DIVISION 3

CONCRETE

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PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formwork for cast-in place concrete.
2. Shoring, bracing, and anchorage.
3. Architectural form liners.
4. Form accessories.
5. Form stripping.

B. Related Sections:
1. Section 03200 - Concrete Reinforcement.
2. Section 03300 - Cast-in-Place Concrete.
3. Section 04810 - Unit Masonry Assemblies: Product requirements for masonry accessories for placement by this Section.
4. Section 05500 - Metal Fabrications: Product requirements for metal fabrications for placement by this Section.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
1. AF&PA - National Design Specifications for Wood Construction.

C. American Society of Mechanical Engineers:
1. ASME A17.1 - Safety Code for Elevators and Escalators.

D. ASTM International:
1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 PERFORMANCE REQUIREMENTS

A. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96, Procedure A.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Submit formwork, shoring, and reshoring shop drawings.
   2. Indicate the following:
      a. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
      b. Means of leakage prevention for concrete exposed to view in finished construction.
      c. Sequence and timing of erection and stripping assumed compressive strength at time of stripping, height of lift and height of drop during placement.
      d. Vertical, horizontal and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.
      e. Notes to formwork erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.
      f. Procedure and schedule for removal of shores and installation and removal of reshores.

C. Product Data: Submit data on void form materials and installation requirements.

D. Design Data:
   1. Indicate design data for formwork, shoring, and reshores.
   2. Indicate loads transferred to structure during process of concreting, shoring and reshoring.
   3. Include structural calculations to support design.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347, ACI 301, ACI 318.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Perform Work in accordance with State of Maryland and City of Frederick Public Work's standard.

1.7 QUALIFICATIONS

A. Design formwork under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Maryland.

1.8 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

B. Lumber Forms:
1. Application: Use for edge forms and unexposed finish concrete.
2. Boards: 6 inches or 8 inches in width, shiplapped or tongue and groove, “Standard” Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.

C. Plywood Forms:
1. Application: Use for exposed finish concrete.
2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch thick; APA/EWA “B-B Plyform Structural I Exterior” grade.
4. Plywood where “Smooth Finish” is required, as indicated on Drawings: APA/EWA “HD Overlay Plyform Structural I Exterior” grade, minimum of 3/4 inch thick.

2.2 PREFABRICATED FORMS

A. Manufacturers: Use Manufacturer with a minimum 5 years of experience.
1. Aluma-Systems Inc., Burke Co.
2. Economy Forms Corp.
3. Molded Fiber Glass Concrete Forms Co.
4. Perma Tubes
5. Sonoco Products Co.
6. Symons Corp.
7. Western Forms, Inc.
8. Substitutions: Section 01600 - Product Requirements.

B. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Pan Type: Steel of size and profile required.

E. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, sizes as indicated on Drawings.

F. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.

G. Form Liners: Smooth, durable, grainless and non-staining hardboard, unless otherwise indicated on Drawings.

H. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch back break dimension, free of defects capable of leaving holes larger than 1-1/4 inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
1. Manufacturers:
a. Arcal Chemical Corporation Arcal-80.
b. Industrial Synthetics Company Synthex.
c. Nox-Crete Company Nox-Crete Form Coating.
d. Substitutions: Section 01600 - Product Requirements.

E. Corners: Chamfer, wood strip type; 1 x 1 inch size; maximum possible lengths.

F. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, non-filled, release tape sealed slots, anchors for securing to concrete formwork.

G. Flashing Reglets: Galvanized steel 22 gage thick, longest possible lengths, with alignment splines for joints, non-filled, release tape sealed slots, anchors for securing to concrete formwork.

H. Vapor Retarder: Where indicated on Drawings, 8 mil thick polyethylene sheet.

I. Bituminous Joint Filler: ASTM D1751.

J. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

K. Water Stops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 1/2 inch wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

2.4 COATINGS

A. Coatings for Aluminum: Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate. Apply one coat primer and one coat finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

A. Earth Forms:
1. Trench earth forms neatly, accurately, and at least 2 inches wider than footing widths indicated on Drawings.
2. Trim sides and bottom of earth forms.
3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
4. Form sides of footings where earth sloughs.
5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

B. Formwork - General:
1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:
1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.

