests have been passed and the Engineer authorizes placing the line in service. It is the Contractor's option whether to make taps for proposed service connection before or after pressure testing the main.

11. All water lines (mains and service lines) shall have a detectable underground marking tape installed above the pipe. The marking tape shall be installed at a depth of approximately 4"-12" below the

finished ground surface. The marking tape shall be continuously lettered with the caption "CAUTION: BURIED WATER LINE BELOW", detectable by a metal locator, and equal to Lineguard, Inc., detectable marking tape Type III.

12. Prior to project closeout, the Contractor shall clean up all construction debris and restore all surfaces disturbed by construction to as near to their "before construction" condition as possible. All paved areas damaged by construction shall be resurfaced. The Contractor shall restore all areas within VDOT right-of-ways to the satisfaction of the VDOT inspector. All grassed areas shall be revegetated in accordance with Specification Section 2V, Topsoiling and Seeding. Prior to seeding, all disturbed surfaces shall be raked to remove all large rocks, clods, or other debris which could interfere with grass growth. In lawns and other areas subject to mowing, the final surface shall be free of stones and smooth enough to allow mowing. The Contractor shall take all measures necessary to restore grass; including but not limited to reseeding, topsoiling, fertilizing, mulching, or watering - at no additional cost to the Owner. Because final cleanup and restoration is often difficult to achieve to the satisfaction of all parties, the Contractor is highly advised to document the before construction conditions with either photograph or videotape.

3.2 SEPARATION OF WATER LINES AND SANITARY SEWERS - Water lines shall be separated from sanitary sewer lines in accordance with the Virginia Department of Health's Waterworks Regulations. Water lines shall be laid at least ten feet horizontally from sewer lines and sewer manholes whenever possible, the distance shall be measured edge-to-edge.

In locations where water/sewer line crossings are required, the water line shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible. In locations where the 10 foot horizontal or 18" vertical separation cannot be achieved, the Engineer shall be notified and work shall cease until the Engineer resolves the situation. The water line will either be re-routed to provide the required separation or special measures may be authorized, including the following: When local conditions prevent a horizontal separation of ten feet, the water line may be laid closer to a sewer main or sewer manhole provided that: (1) the bottom of the water line is at least 18 inches above the top of the sewer; (2) where this vertical separation cannot be obtained, the sewer shall be constructed of mechanical joint water pipe, pressure-tested in place for two hours at 50 psi without leakage prior to backfilling; and (3) the sewer manhole shall be of watertight construction and tested in place with zero leakage.

When local conditions prevent the desired 18" minimum vertical separation, the following construction shall be used: (1) sewers passing over or under water lines shall be constructed of mechanical joint water pipe, pressure tested in place for two hours at 50 psi without leakage prior to backfilling; (2) water lines passing under sewers shall, in addition, be protected by providing:

a. a vertical separation of at least 18 inches between the bottom of the sewer line and the top of the water line,

b. concrete encasement of the water line up to the sewer line to prevent pipe deflection,

c. the water line be centered at the point of the crossing so that water line joints shall be equidistant from the sewer.

d. Sewer Manholes: If a water line passes within 10 feet of a sewer manhole, the sewer manhole shall be tested with zero leakage provided with a waterproof frame and cover.

e. Sewers or Sewer Manholes - No water pipes shall pass through or come in contact with any part of a sewer manhole or any sewer line.

3.4 BORINGS FOR UTILITIES (UNDER ROADS) - Unless specifically noted otherwise on the plans, all utility lines crossing paved public roadways shall be accomplished by jacking or boring and installing the carrier pipe within a steel encasement pipe. All road crossings shall be accomplished in accordance with the VDOT Permit and/or the VDOT inspector's requirements. The Contractor shall first conduct the minimum number of

bore attempts (as specified in the VDOT Permit) before special permission to open cut is requested. During boring or open cut installation, the Contractor shall maintain traffic flow on the roadway.

All 4" and larger main line carrier pipes installed inside encasement shall be ductile iron. The Contractor shall exercise extreme care to ensure that the road crossings are installed to the design depth and slope. Carrier pipes shall be supported by wood blocks strapped to the pipe or adjustable mechanical spacers. The pipe supports shall prevent any part of the carrier pipe from coming in contact with the casing. The casing pipe shall be ASTM A53 Grade B & shall conform to Section 232.02(c)5 of the 2007 VDOT Road & Bridge Specifications. The minimum required wall thickness for the steel casing pipe shall be the lesser of ASTM A53 Standard Weight Class for the casing size <u>or</u> 0.5 inches. The casing pipe shall be fabricated to the required length prior to installing the casing in the bore hole. The minimum size diameter casing pipe used for road and railroad crossings shall generally be a minimum of six inches larger than the largest outside diameter of the carrier pipe. A table of the required casing pipe sizes is shown on the standard detail plan sheets.

When road crossings cannot be accomplished by jacking or boring and if special permission is granted by VDOT, road crossings may be made by open cut. At open cut road crossings, the existing pavement shall be saw cut on either edge of the pipeline trench to minimize damage to the adjacent pavement. Following pipe installation the crossing shall be backfilled full depth with compacted crushed stone. Pavement overlay of the crossing shall be conducted in accordance with the standard detail plan sheets and the VDOT Highway Permit.

3.5 <u>AGGREGATE AND PAVING</u> - Following pipeline installation, disturbed roadways and shoulders shall be repaired. Repair disturbed gravel roadways, driveways, and shoulders. Repair disturbed paved driveways with local material plant mix bituminous concrete. Repair disturbed public roadway pavement in accordance with the standard detail plan sheets and the VDOT Highway Permit.

3.6 <u>INSPECTION AND TESTS</u> - Following installation but prior to placing into service, all water mains shall be subjected to and pass pressure tests, be disinfected, and pass bacteriological testing.

3.6.1 <u>Pressure Testing</u> - After installation, all piping shall be thoroughly flushed by opening hydrants or blowoffs as appropriate. All pressure pipe lines shall then be subjected to a hydrostatic test of 50% greater than the pipe classification pressure of the line being tested for not less than 2 hours during which time the leakage loss shall not exceed the number of gallons per hour for each section tested, as determined by the following formula:

$$L = \frac{SD\,(P)^{1/2}}{148{,}000}$$

L = maximum allowable Leakage, in gallons per hour
S = Length of line under test, in feet
D = Nominal diameter of the pipe, in inches
P = Average test pressure, in psi

Each valved section of water line shall be individually tested between gate valves so that each side of each gate valve is pressurized with the required test psi on one side and zero psi on the other side. Pressure testing shall be conducted as near the high point in the line segment as possible.

The Contractor shall provide all equipment required for the pressure testing and shall be solely responsible for conducting the test. All testing equipment shall be in good working order, to the satisfaction of the Engineer. Pressure testing shall only be conducted under the direct supervision of the Engineer. In the event that any section under test shows leakage in excess of the allowable amount, the Contractor shall make such repairs to the line as are required to bring the loss within the required limits. Any visible leaks shall be repaired, regardless of the test results. The test pressure shall be maintained within 5 psi of the required test pressure at all times during test.

3.6.2 Disinfection - All water lines shall be disinfected prior to being placed in operation. Prior to disinfection all water lines shall be flushed. All valves and hydrants shall be operated during line flushing. Flushing velocities shall not be less than 3 ft/sec.

The contractor shall be responsible for all costs associated with testing. The Owner shall provide the Contractor with enough water to fill, flush, and test the lines one time at no charge. The Owner reserves the right to bill the Contractor for water required for additional flushing. Lines shall be disinfected by chlorination using the following method:

Continuous Feed Method - Potable water shall be introduced into the pipe main at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/l. The chlorinated water shall remain in the pipe line at least 24 hours, after which, the chlorine concentration in the water shall be at least 10 mg/l. All valve and appurtenances shall be operated while the chlorinated water remains in the pipe line.

After disinfection using the previously discussed method, the heavily chlorinated water shall be flushed from the mains using potable water. The chlorinated water shall not be directly discharged to any creek or stream. After flushing, the mains shall be tested for bacteriological contamination. Two water samples for bacteriological analysis must be collected and analyzed by a Virginia licensed laboratory by one of the following two (2) methods. Two (2) samples must be collected 16 hours apart or two (2) samples must be collected no less than 15 minutes apart after allowing the new water main to rest for 16 hours after disinfection. The results of these samples must indicate no coliform contamination before the pipe, tanks or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedure and subsequent testing must be repeated. Samples shall be collected in accordance with the following general guidelines:

i) samples required at regular intervals on each pipe run and no further than 1,200 feet apart

ii) samples required at the end of all dead end lines

iii) at least one set of samples required on each branch line

END SECTION 330100

SECTION 330200 – SEWER LINE CONSTRUCTION

GRAVITY SEWER LINE

PART 1 - GENERAL

1.1 DESCRIPTION

1.2 RELATED SPECIFICATIONS - The following specification sections include other information relevant to sewer line construction:

Section 312000 - Excavation and Backfilling for Utilities

1.3 SUBMITTALS - Provide shop drawings for all construction materials. Provide test reports for all tests conducted.

1.4 CONSTRUCTION LAYOUT - Construction quantities shown on the plans and designated in the bid schedule are estimated based upon field surveying.

The Contractor is responsible for construction stakeout required to build the project.

During design of the project, the Engineer has performed field surveys to determine the location of existing utilities which could conflict with the proposed construction. The plans depict the Engineer's best representation of existing conditions. The exact location of all existing utilities may not be known and is not guaranteed to be shown on the plans. It is the Contractor's responsibility to field locate all existing utilities prior to start of construction. The Contractor shall be responsible for repair of any utilities damaged by construction.

