Project Title: Pedestrian Overpass at University Metrorail Station
MDT No.: CIP 010-CTI-TR12
MDT RPQ No.: 265910-R
Submitter: Dry Run Permit
Date: August 29, 2014
Prepared By: H.J. Ross
Submitted To: Miami-Dade Transit

Seal & Signature

Roberto Sequeira, A.I.A.
State of Florida Registration No. AR 0009035

Date: 9.22.2014

for Specifications: 02284, 03348, 04100, 04851, 05500, 06100, 07415, 07540, 07840, 07900, 08110, 08800, 08900, 09220, 09310, 09900 and 10999

Sequeira & Gavarrete Architecture, Planning, Interior Design
7650 Corporate Center Drive, Suite 300
Miami, Florida 33126

State of Florida
Board of Architecture and Interior Design
Certification of Authorization Number: 5176
Expiration: 28 February 2015
Project Title: Pedestrian Overpass at University Metrorail Station
MDT No.: CIP 010-CTI-TR12
MDT RPQ No.: 265910-R
Submit: Dry Run Permit
Date: August 29, 2014
Prepared By: H.J. Ross
Submitted To: Miami-Dade Transit

Seal & Signature

Date: 8/29/2014

for Specifications: 020500, 024113, 311000, 311316, 312000, 321216, 321313, 321317, 321723, 331100, and 3340000

Nifah & Partners Consulting Engineers, Inc.
8785 SW 165 Avenue, Suite 108
Miami, Florida 33193

State of Florida
Board of Professional Engineers
Certificate of Authorization Number: 7302
Expiration: 28 February 2015
Project Title: Pedestrian Overpass at University Metrorail Station

MDT No.: CIP 010-CTI-TR12
MDT RPO No.: 265910-R
Submittal: Dry Run Permit
Date: December 4, 2014
Prepared By: H.J. Ross
Submitted To: Miami-Dade Transit

Seal & Signature

Kathy Herrera, P.E.
State of Florida P.E. No. 63068

Date: 12/5/14
for Specifications: 031000, 032000, 033000, 033120, 042200, 042300, 051000, 095000, 310000, 312335 and 313100

New Millennium Design Consultants, Inc.
4868 SW 72 Avenue
Miami, Florida 33155

State of Florida
Board of Professional Engineers
Certificate of Authorization Number: 27017
Expiration: 28 February 2015
Project Title: Pedestrian Overpass at University Metrorail Station
MDT No.: CIP 010-CTI-TR12
MDT RPQ No.: 265910-R
Submital: Dry Run Permit
Date: August 29, 2014
Prepared By: H.J. Ross
Submitted To: Miami-Dade Transit

Seal & Signature

Gino A. Valderrama, P.E.
State of Florida P.E. No. 58792

Date: 8/29/14
for Specifications: 221423, 233416, and 238126

201 Alhambra Circle
Miami, Florida 33134

State of Florida
Board of Professional Engineers
Certificate of Authorization Number: 407
Expiration: 28 February 2015

Page iv of ix
Project Title: Pedestrian Overpass at University Metrorail Station
MDT No.: CIP 010-CTI-TR12
MDT RPD No.: 265910-R
Submittal: Dry Run Permit
Date: August 29, 2014
Prepared By: H.J. Ross
Submitted To: Miami-Dade Transit

Seal & Signature

Date: 8/29/14
for Specifications: 142100
201 Alhambra Circle
Miami, Florida 33134

State of Florida
Board of Professional Engineers
Certificate of Authorization Number: 407
Expiration: 28 February 2015
# VOLUME II – TECHNICAL SPECIFICATIONS

## DIVISION 02 – EXISTING CONDITIONS

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02284</td>
<td>SOIL TREATMENT</td>
</tr>
<tr>
<td>020500</td>
<td>MOBILIZATION, SITE PREPARATION AND DEMOBILIZATION</td>
</tr>
<tr>
<td>024113</td>
<td>SELECTIVE DEMOLITION</td>
</tr>
</tbody>
</table>

## DIVISION 03 - CONCRETE

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03348</td>
<td>CONCRETE SEALER</td>
</tr>
<tr>
<td>031000</td>
<td>CONCRETE FORMWORK</td>
</tr>
<tr>
<td>032000</td>
<td>CONCRETE REINFORCEMENT</td>
</tr>
<tr>
<td>033000</td>
<td>CAST-IN-PLACE CONCRETE</td>
</tr>
<tr>
<td>033120</td>
<td>CONCRETE TESTING</td>
</tr>
</tbody>
</table>