8. Keep wood forms wet until stripped.

D. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

E. Framing, Studding and Bracing:
1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

F. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

H. Obtain Architect/Engineer’s approval before framing openings in structural members not indicated on Drawings.

I. Install fillet and chamfer strips on external corners of beams, joists, and columns.

J. Do not reuse wood formwork more than two times for concrete surfaces to be exposed to view. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat forms for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Position recessed reglets for brick veneer masonry anchors in accordance with spacing and intervals specified in Section 04810.

E. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.

G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

I. Form Ties:
1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least 1 inch away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

J. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

K. Construction Joints:
1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true and sharp.

L. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

M. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.

3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

N. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

O. Screed Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not permitted.

P. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Architect/Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.8 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

3.9 SCHEDULES

A. Foundation Walls Not Exposed To View: Site fabricated plywood coated with form oil.

B. Foundation Walls Exposed To View: Smooth steel fan coated with form oil.

C. Supported Floor Slabs: Prefabricated glass fiber pan forms, treated for exposed to view finish.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Sections:
1. Section 03100 - Concrete Forms and Accessories.
2. Section 03300 - Cast-in-Place Concrete.
3. Section 03346 - Concrete Floor Finishing.
4. Section 16060 - Grounding and Bonding for Electrical Systems: Grounding concrete reinforcement.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 530.1 - Specifications for Masonry Structures.
4. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
4. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
5. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
6. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
7. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
8. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
9. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
10. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
11. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
12. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
13. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

C. American Welding Society:
1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
   1. CRSI - Manual of Standard Practice.
   2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate bar sizes, spacing's, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
   1. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI - Manual of Standard Practice and ACI 301.

B. Prepare shop drawings in accordance with ACI SP-66.

C. Perform Work in accordance with State of Maryland and City of Frederick standards.

1.5 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Deformed Reinforcement: ASTM A615/A615M; 60 ksi yield strength, steel bars, unfinished.

B. Plain Wire: ASTM A82; unfinished.

C. Welded Plain Wire Fabric: ASTM A185; in flat sheets; unfinished or galvanized finish as detailed.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel type; size and shape to meet Project conditions.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with ACI 318.

B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8 inch diameter continuous plain bar or wire.

F. Form ties and stirrups from the following:
1. All bars: No. 4 deformed bars.

G. Weld reinforcement in accordance with AWS D1.4.

H. Galvanized Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI.

I. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Architect/Engineer.

2.4 SOURCE QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing, inspection and analysis requirements.

B. Make completed reinforcement available for inspection at manufacturer’s factory prior to packaging for shipment. Notify Architect/Engineer at least seven days before inspection is allowed.

C. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
1. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318.
1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.

E. Maintain concrete cover around reinforcement as follows:

Footings and Concrete Formed Against Earth		3 inches
Concrete exposed to earth or weather	No. 6 bars and larger	2 inches
	No. 5 bars and smaller	1-1/2 inches
Supported Slabs, Walls, and Joists	No. 14 bars and larger	1-1/2 inches
	No. 11 bars and smaller	3/4 inches
Beams and Columns		1-1/2 inches

F. Splice reinforcing in accordance with splicing device manufacturer's instructions.

G. Bond and ground reinforcement in accordance with requirements of Section 16060.

3.2 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Depth	Depth Tolerance	Concrete Cover Tolerance
Greater than 8 inches	plus or minus 3/8 inch	minus 3/8 inch
Less than 8 inches	plus or minus 1/2 inch	minus 1/2 inch

C. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.3 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements Field inspecting, testing, adjusting, and balancing.

B. Field inspection and testing will be performed by testing laboratory in accordance with ACI 318 code.

C. Provide free access to Work and cooperate with appointed firm.

D. Reinforcement Inspection:
1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
2. Welding: Inspect welds in accordance with AWS D1.1.
3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
5. Periodic Weld Inspection: Other welded connections.