The plans indicate those portions of the work which are located on private property. Easements for the proposed construction have been obtained by the Owner. It is the Contractor's responsibility to construct the work as shown on the plans and to limit his encroachment on private property to within the easements' boundaries. It is the Contractor's responsibility to replace any property corners damaged by construction using a licensed surveyor.

The Contractor is responsible for identifying paved, concrete, unpaved roads and parking lots prior to bidding the project. The cost of surface restoration shall be included in the Contractor's unit price bid for pipeline. All property disturbed shall be restored to its original condition to the property owner's satisfaction at no additional cost to the Owner.

1.5 All manholes, cleanouts, vents, and air vacuum relief valves on VDOT right-of-way shall be located as required by the VDOT inspector.

PART 2 - MATERIALS

2.1 PIPE - Unless specifically called for on the plans or specified herein, it shall be the Contractor's option to select the type of pipe material for each application from those acceptable materials specified herein.

2.1.1 Ductile Iron Sewer Pipe - All ductile iron sewer pipe shall be manufactured in accordance with the requirements of ANSI Specification A21.51 (AWWA C151). All ductile iron pipe shall be thickness Class 50 per ANSI Specification A21.50. Pipes shall have an interior cement lining and exterior bituminous seal coating per ANSI Specification A21.51 (AWWA C151).

All fittings shall be ductile iron conforming to the requirements of ANSI A21-10. Fittings shall be provided with an interior cement lining and exterior bituminous seal coating per ANSI A21.51 (AWWA C151).

Pipe joints shall be rubber gasketed push on or mechanical type meeting all applicable requirements of ANSI A2l.11. All pipe shall be stamped by the manufacturer; designating the pipe class, manufacturer, and date of manufacturer.

2.1.2 PVC Sewer Pipe - PVC sewer pipe shall meet SDR-35 requirements for ASTM D3034 (4" - 15" pipe) and ASTM F679 (18" - 27" pipe) Type PSM Poly Vinyl Chloride sewer pipe and fittings with a minimum tensile modulus of 500,000 psi (ASTM D1784). The fittings and pipe shall be rubber gasketed push on type meeting ASTM D3212. Fittings shall meet the requirements of ASTM D3034.

2.2 PIPE CONNECTIONS - Pipe shall normally be laid using the same type of pipe material continuous from manhole to manhole. In locations where new pipe is to be connected to existing or if different pipe materials are specified to be joined, the pipe connection shall be made using the appropriate Fernco flexible coupling. Couplings shall be installed to maintain a smooth, watertight connection.

2.3. PRECAST MANHOLE - Unless shown or specified otherwise, all manholes shall be precast reinforced concrete type as shown on the standard detail plan sheets. Shop drawings showing manhole dimensions, reinforcing, and material specifications shall be submitted to the Engineer for approval. Manholes shall be manufactured in accordance with the ACI 318 and ASTM C-478. Manholes shall be furnished with cast-in- place rubber coated steel steps. Steps shall be skid resistant and spaced approximately 16 inches apart.

All openings for pipe shall be cast-in-place or core drilled. Pipe openings shall be supplied with a flexible connection boot equal to A-LOK or PSX. Flexible boots shall be made from neoprene rubber. All manhole joints shall be waterproofed using flexible bituminous "rope" type sealant applied in the field.

Sewer line connections to existing manholes shall be core drilled and provided with a flexible boot.

Manholes shall be of watertight construction. Unless noted on plans, in areas subject to vehicle travel, manhole tops shall be set by the road grade. A maximum of 12 inches of adjustment rings may be used to reach grade. In areas not subject to vehicles, manhole tops shall be installed above ground, up to a maximum of 24 inches above ground unless otherwise noted on plans. No adjustment rings shall be used to reach this elevation. All lift rings shall be removed and all lift holes sealed. Inverts shall be shaped providing a smooth flow line without obstructions in accordance with the standard detail plan sheets.

2.4 MANHOLE FRAMES AND COVERS - Iron castings shall conform to the standard specifications for Grey Iron Castings ASTM Specification A-48-41, Class 20. Standard manhole frame and cover shall be MH-1 as specified by the Virginia Department of Highways and Transportation. Waterproof manhole frame and covers shall include a machined dovetail groove on the manhole cover seat, fitted with a continuous dovetail gasket. The weight of the manhole cover compresses the gasket, forming a watertight seal. Standard and waterproof manhole frames and covers shall be manufactured by Dewey Bros., Foundry, U.S. Foundry, or approved equal. All manhole frames and covers shall be attached to the manhole using four (4) 3/4" anchor bolts. All manhole frames and covers furnished shall be manufactured in the United States.

Hinged lids shall be equal to Bilco, Type J-AL or Type JD-AL, Halliday, aluminum construction, sized as shown on the drawings. Provide H-20 loading where required. Aluminum hatches shall be coated with a bituminous sealant on all surfaces in direct contact with concrete.

2.5 SERVICE CONNECTIONS - Service connections shall be installed as shown on the standard detail plan sheet. All service lines shall be 6 inch diameter, to be laid at minimum slope to the property lines, and to stop at the property lines, unless indicated otherwise. Service connections to the main line shall be made using a branch tee. A cleanout assembly shall be installed on each service line at the property line.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION - All pipe shall be installed using sound construction techniques in compliance with the pipe manufacturer's recommendations, Virginia Department of Environmental Quality's Sewage Collection and Treatment (SCAT) Regulations, and the Engineer's requirements. A general overview of installation requirements is included herein:

1. All pipe shall be bedded in accordance with the pipe bedding details shown on the standard detail plan sheets and as specified in Section 2J, Excavation and Backfilling for Utilities.

   The trench bottom shall be constructed to provide a firm, stable and uniform support for the full length of the pipe. Bell holes shall be provided at the proper location for each pipe joint to permit proper joint assembly and pipe support. When an unstable subgrade condition is encountered which will provide inadequate pipe support, the trench shall be overexcavated a minimum of 6" or as required and refilled with suitable foundation material. Unstable subgrade conditions include mud, organic matter, bedrock, or other conditions which would result in unsatisfactory pipe support. In all cases, trench excavation shall be sufficient to provide pipe bedding as shown and/or specified. Trenches shall be excavated as the work progresses and are to be backfilled as the pipe is installed. Trenches shall be fully backfilled at the end of each day and open trenches shall not be left unattended. It is the Contractor's full responsibility to excavate and protect utility trenches in a manner that is safe both to his workers and the general public.

2. Trenches for pipelines shall be excavated using suitable equipment/means for each particular installation. Pipeline trenches are to be excavated to the required width and grade in a manner to minimize the disturbance to adjacent areas. Excavated trench bottoms are to be firm and stable prior to the installation of the required pipe and bedding. Trenches shall be reasonably dry prior to pipe installation. Dewatering may include pumping, diversion, or installation of underdrains.

3. The Contractor shall provide all new materials for construction and shall store and install the materials in a manner which does not result in damage to the material. All materials shall be stored in a manner which will prevent the entry of dirt, mud, animals, or other foreign materials. All PVC pipe shall be stored under a roof or cover to prevent damage from sunlight. Damaged materials will be rejected and the Contractor required to provide materials free of defects at no additional charge. Any dirt, mud, or other foreign matter shall be cleaned from all materials prior to installation.

4. All sewer lines and related appurtenances shall be laid in compliance with the manufacturer's recommendations, Virginia Department of Environmental Quality's Sewage Collection and Treatment (SCAT) Regulations, and the plans and specifications. All blisters, excess pipe coatings, or foreign matter shall be removed from the ends of each fitting and piece of pipe. Particular care shall be taken to properly clean and lubricate the pipe interior and exterior at joints to ensure proper connection. Joint gaskets shall be inspected to ensure proper positioning and alignment. In locations where pipe must be cut to install fittings, valves, or to join other lines, the pipe shall be carefully cut using a pipe saw. Cutting of pipe with a torch shall not be allowed. Following pipe cutting, the cut surface shall be filed or sanded to remove any burrs.

5. Pipe lines shall generally be installed in a continuous manner corresponding to plan line numbers as designated on the plans. The Contractor shall not install lines in a manner to purposefully skip sections which would require later completion. Pipe shall be strung daily in amounts equal to the amount anticipated to be installed on that day. Pipe shall not be allowed to be left lying along the proposed line route overnight. Trench excavation and pipe installation shall be in compliance with the VDOT inspector's recommendations or requirements. The Contractor shall fully comply with VDOT's requirements and any shutdowns or delays caused by the Contractor's noncompliance shall be at the Contractor's expense.

6. Sewer lines shall be installed by starting at the low point and proceeding uphill. Pipe shall be installed with the bell end uphill. Pipes installed on slopes greater than 20% shall require ductile iron pipe and concrete anchor blocks. Anchor blocks shall be installed no further than 20 feet apart and there shall be at least one anchor block per individual pipe segment.

7. Pipe shall be installed with straight horizontal and vertical alignment at the proper design grade. In locations where bends in the service lines are necessary, the bends shall be accomplished using fittings. In no case shall be pipe be bent to achieve alignment changes. Cleanouts shall be installed

on service line as required by the local building inspector.

8. The Contractor shall take necessary measures to prevent foreign material from entering the pipe while it is being installed. Pipe trenches shall be dewatered during pipe installation. Special protection shall be provided at open pipe ends to prevent entry of any foreign material. At all times when the pipe is left unattended, the pipe ends shall be plugged to prevent entry of material.