## DIVISION 04 - MASONRY

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>04100</td>
<td>GROUT</td>
</tr>
<tr>
<td>04851</td>
<td>LIMESTONE VENEER</td>
</tr>
<tr>
<td>042200</td>
<td>CONCRETE UNIT MASONRY</td>
</tr>
<tr>
<td>042300</td>
<td>REINFORCED UNIT MASONRY</td>
</tr>
</tbody>
</table>

## DIVISION 05 - METALS

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>05500</td>
<td>METAL FABRICATIONS</td>
</tr>
<tr>
<td>051000</td>
<td>METAL FRAMING</td>
</tr>
</tbody>
</table>

## DIVISION 06 – WOOD AND PLASTICS

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>06100</td>
<td>ROUGH CARPENTRY</td>
</tr>
</tbody>
</table>

## DIVISION 07 – THERMAL AND MOISTURE PROTECTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>07415</td>
<td>STANDING SEAM METAL ROOFINGS</td>
</tr>
<tr>
<td>07540</td>
<td>THERMOPLASTIC POLYOLEFIN SINGLE PLY MEMBRANE ROOFING</td>
</tr>
<tr>
<td>07840</td>
<td>THROUGH-PENETRATION FIRESTOP SYSTEMS</td>
</tr>
<tr>
<td>07900</td>
<td>SEALANTS</td>
</tr>
</tbody>
</table>

## DIVISION 08 - OPENINGS

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08110</td>
<td>METAL DOORS AND FRAMES</td>
</tr>
<tr>
<td>08800</td>
<td>GLAZING</td>
</tr>
<tr>
<td>08900</td>
<td>GLAZED CURTAIN WALL</td>
</tr>
</tbody>
</table>
### TECHNICAL SPECIFICATIONS INDEX

**Project Title:** Pedestrian Overpass at University Metrorail Station  
**MDT No.:** CIP 010-CTI-TR12  
**MDT RPQ No.:** 265910-R  
**Submittal:** Dry Run Permit  
**Date:** August 29, 2014 (* Spec Added: December 12, 2014)  
**Prepared By:** H.J. Ross  
**Submitted To:** Miami-Dade Transit

---

#### DIVISION 09 - FINISHES

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>09220</td>
<td>EXTERIOR PORTLAND CEMENT PLASTER (STUCCO)</td>
</tr>
<tr>
<td>09310</td>
<td>TILE</td>
</tr>
<tr>
<td>095000*</td>
<td>METAL STUDS, METAL LATH, SUSPENSION CEILINGS, PLASTER, AND STUCCO</td>
</tr>
<tr>
<td>09900</td>
<td>PAINTING</td>
</tr>
</tbody>
</table>

#### DIVISION 10 – SPECIALTIES

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10999</td>
<td>MISCELLANEOUS SPECIALTIES</td>
</tr>
</tbody>
</table>

#### DIVISION 14 – CONVEYING EQUIPMENT

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>142100</td>
<td>ELECTRIC TRACTION ELEVATORS</td>
</tr>
</tbody>
</table>

#### DIVISION 22 - PLUMBING

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>221423</td>
<td>STORM DRAINAGE PIPING SPECIALTIES</td>
</tr>
</tbody>
</table>

#### DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>233416</td>
<td>CENTRIFUGAL HVAC FANS</td>
</tr>
<tr>
<td>238126</td>
<td>SPLIT-SYSTEM AIR-CONDITIONERS</td>
</tr>
</tbody>
</table>

#### DIVISION 26 - ELECTRICAL

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>260519</td>
<td>LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES</td>
</tr>
<tr>
<td>260526</td>
<td>GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>260533</td>
<td>RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>260544</td>
<td>SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLEING</td>
</tr>
<tr>
<td>262416</td>
<td>PANELBOARDS</td>
</tr>
<tr>
<td>262726</td>
<td>WIRING DEVICES</td>
</tr>
<tr>
<td>262813</td>
<td>FUSES</td>
</tr>
<tr>
<td>265100</td>
<td>INTERIOR LIGHTING</td>
</tr>
</tbody>
</table>

#### DIVISION 28 – ELECTRICAL SAFETY AND SECURITY

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>282300</td>
<td>VIDEO SURVEILLANCE</td>
</tr>
</tbody>
</table>