3.4 SCHEDULES

A. Reinforcement for Superstructure Framing Members: Deformed bars, unfinished.

B. Reinforcement for Foundation Wall Framing Members and Slab-on-Grade: Deformed bars and wire fabric, unfinished.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete for the following:
   1. Elevator pit walls.
   2. Foundation walls and footings.
   3. Supported slabs.
   4. Slabs on grade.
   5. Control, expansion and contraction joint devices.
   6. Equipment pads.
   7. Light pole base.
   8. Flagpole base.
   9. Thrust blocks.
   10. Manholes.

B. Related Sections:
   1. Section 02320 - Backfill.
   2. Section 03100 - Concrete Forms and Accessories.
   3. Section 03200 - Concrete Reinforcement.
   4. Section 03346 - Concrete Floor Finishing.
   5. Section 03370 - Concrete Curing.
   6. Section 07115 - Rubberized Asphalt Sheet Waterproofing.
   7. Section 07900 - Joint Sealers.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 305 - Hot Weather Concreting.
   3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
   4. ACI 308.1 - Standard Specification for Curing Concrete.
   5. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. ASTM C33 - Standard Specification for Concrete Aggregates.
   3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   4. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   6. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
   7. ASTM C150 - Standard Specification for Portland Cement.
   8. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
   9. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
   10. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   11. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

12. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
13. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
14. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
15. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
16. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
17. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
18. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
19. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
20. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
21. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
22. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
23. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
24. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
25. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
26. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
27. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
28. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
29. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 PERFORMANCE REQUIREMENTS

A. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96, Procedure A.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on joint devices, attachment accessories, and admixtures

C. Design Data:
1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
   a. Hot and cold weather concrete work.
   b. Air entrained concrete work.
2. Identify mix ingredients and proportions, including admixtures.
3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

D. Samples: Submit two 6 inch long samples of expansion/contraction joint and control joint.

E. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Conform to ACI 305 when concreting during hot weather.

C. Conform to ACI 306.1 when concreting during cold weather.

D. Acquire cement and aggregate from one source for Work.

1.7 QUALIFICATIONS

A. Perform Work in accordance with State of Maryland and City of Hagerstown standards.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

B. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

1.9 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I – Normal Portland type; manufactured by St. Lawrence Cement or Lehigh cement Co.

B. Normal Weight Aggregates: ASTM C33.

C. Water: ACI 318; potable, without deleterious amounts of chloride ions.

2.2 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical: ASTM C494/C494M Type A - Water Reducing, Type B – Retarding, Type C – Accelerating, Type D - Water Reducing and Retarding, Type E - Water Reducing and Accelerating, Type F - Water Reducing, High Range, Type G - Water Reducing, High Range and Retarding.

C. Fly Ash: ASTM C618.

D. Silica Fume: ASTM C1240.

E. Slag: ASTM C989; Grade 100; ground granulated blast furnace slag.

F. Plasticizing: ASTM C1017/C1017M Type I, plasticizing; Type II, plasticizing and retarding.

2.3 ACCESSORIES

A. Bonding Agent: Two component modified epoxy resin.

B. Vapor Barrier: ASTM E1745 Class A; 8 mil reinforced thick clear polyethylene film; type recommended for below grade application. Furnish joint tape recommended by manufacturer. (Provide 8 mil in lieu of geo-tech report 6 mil).

C. Non-Shrink Grout: ASTM C1107, Grade A; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type C: ASTM D1752; Premolded sponge rubber fully compressible with recovery rate of minimum 95 percent.

B. Construction Joint Devices: Integral galvanized steel; 1/8 inch thick, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.

C. Sealant and Primer: type, as specified in Section 07900.

2.5 CONCRETE MIX

A. Select proportions for normal weight concrete in accordance with ACI 301 Method 2.

B. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Architect/Engineer.
   1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
   2. Do not use calcium chloride or admixtures containing calcium chloride.
   3. Use set retarding admixtures during hot weather.
   4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing or deicing chemicals.
   5. For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fume, and slag content as required by applicable code.

C. Average Compressive Strength Reduction: Permitted in accordance with ACI 318.

D. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94/C94M.

E. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 301 & ACI 318.

B. Notify testing laboratory and Architect/Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.

D. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6 inches and seal watertight by taping edges and ends.

E. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

F. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.

G. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

H. Extend joint filler from bottom of slab to within ½ inch of finished slab surface. Conform to Section 07900 for finish joint sealer requirements.

I. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

J. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.

K. Install joint covers in longest practical length, when adjacent construction activity is complete.

L. Apply sealants in joint devices in accordance with Section 07900.

M. Deposit concrete at final position. Prevent segregation of mix.

N. Place concrete in continuous operation for each panel or section determined by predetermined joints.

O. Consolidate concrete.

P. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

Q. Place concrete continuously between predetermined expansion, control, and construction joints.

R. Do not interrupt successive placement; do not permit cold joints to occur.

S. Place floor slabs in saw cut pattern indicated or submit alternate plan for approval.

T. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4depth of slab thickness.

U. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

3.4 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing and other items to be cast in.

C. Apply bonding agent to substrate.

D. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels, dimension not to exceed 20 ft.

E. Screed toppings level, maintaining surface flatness of maximum 1/8 inch in 10 ft.

3.5 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed, concrete walls with smooth rubbed architectural finish.

B. Finish concrete floor surfaces in accordance with ACI 301.

C. Wood float surfaces receiving quarry tile, ceramic tile, terrazzo with full bed setting system.

D. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set quarry tile and thin set ceramic tile.

E. Steel trowel surfaces which are indicated to be exposed.

F. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 inch per foot nominal or as indicated on drawings.

3.6 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
   1. Protect concrete footings from freezing for minimum 5 days.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 301.

D. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.7 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Field inspection and testing will be performed by testing laboratory in accordance with ACI 318.

C. Provide free access to Work and cooperate with appointed firm.

D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.

E. Concrete Inspections:
   1. Continuous Placement Inspection: Inspect for proper installation procedures.
   2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

F. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, field cured.
   3. Sample concrete and make one set of three cylinders for every 50 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls.
   4. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
   5. Make one additional cylinder during cold weather concreting, and field cure.

G. Field Testing:
   1. Slump Test Method: ASTM C143/C143M.
   2. Air Content Test Method: ASTM C173/C173M.
   3. Temperature Test Method: ASTM C1064/C1064M.
   4. Measure slump and temperature for each truck; pad delivered to the site.
   5. Measure air content in air entrained concrete for each compressive strength concrete sample.

H. Cylinder Compressive Strength Testing:
   1. Test Method: ASTM C39.
   2. Test Acceptance: In accordance with ACI 318.
   3. Test one cylinder at 7 days.
   4. Test one cylinder at 28 days.
   5. Retain one cylinder for testing when requested by Architect/Engineer or Owner.
   6. Dispose remaining cylinders when testing is not required.

I. Core Compressive Strength Testing:
   1. Sampling and Testing Procedures: ASTM C42/C42M.
   2. Test Acceptance: In accordance with ACI 318 code.
   3. Drill three cores for each failed strength test from concrete represented by failed strength test.

J. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.8 PATCHING

A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

C. Patch imperfections as directed by Architect/Engineer in accordance with ACI 301.

3.9 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Architect/Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

3.10 SCHEDULE - CONCRETE TYPES AND FINISHES

A. Foundation Walls and Footings: 3,000 psi 28 day concrete, form finish with honeycomb filled surface.

B. Slabs on Grade: 4,000 psi 28 day concrete, finish per Article 3.5.

3.11 SCHEDULE - JOINT FILLERS

A. Floor Slab Perimeter: Joint filler Type A set 1/8 inch below floor slab elevation.

B. Exterior Retaining Wall at Loading Dock: Joint filler Type F recessed 3/8 inch with sealant cover.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finishing slabs on grade.

B. Surface treatment with concrete hardener and sealer (new and existing).

1.2 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Prepared concrete slabs and toppings ready to receive finish.

B. Section 03300 - Cast-in-Place Concrete: Control and formed expansion and contraction joints and joint devices.

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Product Data: Provide data on finishing compounds, product characteristics, compatibility and limitations.