9. As the pipe is installed, the trench shall be backfilled and bedded in accordance with the standard detail plan sheets and the specifications. Pipe bedding and trench backfill material shall be installed in layers and fully compacted. Excess excavated and unsuitable backfill material shall be disposed of by the Contractor at location(s) determined by the Contractor, and using disposal methods in full compliance with all applicable laws. The Contractor shall take measures to clean up/repair damage as the work progresses. The Engineer reserves the right to shut down the Contractor's pipe laying until sufficient progress is made toward clean up/repair. Any loss of time due to shutdown as a result of improper cleanup/repair shall not be considered for time extension.

10. Following installation, all sewer lines shall be tested for leaks. The sewer line shall not be placed in service until all required tests have been passed and the Engineer authorizes placing the line in service.

11. All sewer lines (mains and service lines) shall have a detectable underground marking tape installed above the pipe. The marking tape shall be installed at a depth of approximately 4" - 12" below the finished ground surface. The marking tape shall be continuously lettered with the caption "CAUTION: BURIED SEWER LINE BELOW", detectable by a metal locator and equal to Lineguard, Inc., detectable marking tape Type III.

12. Prior to project closeout, the Contractor shall clean up all construction debris and restore all surfaces disturbed by construction to as near to their "before construction" condition as possible. All paved areas damaged by construction shall be resurfaced. The Contractor shall restore all areas with VDOT right-of-ways to the satisfaction of the VDOT inspector. All grassed areas shall be reseeded with a seed mixture to match the existing surface. Prior to seeding, all disturbed surfaces shall be raked to remove all large rocks, clods, or other debris which could interfere with grass growth. In lawns and other areas subject to mowing, the final surface shall be free of stones and smooth enough to allow mowing. The Contractor shall take all measures necessary to restore grass; including but not limited to reseeding, topsoiling, fertilizing, mulching, or watering - at no additional cost to the Owner. Because final cleanup and restoration is often difficult to achieve to the satisfaction of all parties, the Contractor is highly advised to document the before construction conditions with either photograph or videotape.

3.2 SEPARATION OF WATER AND SEWER - Water lines shall be separated from sanitary sewer lines in accordance with the Health Department's Waterworks Regulations. Water lines shall be laid at least ten feet horizontally from sewer lines and sewer manholes whenever possible, the distance shall be measured edge-to-edge. When local conditions prevent a horizontal separation of ten feet, the water line may be laid closer to a sewer main or sewer manhole provided that: (1) the bottom of the water line is at least 18 inches above the

top of the sewer; (2) where this vertical separation cannot be obtained, the sewer shall be constructed of mechanical joint water pipe, pressure-tested in place to 50 psi without leakage prior to backfilling; and (3) the sewer manhole shall be of water tight construction and tested in place with zero leakage.

In locations where water/sewer line crossings are required, the water line shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible. When local conditions prevent a vertical separation described above, the following construction shall be used: (1) sewers passing over or under water lines shall be constructed of mechanical joint water pipe, pressure tested in place to 50 psi without leakage prior to backfilling; (2) water lines passing under sewers shall, in addition, be protected by providing:

a. a vertical separation of at least 18 inches between the bottom of the water and the top of the sewer line,

b. concrete encasement of the water line up to the sewer line to prevent pipe deflection,

c. the sewer line be centered at the point of the crossing so that sewer joints shall be equidistant from the sewer.

d. Sewer Manholes: If a water line passes within 10 feet of a sewer manhole, the sewer manhole shall be tested with zero leakage provided with a waterproof frame and cover.

e. Sewers or Sewer Manholes - No water pipes shall pass through or come in contact with any part of a sewer manhole or any sewer line.

If during construction it becomes evident that the normally required 10 foot horizontal/18 inch vertical water/sewer separation cannot be achieved, the Contractor shall notify the Engineer of the situation and receive direction from the Engineer on how to proceed with construction.

In the event there is a well within 50' of any proposed sewer line, the sewer line shall be constructed of mechanical joint water pipe and pressure tested at a pressure 50 psi (25' each side of well) for two hours with zero leakage. Sewer lines shall not be installed within 35' of any well.

3.3 AGGREGATE AND PAVING - Following pipeline installation, disturbed roadways and shoulders shall be repaired. Repair disturbed gravel roadways, driveways, and shoulders in conformance with VDOT specifications, Section 309, Aggregate Base Course. Repair disturbed paved driveways with local material plant mix bituminous concrete. Repair disturbed public roadway pavement in accordance with the standard detail plan sheets and the VDOT Land Use Permit.

3.4 INSPECTION AND TESTS - Following installation but prior to placing into service, all sewer lines and manholes shall be subjected to and pass leakage tests. All tests shall be conducted under the direct supervision of the Engineer. All tests shall be conducted by the Contractor using his equipment and at his expense. All proposed sewer lines shall be tested by either air testing or water testing. All proposed manholes shall be by vacuum testing or exfiltration. If the gravity sewer lines into and out of a manhole have been tested by air testing, then the manhole shall be tested by using the exfiltration procedure.

3.5.1 Sewer Line Air Test - All sewer mains shall be tested from manhole to manhole. The sewer line air test is the preferred test method. Prior to testing, the sewer line shall be flushed to clean. The sewer line air test shall conform to the latest revision of UNI-B-6. The air testing equipment shall be Air-Lock, as manufactured by Cherne Industrial, Inc., or approved equal. All air used shall pass through a single control panel. Three individual air hoses shall be used for the following connections: from control panel to pneumatic plugs for inflation; from control panel to sealed line for introducing low pressure air; and from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected. The plugs shall resist internal test pressures without requiring external bracing or blocking; however the Contractor shall provide external bracing during the test as an added safety precaution. Plugs shall be seal tested before being used in the actual test installation. The tested line segment shall be plugged and pressurized to 4.0 psi greater than the groundwater back pressure but not to exceed 9 psi. The line shall be allowed to stabilize for two minutes after pressurization. After the pressure has stabilized, the air pressure shall be decreased slowly to 3.5 psi greater than groundwater back pressure, the air hose from the control panel to the air supply shall be discontinued and the timing shall commence. The amount of time required for the air pressure to drop from 3.5 psi greater than back pressure to 2.5 psi greater than groundwater back pressure (1.0 psi drop) shall be recorded. If the time to drop 1.0 psi is less than that given in the attached Table I, then the line segment has failed. Lines which fail the test shall be repaired and retested until the test has passed. If the amount of time given in Table I expires and the pressure drop is less than 1.0 psi, then that line segment passes.

TABLE I

SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

Pipe Diameter (in.)	Minimum Time (min: sec)	Length for Minimum Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec) 100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	.380 L	3:463:46	3:46	3:46	3:46	3:46	3:46	3:46	
6	5:40	398	.854 L	5:405:40	5:40	5:40	5:40	5:40	5:42	6:24	
8	7:34	298	1.520 L	7:347:34	7:34	7:34	7:36		8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34.11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57.41	72.07	86.32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

3.5.2 Sewer Line Water Testing - Water testing of sanitary sewer lines shall be either the infiltration or exfiltration type.

3.5.2.1 Infiltration - Infiltration testing will only be allowed when the groundwater table outside the pipe is no less than 4 feet above the crown of the pipe at all locations. The test will be made by measuring the infiltration flow of water using an appropriate "insert-in-the-pipe" type of 60 degree V-notch weir installed at the downstream manhole. A series of three separate measurements shall be made at 1-hour intervals and the results averaged. The quantity of the infiltration for any section of sewer tested shall not exceed 100 gallons per inch diameter per 24 hours per mile of sewer. Any lines which fail the test shall be repaired and retested until they pass.

Sewer lines which cross a creek, river, or stream shall have zero infiltration. If any infiltration is present, the line shall be either repaired or replaced and retested.

3.5.2.2 Exfiltration - Exfiltration testing shall be used if the pipe trench is dry for its entire length and the groundwater table is below the pipe in all locations. The exfiltration test is conducted by plugging the sewer line at the downstream manhole and filling the sewer line with water until the water depth in the upstream manhole at least 4 feet above the top of the pipe or level with the top of the manhole. The water shall be allowed to stand at least 4 hours then refilled to the starting level. After refilling a timed period of one hour shall be allowed to elapse and the amount of water required to refill shall be measured. The 24-hour loss shall then be computed. The quality of leakage for any section of sewer tested shall not exceed 100 gallons per inch diameter per 24 hours per mile of sewer. Any lines which fail the test shall be repaired and retested until they pass.

Sewer lines which cross a creek, river, or stream shall have zero infiltration. If any infiltration is present, the line shall be either repaired or replaced and retested.

3.6 Manhole Vacuum Testing - Manholes may be tested for leakage using the vacuum test only if the sewer lines into the manhole were not tested by the air test. Manholes are to be tested prior to backfill. Installation and operation of vacuum equipment and indicating devices shall be in accordance with equipment specifications approved by the Health Department.

All pipe openings shall be plugged by pneumatic or mechanical plugs and braced to sustain 10" mercury vacuum. The vacuum test shall be conducted by establishing a 10" mercury vacuum on the manhole and measuring the time required for the vacuum to drop to 9" mercury. The amount of time required for a 1 inch mercury drop shall not be less than those given in the following table:

Minimum Time to Hold 1 in. Mercury Drop

MH Dia.	MH Depth	Min. Time
4'	< 10'	1 min. 0 sec.
4'	10-15'	1 min. 15 sec.
4'	15-25'	1 min. 30 sec.
5'	< 10'	1 min. 15 sec.
5'	10-15'	1 min. 30 sec.
5'	15-25'	1 min. 45 sec.
6'	< 10'	1 min. 30 sec.
6'	10-15'	1 min. 45 sec.
6'	15-25'	2 min. 0 sec.