---

Page viii of ix
DIVISION 31 - EARTHWORK

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>310000</td>
<td>EARTHWORK</td>
</tr>
<tr>
<td>311000</td>
<td>SITE CLEARING</td>
</tr>
<tr>
<td>311316</td>
<td>SELECTIVE TREE AND SHRUB TRIMMING</td>
</tr>
<tr>
<td>312000</td>
<td>EARTH MOVING</td>
</tr>
<tr>
<td>312335*</td>
<td>EXCAVATING, BACKFILLING, AND COMPACTION FOR UTILITIES</td>
</tr>
<tr>
<td>313100*</td>
<td>SOIL TREATMENT</td>
</tr>
</tbody>
</table>

DIVISION 32 – EXTERIOR IMPROVEMENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>321216</td>
<td>ASPHALT PAVING</td>
</tr>
<tr>
<td>321313</td>
<td>CONCRETE PAVING</td>
</tr>
<tr>
<td>321317</td>
<td>CONCRETE PAVEMENT JOINT SEALANTS</td>
</tr>
<tr>
<td>321723</td>
<td>PAVEMENT MARKINGS</td>
</tr>
</tbody>
</table>

DIVISION 33 - UTILITIES

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>331100</td>
<td>WATER UTILITY DISTRIBUTION PIPING</td>
</tr>
<tr>
<td>334000</td>
<td>STORM DRAINAGE UTILITIES</td>
</tr>
</tbody>
</table>

The specifications listed above are for non-standard FDOT related items. Roadway related items, including pavement, curb and gutter, sidewalks, signal pole foundations, signing and pavement markings will follow FDOT Standard Specifications for Road and Bridge Construction, 2013.
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes soil treatment for termite control under new buildings.

1.02 SUBMITTALS

A. Submit the following for review before commencing work:

1. Properly identified soil poisoning chemical product data, including manufacturers' specifications, chemical analysis, recommended dilution, application directions and safety precautions.
2. Sample copy of applicator's warranty for review.
3. Applicator's experience evidence and local and state license numbers.

1.03 QUALITY ASSURANCE

A. Work shall be done by a bonded applicator whose principal business is extermination and termite treatment and who can show evidence of at least 5 years of successful operation in his field.

B. Use only products that bear a federal registration number of the U.S. Environmental Protection Agency (EPA) and the Florida Department of Agriculture and Consumer Affairs. Provide shop drawings ascertaining same. Use of chlordane or heptachlor is prohibited.

C. Field Samples: Test samples of the mixture of concentrate and water will be taken by the Owner's testing laboratory. If sample solution indicates non-compliance with manufacturer's application requirements, Contractor shall pay for the initial test, subsequent retesting required by the Owner, and re-application of soil treatment solution.

1.04 PROTECTION

A. Do not apply solution when soil or fill is excessively wet or after heavy rains, to avoid surface flow of overspray of toxicant from application site.

B. Unless treated areas are to be immediately covered, take precautions to prevent disturbance of treatment by human or animal contact.

C. Comply with applicable laws, codes and ordinances of Federal, State and local regulatory agencies having jurisdiction over use of soil poisons.

D. Provide warning signs and instruct workers to use protective measures for their safety.

1.05 WARRANTY
A. Upon completion of soil treatment and as a condition of final acceptance, furnish Owner with a written warranty from the applicator, stating that:

1. Application was made at concentration, rates, and methods that comply with these specifications.
2. Effectiveness of treatment is warranted for not less than 5 years without additional cost to the Owner, by means of a 5-year repair and replacement bond.
3. Upon evidence of subterranean termite activity, affected area will be retreated at no additional charge to the Owner. Additional treatment shall be sufficient to prevent termites from attacking building or its contents.
4. Upon occurrence of damage to building or to its contents within warranty period, affected area will be retreated and damage replaced at no cost to the Owner.
5. Warranty bond shall be drawn in favor of the Owner, successor, or assigns and shall be non-cancelable by all parties to the contract except the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide materials approved by local authority having jurisdiction.

B. The following materials are acceptable, subject to compliance with paragraph A:

1. BASF Corporation, Agricultural Products; Termidor.
2. Bayer Environmental Science; Premise Pre.
3. FMC Corporation, Agricultural Products Group; Baseline.
4. Syngenta; Demon Max.

2.02 PRECONSTRUCTION SUBTERRANEAN TERMITE TREATMENT

A. Use product emulsion concentrations per manufacturer's printed application instructions.

B. Establish horizontal barriers at the rate indicated in the manufacturer's application instructions.

C. Establish vertical barriers at the rates and places indicated in the manufacturer's application instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not proceed with the work until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.
3.02 APPLICATION

A. Notify Owner's laboratory 48 hours before preparing mixture of concentrate and water as recommended by the manufacturer for the specific applications and conditions applying to the project.