C. Manufacturer's Installation Instructions: Indicate criteria for preparation and application for both new and existing slabs.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products under provisions of Section 01600.

B. Deliver materials in manufacturer's packaging including application instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sonneborn

B. Master Builders.

C. Thoroseal.

D. Substitutions: Under provisions of Section 01600.

2.2 COMPOUNDS - HARDENERS AND SEALERS

A. Chemical Hardener: Sonneborn – Lapidolith (new slab).

B. Chemical Hardener, Sealer: Sonneborn – Jure-N-Harden (existing slab).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01300.

B. Verify that floor surfaces are acceptable to receive the Work of this Section.

3.2 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301.

B. Wood float surfaces which will receive quarry tile, ceramic tile, with full bed setting system.

C. Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring thin set quarry tile thin set ceramic tile.

D. Steel trowel surfaces which are scheduled to be exposed.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 inch per foot nominal or as indicated on Drawings.

3.3 FLOOR SURFACE TREATMENT

A. Apply liquid hardener/sealer in accordance with manufacturer's instructions on scheduled floor surfaces.

B. Finish to a polished sheen.

3.4 TOLERANCES

A. Maximum Variation of Surface Flatness For Exposed Concrete Floors: 1/8 inch in 10 ft.

B. Maximum Variation of Surface Flatness Under Seamless Resilient Flooring: 1/8 inch in 10 ft.

C. Maximum Variation of Surface Flatness Under Carpeting: 1/8 inch in 10 ft.

3.5 SCHEDULES

A. All exposed new concrete: Liquid hardener/sealer. Three coat system.
   1. First Coat: Dilute 1 Part Lapidolth to 4 parts water.
      Apply at 200 to 300 sf per gallon.

   2. Second Coat: Dilute 1 part Lapidolth to 3 parts water.
      Apply at 200 to 300 sf per gallon

   3. Third Coat: Dilute 1 part Lapidolth to 3 parts water.
      Apply at 200 to 300 sf per gallon

      a. As third coat is drying and a uniform appearance of white crystals are visible, flood the floor with water and buff with a commercial floor buffer using a 3M Black Pad or similar abrasive. Continue buffing until the floor acquires a patina or polish and the whiteness is gone.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Initial curing of horizontal and vertical concrete surfaces.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete.

B. Section 03346 - Concrete Floor Finishing. - for exposed concrete slabs.

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 302 - Recommended Practice for Concrete Floor and Slab Construction.

C. ACI 308 - Standard Practice for Curing Concrete.

D. ASTM C171 - Sheet Materials for Curing Concrete.

E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

F. ASTM D2103 - Polyethylene Film and Sheeting.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Product Data: Provide data on curing compounds, product characteristics, compatibility and limitations.

C. Manufacturer's Installation Instructions: Indicate criteria for preparation and application.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain one copy of document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products under provisions of Section 01600.

B. Deliver curing materials in manufacturer's packaging including application instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sonneborn

B. Master Builders

C. Thoroseal.

D. Substitutions: Under provisions of Section 01600.

2.2 MATERIALS

A. Membrane Curing Compound: ASTM C309 Type 1-D Class A or B, Acrylic type, clear without fugitive dye; equal to Kure-N-Seal WB as manufactured by Sonneborn.

B. Water: Potable and not detrimental to concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate conditions under provisions of Section 01300.

B. Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION - HORIZONTAL SURFACES

A. Cure floor surfaces in accordance with ACI 308.

B. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions as follows:
1. First coat applied at rate of 200 to 400 sf/gallon.

C. Polyethylene Film: Spread polyethelene film over floor slab areas, lapping edges and sides and sealing with pressure sensitive tape; cover with plywood; maintain in place for 7 days.

3.3 EXECUTION - VERTICAL SURFACES

A. Cure surfaces in accordance with ACI 308.

B. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions for curing purposes.

C. Exposed concrete shall be cured and finished in accordance with Section 03346.

3.4 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500.

B. Do not permit traffic over unprotected floor surface.

END OF SECTION