If the manhole fails the test, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test. If mastic manhole joint sealant is completely pulled out during the vacuum test, the manhole shall be disassembled and the mastic replaced

3.7 Manhole Exfiltration Testing - Manholes which are not vacuum tested shall be tested by exfiltration. Manholes shall be tested prior to backfilling. This test method shall not be conducted when the groundwater table level is equal to or higher than the manhole invert out elevation.

All pipe openings shall be plugged by pneumatic or mechanical plugs. The manhole shall then be filled with water to the top of the rim. The manhole shall be allowed to soak for a time period not to exceed four (4) hours. Following the initial four (4) hours soaking period, the manhole shall be refilled with water to the top of the rim. The water shall then be allowed to remain in the manhole for a period of four (4) hours. At the end of the four (4) hour test period the amount of leakage will be measured as the volume of water necessary to refill the manhole. The leakage rate shall not exceed 0.25 gallons/hour (1.0 gallons for 4 hour test).

All manholes failing the test shall be repaired or replaced and retested until the manhole passes the test.

3.8 Deflection Test for PVC Pipe - The Engineer may require deflection tests on any section(s) of pipe installed. Deflection tests shall be performed at least 30 days after final full backfill has been placed. The deflection test shall be performed by use of rigid balls or mandrels, to be supplied by the Contractor, having diameters equal to 95% of the inside diameter of the pipe, and pulled through the sewer line without the use of mechanical devices. Maximum allowable deflection shall be 5%. Should any pipe fail the test, it shall be dug up, inspected by the Engineer, and either replaced or re-installed.

END SECTION 330200

SECTION 330300 – STORM SEWER CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All piping, structures, and incidental material brought to the job site for the storm sewer system. The work of this Section shall consist of excavating, installing, backfilling, and surface reparation of piping and structures on a previously prepared subgrade, as shown on the Plans.

1.2 SUBMITTALS

A. As specified in Section 013300.

B. Documentation from pipe and drainage structure suppliers that their items are in compliance with applicable standards of the Virginia Department of Transportation (VDOT).

1.3 RELATED SECTIONS

A. The drawings, all other applicable/related technical specifications, and general provisions of the agreement, including the general conditions and supplemental conditions apply to this section.

1.4 REFERENCES

A. VDOT "Road and Bridge Specifications," current edition.

B. VDOT "Road and Bridge Standards," current edition.

C. Virginia Department of Conservation and Recreation "Virginia Erosion & Sediment Control (ESC) Handbook," current edition.

PART 2 - PRODUCTS

2.1 STORM SEWER PIPE - The storm sewer pipe shall conform with the VDOT Road Designs and Standards and Sections 232, 302 and any other applicable sections of the V.D.O.T Road and Bridge Specifications.

2.2 STORM SEWER STRUCTURES - The storm sewer structures shall conform with V.D.O.T. Road Designs and Standards and Sections 302, 502 and any other applicable sections as stated in the V.D.O.T. Road and Bridge Specifications.

2.3 PRECAST STRUCTURES - Shop drawings of all precast structures and pipe shall be submitted for approval by the Contractor and shall be stamped and signed by V.D.O.T. and the Contractor indicating their approval of the particular manufacturer.

2.4 ROOF DRAINS - Footing drain pipe and roof drain pipe shall be either Schedule 40 PVC, ductile iron, or PVD SDR-35.

PART 3 – EXECUTION

3.1 STORM SEWER PIPE - Construction with storm sewer pipe shall conform to Sections 232, 302 and any other applicable sections as stated in the V.D.O.T. Road and Bridge Specifications for Class III or Class V (as appropriate) reinforced concrete pipe and ASTM F2306 double-wall smooth interior HDPE pipe. Storm pipe may be either reinforced concrete or double-wall smooth interior HDPE unless indicated otherwise. All pipe joints shall be gasketed and watertight. Joints for concrete pipe shall be either bell & spigot or tongue & groove type. Joints for HDPE pipe shall be bell & spigot type.

3.1.1 Foundation in Poor Soils - Whenever the materials found at the minimum depths of excavation are judged by the Geotechnical Engineer to be unsuitable for founding pipe or structure, the Contractor shall make additional excavation as directed at no additional cost to the Owner, and the additional excavation shall be replaced with No. 25 or No. 26 stone placed to the bottom of structure footing or to support one-half the outside diameter of pipe. In all instances the additional excavation shall be carried 4 inches (minimum) below the bottom of structure footing or pipe line.

3.1.2 Unauthorized Excavation - If any excavation is caused by the Contractor's error, or wherever the excavation is carried beyond or below the lines and grades, the Contractor shall at his own cost and expense refill such excavated space with No. 25 or No. 26 stone placed to support one-half the outside diameter of pipe in order to assure the stability of the pipes and structures, as directed by the Engineer

3.2 STORM SEWER STRUCTURES - Storm sewer structures shall conform to Sections 302, 502 and any other applicable sections as stated in the V.D.O.T. Road and Bridge Specifications. Structures shall be constructed in accordance with the V.D.O.T. Road Designs and Standards. Mastic joint sealant shall be required at all structure joints. All structures shall have VDOT IS-1 inlet shaping.

3.3 ROOF DRAINS - This section of specifications applies to all underground roof drain piping greater than five
(4) feet from the proposed building.

3.3.1 Roof drains unless otherwise noted, shall be:

Piping 6" and smaller: Piping shall be either PVC Schedule 40 material with solvent welded joints, PVC SDR-35 material with bell & spigot joints, or ductile iron material with bell & spigot joints.

Piping Larger than 6": All roof drain piping larger than 6" shall be either PVC SDR-35 or ductile iron material (Contractor's option) with bell & spigot joints.

3.3.2 Cleanouts shall be installed at all changes in direction greater than 45 degree.

3.3.3 Roof drain piping shall have a minimum grade of 1/8" per foot, except as otherwise indicated on the plans.

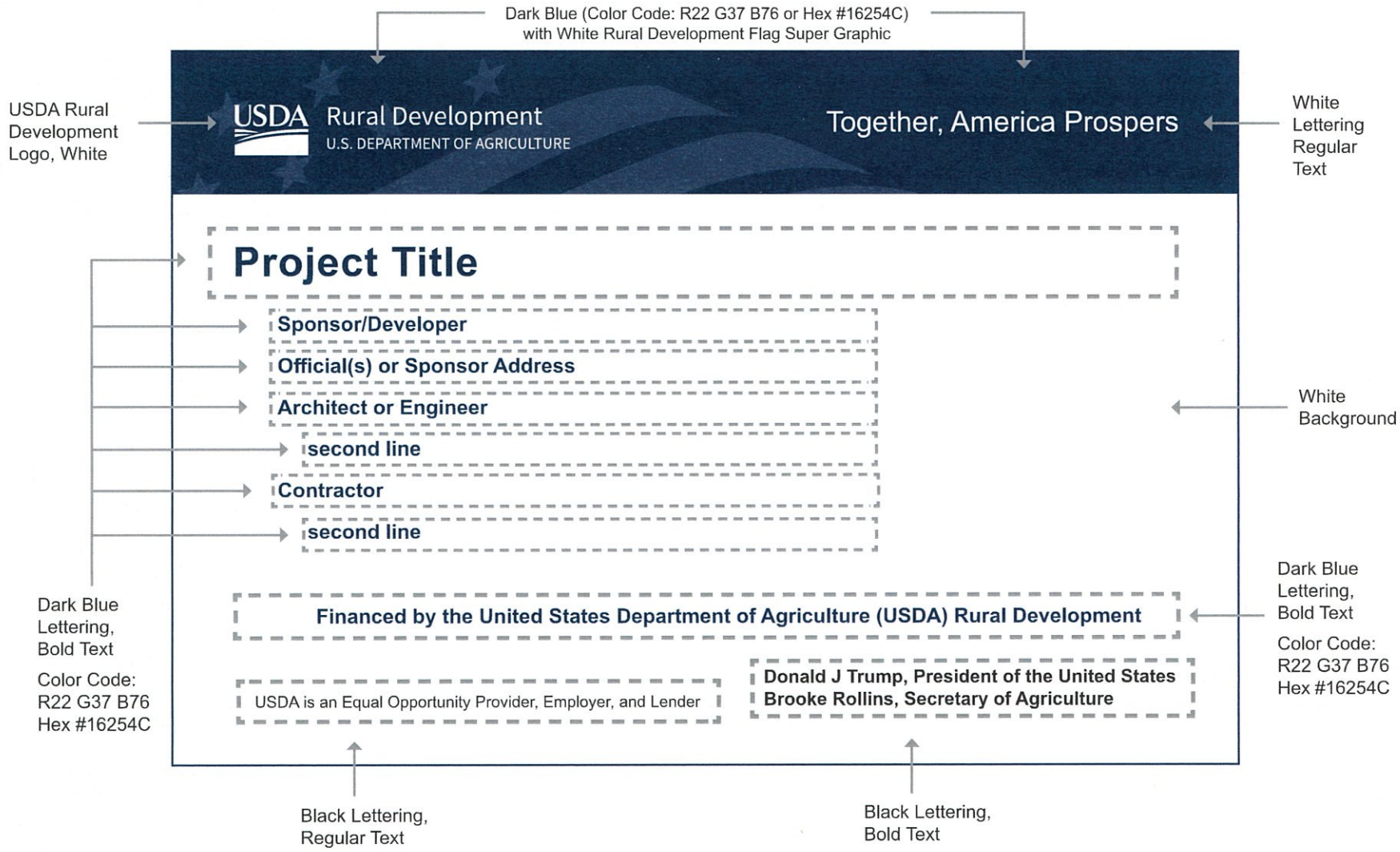
3.4 RIP RAP - All rip rapped outfalls indicated on the construction drawings shall conform to Section 414 and any other applicable sections as stated in the Road and Bridges Specifications, and shall be placed in accordance with Road Designs and Standards, or any other applicable detail in the construction drawings.