B. Apply treatment to the following:

1. Soil and earth which will be covered by or lie adjacent to new buildings.
2. Masonry foundations.
3. Areas around pipes and conduits penetrating slabs on fill to provide a lethal barrier to subterranean termites.

C. Apply solution after subgrade has been made ready for placement of floor slab vapor barrier, and as soon as practical prior to placement of concrete slabs and caps on masonry piers, but after footings, foundation walls and below grade waterproofing have been completed.

D. Make application at least 12 hours prior to placement of concrete slabs during normal working hours in order to be subject to inspection. Notify applicator at least 24 hours prior to time application of soil poisons will be completed.

E. Soil Conditions: Apply soil poisoning when, moisture content soil is sufficiently low to allow uniform distribution of chemical throughout specified areas.

F. Application Under Slabs on Fill or Grade: Apply solution uniformly to all areas under concrete slabs, including walkways, entrance platforms and sidewalks within 5' of buildings. Apply a minimum of 1 gallon of soil poison uniformly to each 10 sf of area to be treated. Treat ground areas under concrete slabs on grade and paving which abut building slabs for a distance not less than 3' from building.

G. Application Along Foundation Walls, Pipes, and Conduits: Treat critical areas along both sides of exterior and Interior foundation walls, columns, and around utility pipes, conduits, ducts and other such items extending through soil beneath and adjacent to new construction, to a depth of one foot in a strip 6" wide, at a rate of 4 gallons of soil poison to each 10 sf. Mix chemical with soil as it is placed against walls and utility lines. Apply at least one gallon of soil poison around each pipe.

H. Application to Masonry Foundation Walls: Treat voids of unit masonry foundation walls, top of course occurring at or just above grade level, with additional treatment of not less than 2 gallons of chemical for each 5 lf.

I. Re-treatment of Disturbed Soil: Retreat soil surfaces that are disturbed after treatment and before placement of slabs and covering structures.

3.03 CLEANUP

A. Improper disposal of pesticide, spray mixture or rinsate is a violation of Federal law. Comply with manufacturers instructions for disposal of these material and empty containers. Do not allow supplies of chemicals to remain on site unattended.

END OF SECTION
PART 1 -- GENERAL

1.01 SUMMARY

A. The Work specified in this section consists of all Work necessary to move in personnel and equipment and prepare the site for construction, complete and to remove same when construction is complete.

1.02 REFERENCES:

A. American National Standards Association (ANSI):

1. A10 Series - Safety Requirements for Construction and Demolition.
2. National Electrical Contractors Association (NECA):
   a. 10 - Portable Fire Extinguishers.
   b. 70 - National Electrical Code.
   c. 241 - Safeguarding Construction, Alterations, and Demolition Operations.

National Electrical Manufacturers Association (NEMA).
Underwriters Laboratories (UL).

PART 2 – PRODUCTS

2.01 TEMPORARY UTILITIES

A. CONTRACTOR shall be required to provide all temporary facilities required for performing the Work as specified herein.

2.02 MATERIALS AND EQUIPMENT

A. Provide new materials and equipment. If acceptable to the Engineer, undamaged previously used materials and equipment in serviceable condition may be used. Provide materials and
equipment suitable for the use intended, of capacity for required usage, and meeting applicable codes and standards.

B. Water: Provide potable water approved by local health authorities.

C. Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

D. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

E. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

PART 3 -- EXECUTION

3.01 LAYOUT

A. CONTRACTOR shall set up its construction facilities in a neat and orderly manner and accomplish all required Work in accordance with applicable portions of these specifications.

B. CONTRACTOR shall confine its operations to Work to applicable right of way areas as shown on the drawings and/or specified in these contract documents.

3.02 DEMOBILIZATION

A. Relocation: Relocate construction aids as required by progress of construction, storage limitations, or Work requirements and to accommodate requirements of Government agencies and other contractors at the Site.

B. Removal: Remove temporary materials, equipment, and services when construction needs can be met and allowed by use of permanent construction, or at completion of the Project.

1. At the completion of Work, the CONTRACTOR shall remove its personnel, equipment, and temporary facilities from the site in a timely manner.

2. CONTRACTOR shall be responsible for transporting all unused/salvaged materials belonging to the City to a place of storage as designated by the Owner.

3. CONTRACTOR shall remove from the site and dispose of all other materials and debris resulting from its construction activities and return all areas used for its activities to a condition as noted on the Contract documents.
C. Repair: Clean and repair damage caused by installation or by use of temporary facilities.

1. Remove foundations and underground installations for construction aids.

2. Grade the areas of the Site affected by temporary installations to required elevations and clean the area.

3.03 TEMPORARY UTILITIES:

A. General:

1. Engage the appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

2. Provide adequate utility capacity at each stage of construction. Prior to availability of temporary utilities at the Site, provide trucked-in services as required for start-up of construction operations.

3. Obtain and pay for temporary easements required to bring temporary utilities to the Project Site, where CITY permanent easement cannot be used for that purpose.

4. Furnish, install, and maintain temporary utilities required for adequate construction, safety, and security. Modify, relocate, and extend systems as Work progresses. Repair damage caused by installation or use of temporary facilities. Grade the areas of Site affected by temporary installations to required elevations and grades, and clean the area. Remove on completion of Work or until service or facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

5. The types of temporary construction utilities and facilities required include, but not by way of limitation, water distribution, drainage, dewatering equipment, enclosure of Work, heat, ventilation, electrical power distribution, lighting, hoisting facilities, stairs, ladders, and roads.

6. Inspect and test each service before placing temporary utilities in use. Arrange for required inspections and tests by governing authorities, and obtain required certifications and permits for use.

7. Materials used for temporary service shall not be used in the permanent system unless so specified or acceptable to the Engineer.

B. Because of operational requirements, CITY may restrict or curtail CONTRACTOR use of certain utilities. If these utilities are critical to CONTRACTOR’s operations and completion of the Contract on the agreed schedule, CONTRACTOR shall consider furnishing alternate
sources for its own use. Restriction or curtailment of these utilities shall not be a basis for a claim against the Owner or an extension of the agreed schedule.

3.04 TEMPORARY ELECTRICITY AND LIGHTING:

A. New Service:

1. Arrange with utility company and provide service required for power and lighting.

2. Connect temporary service in a manner directed by utility company officials. Provide separate meter for metering of power used by all entities authorized to be at or perform Work at the Project Site.

4. The electric service shall be of sufficient capacity and characteristics for the various construction tools, machinery, lights, heating and air conditioning, pumps, and other tools required by CONTRACTOR and its Subcontractors.

5. Provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, use of power tools, electrical heating, and lighting. Provide overload protection. Locate multiple outlets spaced so that entire area of construction can be reached by power tools on a single extension cord of 100-foot maximum length. Supply power for electric welding, if any, from either temporary power distribution system or by engine-driven, power-generator sets at CONTRACTOR's option.

6. Provide all necessary temporary wiring, panelboards, switches, outlets, and other devices so that power and lighting is available throughout the construction area. Include meters, transformers, overload protection disconnects, automatic ground fault interrupters, and main distribution switch gear. Include overcurrent protection on all conductors of the temporary system.

7. Provide adequate artificial lighting for all areas of Work when natural light is not adequate for Work. Sufficient light shall be provided for general construction areas and floor areas, with additional sufficient lighting for specific tasks and to meet safety requirements.

B. Use of Permanent System:

1. Prior to use of permanent system for construction purposes, obtain written permission of the Utility Company.

2. Maintain permanent system as specified for temporary facilities.
C. Costs of Installation and Operation:

1. Pay fees and charges for permits and applications.
2. Pay costs of installation, maintenance, removal of temporary services, and restoration of any permanent facilities used.
3. Pay costs of electrical power used.
4. Obtain and pay costs for temporary easements, if required.

3.05 TEMPORARY WATER:

A. New Service:

1. Arrange with utility service company to provide water for construction purposes.
2. Water Source: Miami-Dade WASD.
3. Connect service to water main in a manner directed by utility company officials. Provide with meter and shut off valve near connection to the water main.
4. Size water service to provide adequate volume for all anticipated construction uses, and to maintain minimum required pressure.
5. Install piping with outlets located so that water is available throughout the construction area.
7. Sterilize temporary water piping prior to use.

B. Costs of Installation and Operation:

1. Pay all costs for installation, maintenance, and removal.
2. Pay costs for water used.

3.06 TEMPORARY TELEPHONE SERVICE:

A. General:

1. Arrange with local telephone service company and provide direct line telephone service at the construction Site for the use of construction personnel and employees.

B. Costs of Installation and Operation:
1. Pay all costs for installation, maintenance and removal, and service charges for local calls. Toll charges shall be paid by the party who places the call.

3.07 TEMPORARY SANITARY FACILITIES:

A. CONTRACTOR-Furnished Facilities:

1. Furnish, install, and maintain temporary sanitary facilities for use through construction period. Remove on completion of Work.