END OF SECTION 330300

EXHIBITS

Temporary Construction Sign for Rural Development Projects

Recommended Font: Arial



SIGN DIMENSIONS: 1200mm x 2400mm x 19mm (approx.4' x 8' x 3/4)
PLYWOOD PANEL (APA RATED A+B GRADE-EXTERIOR)

LIST OF DRAWINGS

T100	Title Sheet, Drawing Index, and Location Information
G100	Project Information
G101	Life Safety Plan
G102	Security Plan

CIVIL

C101	Site / Grading Plan
C102	Sidewalk / Parking Layout
C103	Sidewalk Layout Plan
C104	Storm Drain Layout
C105	Gas Piping Plan
C201	Erosion and Sediment Control Plan and Notes
C202	Erosion and Sediment Control Details
C401	Enlarged Site Layouts
C501	Construction Details
C502	Construction Details
C503	Construction Details
C504	Restocking and Maintenance Bay Concrete Details

LANDSCAPING

L101	Landscape Plan

STRUCTURAL

S101	Foundation Plan
S102	Roof Framing Plan
S201	Notes and Special Inspections
S202	Foundation Details
S203	Structural Details

ARCHITECTURE

A101	Floor Plan – Partition Types and Notations
A102	Floor Plan – Dimensions

ARCHITECTURE, continued

A103	Roof Plan
A104	Roof Details
A105	Reflected Ceiling Plan
A201	Elevations
A301	Building Section – South
A302	Building Section – Office Area
A303	Building Section – North
A304	Building Section – Apparatus Bay (East to West)
~~A305~~	~~Building Section – Apparatus Bay (North to South)~~ (Not provided).
A306	Maintenance Bay Section and East Elevation (Additive Bid Item #1)
A307	Wall Section
A308	Wall Section
~~A309~~	~~Wall Details – Overhead Doors~~ (Not provided).
A401	Service Area – Enlarged Plan / Interior Elevations
A402	Office Area – Enlarged Plan / Interior Elevations
A403	Bunkroom Area – Enlarged Plan / Interior Elevations
~~A501~~	~~Partition and Wall Types / Miscellaneous Details~~ (Not provided).
A502	Vestibule Storefront Details
A503	Metal Canopy Plans and Details
A601	Door Schedule / Glazing Schedule
A602	Door and Frame Details
A603	Window Schedule / Window Details
A604	Finish Schedule / Toilet Accessory Schedule
A605	Signage Plan
A606	Building Identification Sign
A701	Finishes Floor Plan

MPE SPECIFICATIONS

MPE101	Mechanical, Plumbing and Electrical Specifications
MPE102	Mechanical, Plumbing and Electrical Specifications

PLUMBING

P101	Sanitary Sewer, and Vent Piping Floor Plan
P102	Sanitary Sewer, and Vent Piping Floor Plan
P201	Domestic Water Piping Plan
P202	Domestic Water Piping Plan

PLUMBING, continued

P301	Plumbing Schedule and Details
P401	Roof Drain Plan

FIRE PROTECTION

FP101	Fire Protection Design Intent
FP102	Fire Protection Design Intent

MECHANICAL

M101	Mechanical Floor Plan
M201	Mechanical Details

ELECTRICAL

E101	Lighting Floor Plan
E102	Power and Communications Floor Plan
E103	Fire Alarm Floor Plan
E104	Schedules and Details
E105	Electrical Site Plan

END LIST OF DRAWINGS.

OWNER'S STATEMENT : BOUNDARY LINE ADJUSTMENT

THE ADJUSTMENT OF THE BOUNDARY LINE AS IT APPEARS ON THIS PLAT (REPLAT) IS WITH THE FREE CONSENT AND IN ACCORDANCE WITH THE DESIRES OF THE UNDERSIGNED OWNER(S) PROPRIETOR(S) AND TRUSTEE(S), IF ANY.

GIVEN UNDER MY (OUR) HAND AND SEAL THIS THE_____

DAY OF _____20____

_____SEAL

_____SEAL

_____SEAL

_____SEAL

_____SEAL

NOTARY STATEMENT

STATE OF_____

COUNTY OF _____TO WIT:

I, _____, A NOTARY PUBLIC IN AND FOR THE STATE AND COUNTY AFORESAID, DO HEREBY CERTIFY THAT

_____

WHOSE NAME(S) IS (ARE) SIGNED TO THE FOREGOING STATEMENT, PERSONALLY APPEARED BEFORE ME IN MY STATE AND COUNTY AND ACKNOWLEDGED THE SAME.

MY COMMISSION EXPIRES_____

GIVEN UNDER MY HAND THIS _____DAY OF _____20____

_____
NOTARY PUBLIC

_____
REGISTRATION NUMBER

THERE IS HEREBY RESERVED A 20' WIDE DRAINAGE AND UTILITY EASEMENT ALONG ALL LOT LINES. 10' ADJACENT TO ALL INTERIOR LOT LINES AND 20' CONTIGUOUS TO ALL OUTSIDE BOUNDARY LINES. THIS IS IN ADDITION TO ANY DRAINAGE AND UTILITY EASEMENTS SHOWN HEREON

CERTIFICATE OF APPROVAL

THE DIVISON(S) AND/OR BOUNDARY ADJUSTMENT SHOWN HEREON IS HEREBY APPROVED BY THE FOLLOWING:

_____
AGENT WASHINGTON COUNTY SERVICE AUTHORITY

LAND SURVEYORS CERTIFICATE

I HEREBY CERTIFY THAT THIS PLAT IS BASED ON A CURRENT FIELD SURVEY PERFORMED UNDER MY DIRECT SUPERVISION AND IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND COMPLIES WITH THE MINIMUM PROCEDURES AND STANDARDS ESTABLISHED BY THE VIRGINIA STATE BOARD OF ARCHITECTS, PROFESSIONAL ENGINEERS, LAND SURVEYORS, AND LANDSCAPE ARCHITECTS. THIS PLAT HAS BEEN PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND MAY NOT INDICATE ALL ENCUMBERANCES WHICH MAY EXIST ON THE PROPERTY.
I CERTIFY THAT THIS PLAT IS AN ACTUAL ON THE GROUND SURVEY AND THERE ARE NO EASEMENTS OR ENCROACHMENTS VISIBLE ON THE GROUND OTHER THAN SHOWN HEREON.
THIS SURVEY IS SUBJECT TO ANY AND ALL COVENANTS, CONVEYANCES, RESTRICTIONS, AND VISIBLE OR RECORDED EASEMENTS THAT MAY BE DISCLOSED BY A FULL AND ACCURATE TITLE SEARCH.
NO CEMETERY FOUND.
CALLS IN PARENTHESIS DENOTE PLAT OR DEED OF RECORD.
SOURCE OF TITLE: INST. NO. 230000138 AND 240001765
PLACE OF RECORD OF LAST INSTRUMENT IN CHAIN OF TITLE:
WASHINGTON COUNTY CIRCUIT COURT CLERKS OFFICE
SITE SOURCE FOR FLOOD ZONE DETERMINATION, I.E. FEMA FLOOD INSURANCE RATE MAP (FIRM)
REFERENCE: FEMA ZONE X
COMMUNITY PANEL ID: 51191C0170C
EFFECTIVE DATE: SEPT. 29, 2010