2. Provide for all construction workers under this Contract and representatives at the Site.

3. Toilet facilities shall be of the chemical, aerated recirculation, or combustion type, properly vented, and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

4. Wash Facilities: Install potable water-supplied wash facilities at locations convenient to construction personnel involved in the handling of compounds and materials where wash-up is necessary to maintain a safe, healthy and sanitary condition. Where recommended or required by governing authorities and regulations or recognized standards provide emergency safety showers, emergency eye-wash fountains, showers, and similar facilities. Dispose of drainage properly. Supply soap and other cleaning compounds appropriate for each condition.

5. Drinking Water Fixtures: Provide containerized tap-dispenser type drinking water units.

6. Supply and maintain toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility. Provide appropriate covered waste containers for used material.

B. Use of Existing Facilities:

1. Existing restrooms facilities shall not be used.

3.08 SEWERS AND DRAINAGE:

A. General: Where sewers or drainage facilities are not available for discharge of effluent, provide containers to remove and dispose of effluent off the Site in a lawful manner. If existing sewers are available for temporary drainage near the Site prior to completion of permanent sewers, provide temporary connections to remove effluent that can be lawfully discharged into the sewers. If existing sewers cannot be used for discharge, provide drainage ditches, dry wells, waste stabilization ponds, and similar discharge facilities to remove effluent that can be lawfully discharged in that manner.
B. Connect temporary sewers to the municipal sewer systems in the manner directed by the sewer department officials.

C. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy usage, restore to normal conditions promptly. Provide and maintain temporary earthen embankments and similar barriers in and around construction excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rain storms.

3.09 TEMPORARY CONSTRUCTION AIDS:

A. General:

1. Provide construction aids and equipment required by personnel and to facilitate the execution of the Work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.

2. Materials may be new or used, must be suitable for the intended purpose, and meet the requirements of applicable codes, regulations, and standards.

3.10 TEMPORARY SAFETY AND HEALTH:

A. General: CONTRACTOR shall be solely responsible for initiating, maintaining, and supervising all safety and health precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide necessary protections to prevent injury or loss to, all employees on the Work and other persons and organizations who may be affected thereby.

3.10 TEMPORARY FIRE PROTECTION:

A. General:

1. CONTRACTOR shall be responsible for development of a fire prevention and protection program for all Work under this Contract.

2. The program shall comply with the applicable provisions for safety and protection specified in the Contract Documents and with applicable parts of the NFPA 10 and 241.

3. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near such usable stairwell.

4. Store combustible materials in containers in fire-safe locations.
5. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.

6. Provide supervision of welding operations and similar sources of fire ignition.

7. Post warning and instructions at each extinguisher location, and instruct construction personnel on proper use of extinguishers and other available facilities at Project Site. Post local fire department telephone number on or near each telephone instrument at Project Site.

B. Permanent Fire Protection:

1. Complete each fire protection facility at earliest reasonable date, place into operation, and make ready for emergency use.

2. Instruct personnel at Site on availability and proper use.

- END OF SECTION -
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Demolition and removal of selected portions of a building.
2. Demolition and removal of selected site elements.
3. Patching and repairs.

1.2 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soil-ing during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.3 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

B. Historical items indicated remain the Owner's property. Carefully remove and salvage each item in a manner to prevent damage and deliver promptly to the Owner.
C. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered during selective demolition, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

1. Cooperate with Owner's archaeologist or historical adviser.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.

B. Proposed dust-control measures.

C. Proposed noise-control measures.

D. Schedule of selective demolition activities indicating the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
   2. Interruption of utility services.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
   6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
   7. Locations of temporary partitions and means of egress.

E. Inventory of items to be removed and salvaged.

F. Inventory of items to be removed by Owner.

G. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

H. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."
   1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

I. Landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Predemolition Conference: Conduct conference at Project site to comply with preinstallation conference requirements of Division 1 Section "Project Meetings."

1.6 PROJECT CONDITIONS

A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner assumes no responsibility for actual condition of buildings to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Asbestos: It is not expected that asbestos will be encountered in the Work. If any materials suspected of containing asbestos are encountered, do not disturb the materials. Immediately notify the Architect and the Owner.

D. Storage or sale of removed items or materials on-site will not be permitted.

1.7 SCHEDULING

A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

1.8 WARRANTY

A. Existing Special Warranty: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS
2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.
   1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
   2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.
B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.
E. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.
F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
      a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.
B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

C. Utility Requirements: Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

C. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

D. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
5. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.
6. Cover and protect furniture, furnishings, and equipment that have not been removed.

E. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
   1. Construct dustproof partitions of not less than nominal 4-inch studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant plywood on the demolition side.
   2. Insulate partition to provide noise protection to occupied areas.
   3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
   4. Protect air-handling equipment.
   5. Weatherstrip openings.

F. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS
   A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
      1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

   B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
      1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

   C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.5 SELECTIVEDEMOLITION
   A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition work above each floor or tier before disturbing supporting members on lower levels.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.

6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

8. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.

10. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctions with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Break up and remove concrete slabs on grade, unless otherwise shown to remain.

3.6 PATCHING AND REPAIRS

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.

B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.
C. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

D. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance.
   1. Closely match texture and finish of existing adjacent surface.
   2. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
   3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.
   4. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   5. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.

E. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. Change filters on air-handling equipment on completion of selective demolition operations.

- END OF SECTION -
SECTION 03348
CONCRETE SEALER

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes surface preparation and field application of penetrating sealers to interior concrete slabs.

1.02 SUBMITTALS

A. Product Data:

1. Material List: Indicate each material and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Submit samples on the following substrates for the Architect's review of color and texture only:

a. Concrete: 4" square samples for each color and finish.

C. Qualification Data: For Applicator.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Paint applicator shall be licensed in the State of Texas.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Compliance with VOC content requirements.
B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.06 PROJECT CONDITIONS

A. Apply waterborne sealants only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned sealants only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply sealants when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Application may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. This specification is based on "Ashford Formula" as manufactured by Curecrete Distribution, Inc.

B. Other acceptable systems include the following approved manufacturers:

1. "Day-Chem Hardener (J-l5)" as manufactured by Dayton Superior Corporation.
2. "Seal Hard" as manufactured by L&M Construction Chemicals, Inc.

2.02 MATERIALS, GENERAL

A. Material Quality: Provide factory-formulated sealers as recommended by the manufacturer for application indicated. Material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

2. Coatings shall comply with the Federal and State Guidelines for maximum allowed VOC contents.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.

1. Proceed with sealant application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of sealant will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

3.02 PREPARATION

A. General: Remove finished floor drain covers, plates and similar items already installed that are not to be painted. Plug and tape protect openings in the slab intended for drainage.

1. After completing sealant in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying sealant, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Prepare concrete to be sealed. Remove efflorescence, chalk, dust, dirt, grease, oils and release agents. Roughen as required to remove glaze. If previous hardeners or sealers have been used, use mechanical methods of surface preparation.

   a. Use abrasive blast-cleaning methods if recommended by sealant manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests.
   c. Clean concrete floors to be sealed with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry and vacuum before painting.

D. Material Preparation: Mix and prepare sealant materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary,
remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.03 APPLICATION

A. General: Apply sealers according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Apply first coat at a rate of 200 feet per gallon, when using spray applicator.

C. Allow sealer to be absorbed into the concrete. Mist sealer, according to the manufacturer's directions to maintain a wet surface for 30 minutes.

D. Broom sealer into dry spots that appear during the process.

E. Following the elapsed 30-minute cure time, saturate the floor with clean water and power scrub, using a wet vacuum, to remove all excess sealant and water. Squeegee dry.

3.04 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish and other discarded paint materials from Project site.

1. After completing sealer, clean spattered surfaces.

3.05 PROTECTION

A. Protect work of other trades. Allow surfaces to fully dry 24 hours before allowing foot traffic. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

END OF SECTION
SECTION 03 10 00
CONCRETE FORMWORK
PART 1 GENERAL

1.01 SUMMARY

A. Related Sections:
   1. 03 20 00 - Concrete Reinforcement
   2. 03 30 00 - Cast-in-Place Concrete
   3. 04 23 00 - Reinforced Unit Masonry

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. D994-94 Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
   2. E154-88(93) Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls or as Ground Cover.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
   1. ACI 117/117R-90 Tolerances for Concrete Construction and Materials.
   2. ACI 301 Specifications for Structural Concrete for Buildings.
   3. ACI 318-08 Building Code Requirements for Reinforced Concrete.
   4. ACI 347R-88 Recommended Practice for Concrete Formwork.