_____
LAND SURVEYOR

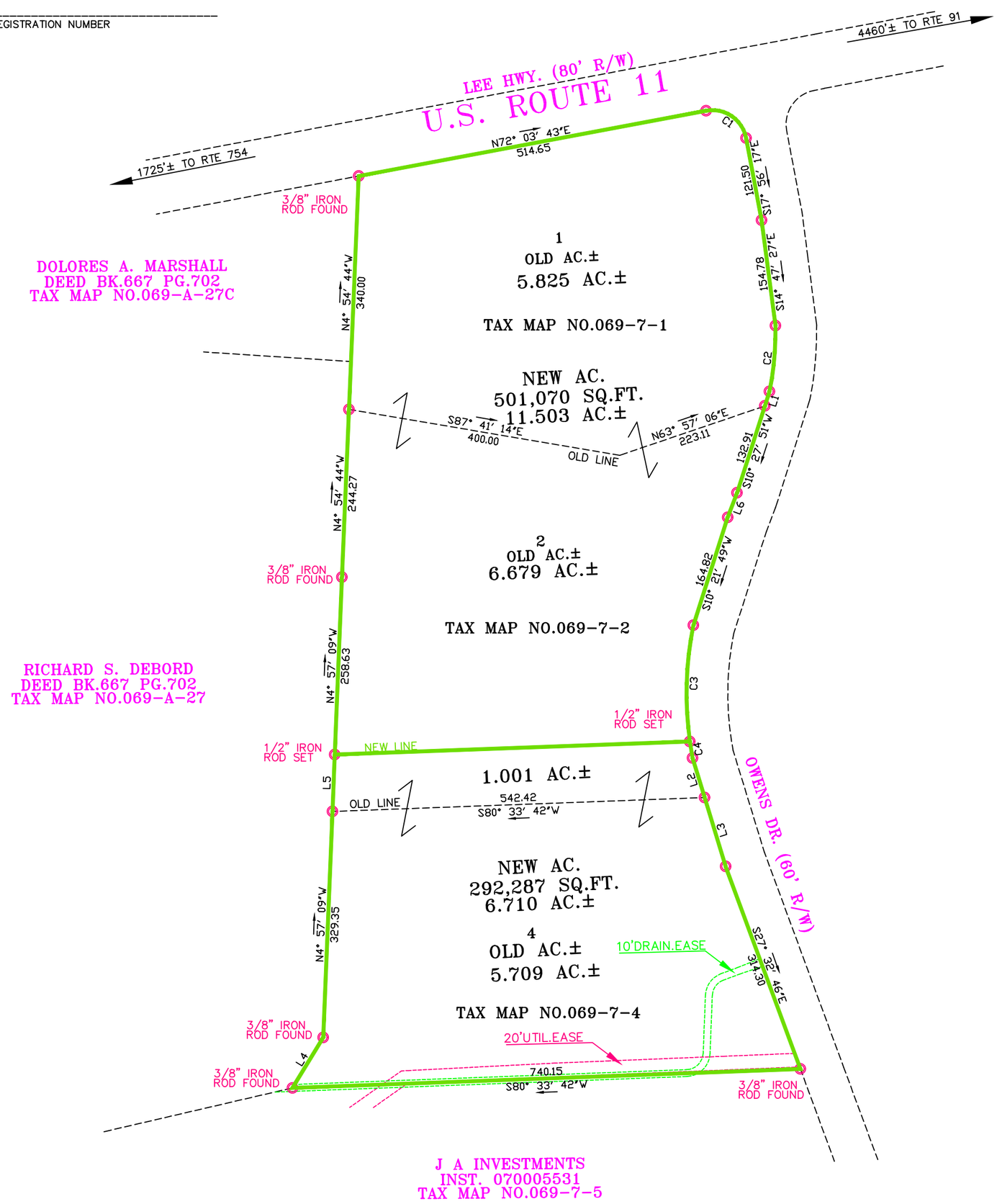
COMMONWEALTH OF VIRGINIA
L.K. ADDISON
LIC. NO. 1049
01-14-25
LAND SURVEYOR

Curve Table

Curve #	Length	Radius	Delta	CHORD	BEARING
C1	78.54	50.00	90.0000	70.71	S62° 56' 17"E
C2	96.45	447.47	12.3496	96.26	S2° 09' 48"E
C3	170.13	507.47	19.2079	169.33	S5° 35' 32"E
C4	24.36	507.47	2.7500	24.35	S16° 34' 16"E

Line Table

Line #	Length	Direction
L1	21.87	S10° 27' 51"W
L2	60.12	S24° 17' 53"E
L3	104.70	S24° 17' 53"E
L4	85.89	N24° 05' 25"E
L5	82.79	N4° 57' 09"W
L6	38.30	S13° 36' 42"W



J A INVESTMENTS
INST. 070005531
TAX MAP NO.069-7-5

ZONED: M-2
TAX MAP NO.069-7-1
TAX MAP NO.069-7-2
TAX MAP NO.069-7-4
SCALE 1" = 150'

PLAT SHOWING A BOUNDARY LINE ADJUSTMENT OF THE
PROPERTY OF COUNTY OF WASHINGTON, VIRGINIA
BEING ALL OF THAT CERTAIN LOT OR TRACT OF LAND LYING IN THE MONROE MAGISTERIAL DISTRICT OF WASHINGTON COUNTY, VA AND MORE PARTICULARLY DESIGNATED AS LOTS NO.1, 2 AND 4 OF THE GLADE-HIGHLANDS INDUSTRIAL PARK AND RECORDED IN PLAT BOOK 40 PAGE 10. DEEDS RECORDED IN INST. NO. 230000138 (LOT1) AND 240001765 (LOTS 2 AND 4).

PROPERTY ADDRESS: (VACANT) OWENS DR. GLADE SPRING, VA.

ADDISON SURVEYORS
LAND SURVEYING LAND PLANNING
CONSTRUCTION SURVEYING
432 EAST MAIN ST. ABINGDON, VA 24210
(276)676-3001 (276)676-3190 FAX
E-MAIL:robin@addisonsurveyors.com

(R13)

NO.	DATE	REVISION

DRAWN BY: RSH	DATE: 01-14-25	DRAWING NO.: ????
CHECKED BY: LKA	DATE: 01-14-25	JOB: GHIP_BLA.DWG
SHEET: 1 OF 1	BOOK NO.: 092024	FILE NO.: 00W005_25

GEOTECHNICAL STUDY

Proposed Highlands Park EMS Station
Washington County, Virginia

Prepared for:

Washington County Virginia
1 Government Center Place
Abingdon, VA 24210

Prepared by:

COMMONWEALTH OF VIRGINIA
LESLIE C. SUTHERLAND
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11/4/25
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Engineers–Architects–Planners–Environmental Specialists

November 2025

TABLE OF CONTENTS

INTRODUCTION 1

SITE DESCRIPTION 1

PROJECT DESCRIPTION 1

SUMMARY OF SUBSURFACE EXPLORATION 2

SUBSURFACE DESCRIPTION 3

DISCUSSION, OPINIONS & RECOMMENDATIONS 4

LIMITATIONS 7

APPENDICES

NOTES TO BORING LOGS
LOCATION OF BORINGS SKETCH
BORING LOGS

INTRODUCTION

We understand that construction of a proposed EMS Station is planned in Highlands Park near Glade Spring, Virginia. The proposed building will be approximately 15,000 square feet. We have completed a geotechnical study for the proposed building site. The results of the study, presented in outline and tabular form, comprise this report.

Purpose of Study: Provide geotechnical engineering advice and recommendations concerning the project.

Elements of Study: Ten borings, a site reconnaissance, and an analysis of the collected data.

SITE DESCRIPTION

Location and Topography: The proposed EMS Station will be built on Tract 4 of Highlands Park, about a mile west of Glade Spring. The site is accessed from Owens Drive, on the south side of Lee Highway (Rte. 11). The site is grass-covered and located on gentle slope that drops in elevation as you move south toward Hall Creek. Within the proposed construction area, relief is approximately 20 feet. Surface drainage is considered fair to good.

Geology: This area is in the Valley and Ridge geomorphic province which is characterized by northeast-trending folded and faulted sedimentary rocks. According to an earlier report, the site is underlain by limestones and dolomite of upper Cambrian and lower Ordivician age. The rock strata strike northeasterly and dip at angles of about 45 degrees. Irregular bedrock surfaces and rock pinnacles are common.

Numerous sinkholes (surface depressions) occur in and around the Highlands Park area. One small sinkhole was observed near the southeast corner of the proposed building area. Boring 10 was completed in the depressed area.

PROJECT DESCRIPTION

Proposed Structure

- **Type:** One-story, masonry- and/or wood-framed building with concrete slab-on-grade floor.

- **Finish Floor Elevation:** A preliminary finished-floor elevation has been set at 2076.7 feet. With the existing ground elevation within the building area ranging from about 2078 ft to 2068 ft, up to 2 ft of cut and 8 ft of fill may be required within the building area. Similar cut depths are expected for the parking areas and access road, but fill depths may increase to approximately 10 feet

- **Plan Dimensions:** The proposed structure is rectangular; in plan dimensions, the structure is approximately 215 ft x 70 ft.

- **Expected Structural Loads:** Not available, wall loads are expected to be light, around 2000 plf. No unusual loads are expected.

Source of Information: From a Proposed Site Plan, dated June 20, 2025, by The Lane Group.

SUMMARY OF SUBSURFACE EXPLORATION

Test Borings			
No. of Borings: Ten		**Range in Depth, ft:** 2.5 to 25.2	
Drilling Contractor: Total Depth Drilling		**Crew:** Donnie & Cyier	
Drill Rig		**Support Vehicles**	
CME ATV		**Water Truck**	
Truck-mounted CME Rig	x	**Front-end Loader**	
Other – Four-wheeler ATV		**Other** - 1-ton truck	x
Drill Tools			
Hollow-Stem Auger	x		
NQ2" Rock bit & barrel	x	**NW Casing**	
Type of Borings & Drilling Quantities in ft		**Type of Sampling & Sampling Details**	
Auger Probe		**Standard Penetration Test:** 5-ft intervals or less	
Soil – Intermittent Sampling	104.3	**Extra Samples:**	
Soil - Continuous Sampling		**Shelby Tube:**	
Boulders		**Bulk:**	
NQ2" Rock	5.0		
NW Casing			

A representative of our firm directed the drill crew regarding boring locations and sampling requirements. He also examined the samples as they were recovered, prepared a field log of the borings, and adjusted the drilling program to fit the conditions encountered. Soil samples were placed in glass jars for temporary storage. Boring logs and a sketch of the boring locations are in the Appendix.

Standard Penetration Test - performed by driving a split-barrel sampler (2" O.D., 1.375" I.D.) 1 ft using 140-lb hammer, 30" fall; yields N-value or blow-count in blows per foot that provides relative indication of consistency and density.

SUBSURFACE DESCRIPTION

Strata descriptions are summarized in the tables below. For details of individual strata, please refer to the boring logs in the Appendix. Where possible, the strata descriptions are arranged in descending order. With discontinuous layers, a given layer may directly overlie more than one stratum; or the opposite, more than one layer may rest on a single stratum of broad lateral extent. Topsoil depths ranged from about 6 to 8 inches where encountered.

Descriptive Table

Stratum: Tan clayey SILT with few weathered limestone fragments		
Thickness ft: 4 to 9	**N-values:** 5 to 20	**Moisture:** Moist and moist to wet
Occurrence: All borings with exception of Borings 2, 6, and 7		
Properties: Fairly uniform consistency and composition; consistency ranged from medium to very stiff, N-value average of 12 indicates stiff consistency; shear strength is judged as low to moderate; compressibility is judged low (under proposed load conditions).		

Stratum: Tan and red SILT		
Thickness ft: 5 to 16^{+}	**N-values:** 1 to 31	**Moisture:** Moist, few wet samples
Occurrence: All borings with exception of Borings 4, 5, and 10.		
Properties: Fairly uniform; N-value average of 13 calculated indicates stiff consistency; shear strength is judged as low to moderate; compressibility is judged low (under proposed load conditions).		

Stratum: Light gray LIMESTONE bedrock		
Thickness ft: Undetermined;	**N-values:** NA	**Moisture:** NA
Occurrence: 5 feet of bedrock was cored in Boring 10. The bedrock was described as light gray Limestone with calcite-healed fractures. Core recovery and Rock Quality Designation were 98 and 96 percent, respectively; both excellent. Bedrock was presumed (based on auger and/or spoon refusal) in Borings 1 through 9 at depths ranging from 2 to 18 feet below existing ground. The bedrock surface was judged as steep in several borings based on the augers or drilling rods leading off of vertical after encountering presumed bedrock.		
Properties: Hard; Rock Quality Designation was excellent; shear strength is judged high; compressibility is judged as negligible (under proposed load conditions).		

Groundwater

No groundwater was encountered in the borings. The borings were backfilled on completion of the hole or at the end of our field work.

GEOTECHNICAL OPINIONS AND RECOMMENDATIONS

Proposed Structure

Subsurface Conditions

- Below 6 to 8 inches of topsoil, the soil borings generally indicate that stiff tan and red clayey silt and silt cover the site. The silt ranges in thickness from 2 ft to about 17 feet. A few borings revealed a thin layer (1 to 2 feet) of soft to medium tan clayey silt may be encountered locally below the topsoil.

  No voids were observed in the soil.

- An irregular bedrock surface was encountered within the proposed building area. Limestone bedrock was observed on outcrop (albeit below proposed finished-floor elevation), and encountered within the borings at elevations varying from 2058 to 2072 feet.

- Limestone bedrock was cored in Boring 10. The bedrock was described as gray hard limestone with calcite-healed fractures. No voids were observed in the core.

Foundation Conditions

Opinions

- Based on our borings and the preliminary finished floor elevation of 2076.7 ft, the probable bearing strata for the building will be tan and red stiff silt, and controlled fill (described below). In our opinion, these strata are suitable to support the proposed structure.

- Up to 8 ft of fill may be required to prepare some areas of the building site.

- No groundwater was encountered in our borings.

- The on-site silt will lose strength and stability when disturbed at high soil moisture content.

Recommendations

1. Support the proposed structure on spread and/or continuous footings bearing on stiff silt and controlled fill. These strata are also considered suitable for construction of a concrete slab-on-grade floor.

2. Any soft soil encountered at subgrade elevation should be undercut and replaced with controlled fill. The area and depth of undercut should be determined during construction by a geotechnical engineer. Alternatively, footings can be lowered to stiff soil if deemed more feasible.
3. Design footings using an allowable soil pressure of 2000 psf.
4. Place footings at least 24 inches below exterior grade.
5. We recommend placement of fill on the project be constructed as controlled fill.
6. Avoid equipment traffic, to extent possible, on the silt to protect soil strength.
7. If masonry walls are used, we recommend control joints be constructed at 20 to 30 ft intervals to reduce the potential of cosmetic cracks.
8. Using the 2009 International Building Code, Table 1613.5.2, we recommend a seismic site classification of C based on our calculations.

Controlled Fill

We recommend all fill placed on the project be constructed as controlled fill. On-site materials are acceptable for use as controlled fill if placed at the proper moisture content.

Once grass and topsoil have been removed and subgrade elevation is established (for building and parking areas) in areas to receive fill, we recommend proof-rolling the area with a loaded truck (gross weight of 10 to 15 tons) or other suitable piece of equipment to disclose soft areas. Improvement of soft areas may entail shallow undercut and replacement with controlled fill. The area and depth of undercut, if any, should be determined during construction. Proof rolling should not be attempted until dry weather.

- **Recommendations**

1. Place controlled fill as outlined below:

    a. Remove any topsoil in fill area.

    b. Construct controlled fill under continuous observation and testing of engineering technician.

    c. Place soil fill in 6- to 8-in lifts and compact each lift to at least 95% of maximum density as determined by ASTM Method D 698 (Standard Proctor).

    d. Maintain proper moisture content of fill during placement as determined by technician or engineer.

    e. Construct fill during summer or late fall, if possible, to take advantage of favorable weather conditions for soil moisture control.

f. In the area of the existing sinkhole (Boring 10), we recommend exploring the subsurface (with a backhoe or trackhoe) prior to placing fill. If voids are observed, the use of geofabrics or flowable fill (low strength concrete) may be useful to stabilize the area.

General

Construction activity in areas of sinkhole development requires acceptance of risk because of inherent defects in the subsurface material. Some defects that can exist are listed below.

1. Open cavities in bedrock
2. Hidden voids in soil cover
3. Soft, saturated soils overlying bedrock
4. Rock pinnacle/irregular rock surface

This list is not complete but it illustrates the variety of problems that can occur.

The risk of problems related to these defects can never be entirely eliminated. However, awareness of the potential problems combined with prudent investigative studies make it feasible to use such property. Typically, there is a cost premium which is related to design and construction in karst terrain because of the necessary increase in degree of investigation and monitoring during construction. Obviously, a cost increase also occurs if the need for preventative or remedial work is deemed needed as a result of the investigation or problems encountered during construction. Ideally, sufficient studies are completed to the extent that design and construction can proceed at a level of acceptable risk.

During our study of the site, we found no evidence of cavities within the upper 25 ft of soil and rock. Yet the presence of sinkholes on and near the site confirms that solution channels are present in the subsurface. For the sinkholes to have developed, there must be an outlet, or throat, leading from the bottom of the sinkhole to a network of openings in the rock.

When a throat becomes blocked with sediment, rock, or other obstruction, the sinkhole becomes inactive. At this time the cone-shaped depression which has been formed becomes the depository for an accumulation of sediments. Natural sinkhole fillings tend to be a mixture of local soil and fine organic material. Artificial filling by man may consist of soil, rock, and various assortments of trash and debris. We observed no artificial fill within the sinkhole observed.

Follow Up

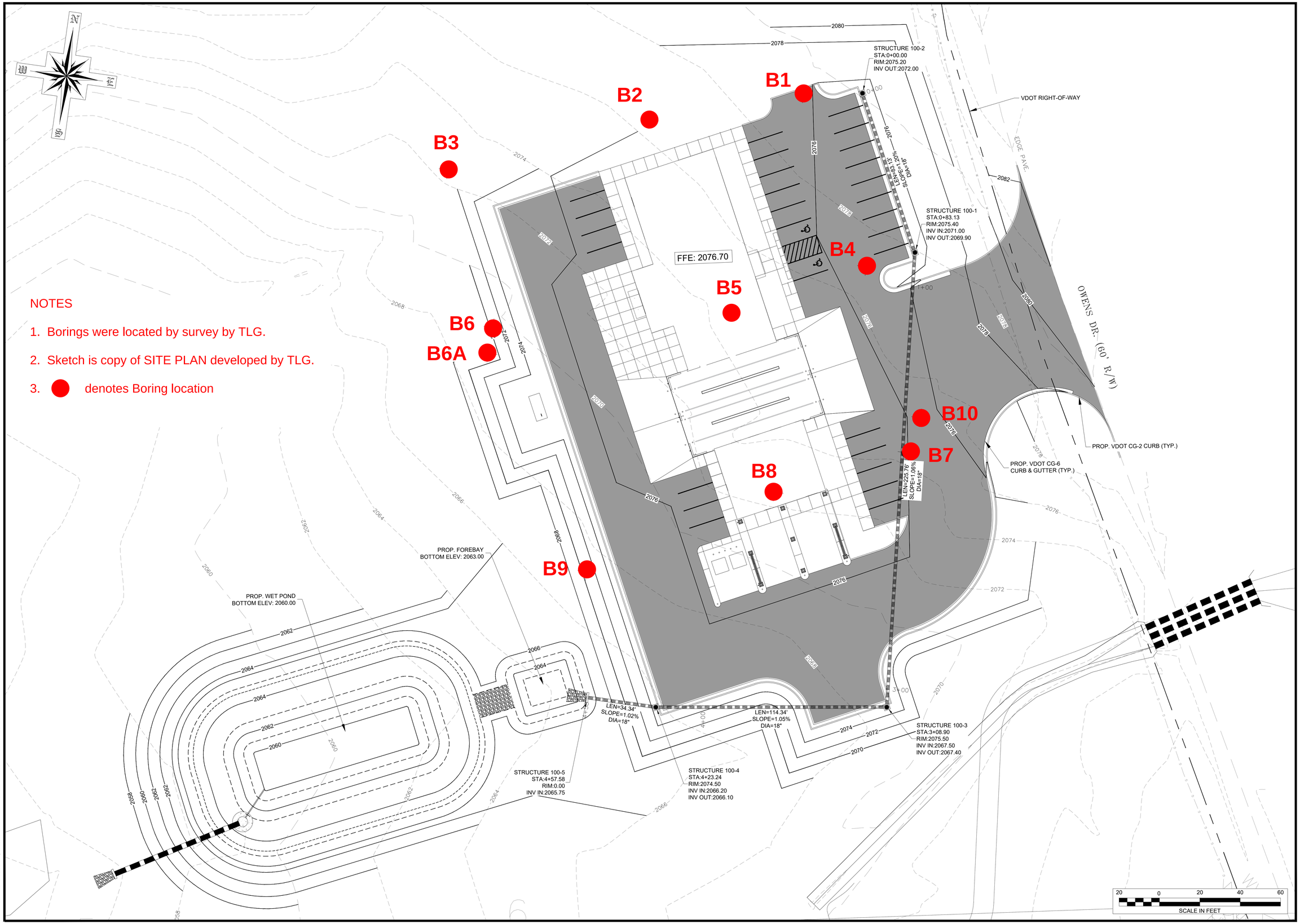
Follow-up is an important part of all geotechnical aspects of a project. If conditions are encountered during construction that are not consistent with those encountered during our field investigation, we should be notified immediately. Additionally, we should be notified immediately if surface collapse or voids are encountered in the soil or bedrock during construction.

LIMITATIONS

The analysis and recommendations submitted in this report are based on data obtained from field investigations. This report does not reflect any variations that may occur between locations of subsurface exploration. Such variations may not become apparent until construction is underway. If variations become evident, we should be notified so that immediate recommendations can be rendered.

This report has been prepared for the Washington County Board of Supervisors, to be used in foundation design and construction of the proposed EMS Station in Washington County Virginia. Anyone using this report for any purpose other than the project described herein must draw his own conclusions regarding construction procedures and soil conditions. We disclaim all responsibility and liability for any part that is removed, quoted, or reproduced separately from the entire report.

APPENDIX



NOTES

1. Borings were located by survey by TLG.
2. Sketch is copy of SITE PLAN developed by TLG.
3. ● denotes Boring location

File: F:\WASHINGTON COUNTY, VIRGINIA\EMS FACILITY GLADE SPRING\SITE DESIGN\GLADE SPRING EMS SITE DESIGN.DWG

the LANE GROUP
engineering
architecture
environmental
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Phone: 276.206.8571 | www.thelanegroupinc.com
ABINGDON | BIG STONE GAP | GALAX

NEW EMS FACILITY FOR
WASHINGTON COUNTY, VIRGINIA
HIGHLANDS BUISNESS PARK
OWENS DRIVE
GLANDE SPRING, VA 24340

LOCATION OF BORINGS
SKETCH

DATE:	06-20-2025
NO.	REVISION DATE
1	
2	
3	
SHEET:	C101
DRAWN BY: MPH	CHECKED BY: MRL
PROJECT NO.	TLG-2515

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NOTES TO BORING LOGS

These notes refer to and are a part of the accompanying boring logs.

1. The borings were made by a boring contractor under the observation of a representative of our firm. These boring logs were compiled from field logs and the results of visual examination of the soil samples.

2. The logs of the borings apply only at the specific boring locations and on the dates indicated. They are not warranted to be representative of subsurface conditions at other locations and times.

3. The depth of the indicated boundaries between soil strata is approximate. The transition between the strata may be gradual.

4. The groundwater levels shown on the boring log represent measurements made after completion of a boring. These observations do not reflect seasonal changes in the water table or the effects of intense rainfall or runoff. In any excavation, trickling flow or seepage may be encountered from perched water which is at levels above the water table observed in the borings.

5. "Decomposed rock" is residual material having a standard penetration resistance of 50 blows or more per six inches. Decomposed rock can be an extremely hard and compact mixture of soil and weathered fragments of rock which may require rock excavation methods for removal.

6. "Sound" and/or "relatively sound rock" are non-decomposed rock and rock in which weathering is largely confined to joints. Such rock may be fractured to varying degrees.

7. Soil samples recovered from the borings have been stored at The Lane Group in Abingdon, Virginia, and are available for inspection by appointment. The soil samples will be discarded two months after submission of our report unless a request is received to retain them for a longer period.

8. The locations and elevations of the borings were determined by survey. The locations and elevations of the borings should be considered accurate only to the degree implied by the method used.

LOG OF BORING 1

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2079	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
Topsoil		1-1-3	8" Topsoil, tan clayey SILT with weathered limestone fragments, medium, moist
Tan clayey SILT with few limestone fragments	5	2-6-9	Tan clayey SILT with limetone fragments, firm, moist
		2-7-8	Ditto, firm
	10		
Tan and brown SILT		2-4-4	Tan SILT, firm, moist to wet
	15	WOH-1	Brown SILT with severely weathered Limestone, wet to saturated
Boring Terminated @ 17.0'			Auger refusal @ 17.0'; augers leading off of vertical
	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	8		

NOTES:

No water encountered
WOH denotes Weight of Hammer

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl

LOG OF BORING 2

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2076	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
Topsoil		1-1-2	8" Topsoil, tan clayey SILT with weathered limestone fragments, medium, moist
Tan SILT with limestone fragments	5	4-19-12	Tan SILT with limetone fragments, firm, moist
		3-7-6	Ditto, firm
	10		
		2-4-4	Tan SILT with limestone fragments, firm, moist
	15	WOH-4	Tan SILT with severely weathered Limestone, medium wet
			Auger leading off of vertical; no sample (presumed steep bedrock surface)
Boring Terminated @ 18.0'	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	8		

NOTES:

No water encountered
WOH denotes Weight of Hammer

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl

LOG OF BORING 3

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2072	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
Topsoil		2-2-4	6" Topsoil, tan clayey SILT with weathered limestone fragments, firm, moist
Tan SILT and clayey SILT with limestone fragments	5	2-7-6	Tan SILT and clayey SILT with weathered limetone fragments, firm, moist
		3-8-9	Tan clayey SILT with limestone fragments, firm, moist
	10		
Red SILT		2-4-4	Ditto and red SILT, firm, moist
		3-9-9	Red SILT and severely weathered limestone, wet
	15		Auger refusal, spoon leading off vertical
Boring Terminated @ 14.5'			(presumed steep bedrock surface)
	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	7		

NOTES:

No water encountered

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl

LOG OF BORING 4

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2076.5	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
Topsoil		2-2-3	8" Topsoil, tan SILT with weathered limestone fragments, firm, moist
Tan clayey SILT and SILT	5	2-14-6	Tan clayey SILT with weathered limetone fragments, firm, moist
		2-4-5	Ditto and tan SILT
	10	25/0.2'	Ditto and red SILT, firm, moist
Boring Terminated @ 9.2'	15		
	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	6		

NOTES:

No water encountered

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl

LOG OF BORING 5

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2074	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
~~Topsoil~~		1-1-2	6" Topsoil, tan SILT with weathered limestone fragments, medium, moist to wet
Tan clayey SILT and SILT	5	2-5-6	Tan clayey SILT, firm, moist
		2-5-5	Tan clayey SILT, firm, moist
	10	2-2-3	Ditto, auger refusal @10.5' Spoon leading off of vertical, (presumed steep bedrock surface)
Boring Terminated @ 10.5'	15		
	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	5		

NOTES:

No water encountered

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl

LOG OF BORING 6

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2070	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
~~Topsoil~~		1-1-2	6" Topsoil, tan SILT with weathered limestone fragments, medium, moist to wet
Tan SILT			
		12	Tan SILT and limestone fragments, wet
Boring Terminated @ 4.0'	5		Auger Refusal @ 4'
	10		
	15		
	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	5		

NOTES:

No water encountered

Boring 6A was offset 10' away; Auger refusal @ 3.5' (no log of B6A)
Limestone outcrop observed 25' west of B6

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl

LOG OF BORING 7

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2074	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
~~Topsoil~~		2-2-3	6" Topsoil, and tan SILT, firm, moist
Tan SILT			
Boring Terminated @ 2.0'			
	5		
	10		
	15		
	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	3		

NOTES:

No water encountered

Boring 7A was offset 10' south of Boring 7; Auger refusal at 2.0' (no log of B7A)

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl

LOG OF BORING 8

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2072	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
Topsoil		1-1-3	6" Topsoil, and tan SILT, medium, moist to wet
Tan clayey SILT	5	2-6-8	Tan clayey SILT, firm, moist
		3-7-10	Ditto, firm
	10	9-25	Tan clayey SILT, firm, moist
Boring Terminated @ 10.0'			spoon refusal
	15		
	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	2		

NOTES:

No water encountered

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl

LOG OF BORING 9

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2067	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
Topsoil		1-2-3	6" Topsoil, and tan SILT, medium, moist to wet
Tan clayey SILT			
	5	3-6-7	Tan and red clayey SILT, firm, moist
Tan SILT		3-6-6	Ditto, and tan SILT, firm, moist to wet
	10	25	Tan SILT, wet and severely weathered Limestone
Boring Terminated @ 9.5'			spoon leading off of vertical, (presumed steep bedrock surface)
	15		
	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	2		

NOTES:

No water encountered

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl

LOG OF BORING 10

Project: Washington County - Proposed Highlands Park EMS Station		**Location:** Washington County, VA	
Type of Boring: Soil Boring - Rock Coring		**Drilling Contractor:** Total Depth Drilling	
Elevation, ft: ~2075	**Date Started:** 4/4/25	**Date Completed:** 4/4/25	**Weather:** Partly Cloudy

Stratum Description	Depth, ft	BLOWS* / REC./RQD**	Sample Description
	0		
Topsoil		3-4-4	6" Topsoil, tan clayey SILT, firm, moist
Tan clayey SILT			
		3-20	Tan silt with some weathered dolomite fragments, firm, moist
	5		
Light gray Limestone		98/96	Light gray LIMESTONE, hard with calcite-healed fractures
	10		
Boring Terminated @ 9.1'			
	15		
	20		
	25		
	30		
	35		

Groundwater Data

Depth, ft	Time, hr	Depth, ft	Time, hr
Dry	0		
Dry	2		

NOTES:

* No. of Blows Required to Drive 2" O.D., 1.375" I.D., Sampler 6" Using 140-lb Hammer, 30" Fall
** Core Recovery as Percent of Length of Drill Run. RQD is Rock Quality Designation
See NOTES TO BORING LOG which are a part of this log.

CWT-1.exl