B. Qualifications:
   1. Formwork Engineer: Professional Engineer, with Florida registration and experience in design of formwork and related items.
   2. Formwork Contractor: Florida licensed contracting firm having 5 years successful experience in fabrication and erection of formwork systems of similar scope and complexity as required for this project. Contractor shall have sufficient capacity to produce formwork without causing delay in work.
1.04 FORMWORK AND RESHORING DESIGN

A. Formwork:

1. Comply with Chapter 4 of ACI 301
2. Formwork engineer shall perform or oversee design, drawings, erection, and removal.
3. Design according to ACI 117 and ACI 347, including provisions for construction loads and placing equipment to be used on project.
4. Verify strength and stiffness of in-place building elements to resist required loads and restrict deformations to specified tolerances.
5. Earth cuts shall not be used as forms for vertical surfaces. Natural rock formations maintaining a stable vertical cut may be used as side forms. Comply with OSHA's "Trench Safety Act".
6. Design and Installation of Formwork: Form ties that leave through holes in the concrete are not allowed.
7. Removal Strength:

   a. Wall forms and column forms may be removed 12 hours after pouring.
   b. Slabs supported by precast joists may have forms removed as follows:

      1) Joist spacing 4'-6" or less, 24 hrs.
      2) Joist spacing between 4'-6" and 6'-8", 48 hrs.
      3) Joist spacing between 6'-8" and 8'-8", 72 hrs.

   c. Beams and other slabs shall not have forms removed until the concrete has achieved 75 percent of its design strength. Beams shall be reshored immediately upon removal of forms.
   d. In addition to the above, flat slab forms and stair slab forms shall not be removed for 5 days. Upon removal of forms, reshores shall be placed and remain in place until concrete is 14 days old.

B. Reshoring:

1. Design reshoring to resist active loads.
2. Space shoring so no lower floor or member will be excessively loaded from design live loads or will induce tensile stress in concrete members where no reinforcing steel is provided.
3. Extend shores beyond minimums to ensure proper distribution of loads throughout structure.
4. Consider special loading requirements to support load of special elements where elements of similar size and capacity do not exist in supporting structure below.
1.05 FORMWORK SUBMITTALS

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items.

B. Formwork:

1. Submit shop drawings, signed and sealed by formwork engineer, for fabrication and erection of specific finished concrete surfaces as indicated. Show construction of forms as required.
2. The Engineer’s review is for general applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility, and will not be reviewed.

C. Reshoring:

1. Submit shop drawings, signed and sealed by formwork engineer, for reshoring system showing:
   a. Arrangement and sequencing of shores required.
   b. Specific areas where shores do not align vertically.
   c. Required installation procedures.
   d. Removal criteria.
2. Submit calculations showing:
   a. Loading diagrams for each floor or differently loaded area showing maximum imposed loads at each critical sequence.
   b. Ratio of total load to strength at actual age.
   c. Verification of member strength where shores do not align vertically.
   d. Verification of structure to resist required lateral loads.

D. Foundations for Formwork and Reshoring:

1. Submit shop drawings, signed and sealed by formwork engineer, or include with formwork and reshoring shop drawings, showing:
   a. Subgrade preparation required including compaction and moisture control.
   b. Size and description of sill assemblies.

E. Formwork Removal:

1. Authorization for Removal: Formwork engineer shall furnish a signed and sealed report establishing the criteria for removal of formwork, shoring, and reshoring. Deviation from established criteria is not allowed.
PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Forms for Exposed Finish Concrete:
   1. Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, or other acceptable panel-type materials. Provide continuous, straight, smooth, exposed surfaces.
   2. Furnish in largest practicable sizes to minimize number of joints and to comply with joint system shown on drawings.
   3. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete, restricting bow and deflection to specified tolerances.
   4. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
   5. Where concrete is scheduled to have Smooth Rubbed Finish (Sm Rb-Fn), use plywood complying with U.S. Product Standard PS-1 "B-B (Medium Density Overlaid Concrete Form", Class I, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces to be concealed in finished structure with plywood, lumber, metal, or other material.

C. Forms for Textured Finish Concrete:
   1. Form textured finish concrete surfaces with units of face design, arrangement, and configuration as shown on drawings or as required to match A/E S ontrol sample.
   2. Provide form supports to ensure stability of textured form liners.

D. Cylindrical Columns and Supports:
   1. Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection.
   2. Prefabricated fiberglass or steel forms may be used.
   3. Provide units with sufficient wall thickness to resist loads imposed by wet concrete and restrict deformation to specified tolerances.

E. Form Ties: Ties that leave plastic tube lined holes through members are not allowed.

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

G. Forming Accessories: CRD-C572-74 polyvinyl chloride (PVC).
1. Waterstops: Flat dumbbell type at construction joints and center bulb type at building expansion joints.
2. Chamfers: 1/2” radius on outside corners of exposed-to-view concrete unless drawings show other size or shape.
3. Drips: 3/8” wide x 1/2” high drip groove placed 3/4” back from edge in cast-in-place exterior soffits.

H. Premolded Expansion Joint: ASTM D994, 1/2” thick.

I. Vapor Retarder:
   1. Provide moisture retarder cover over prepared base material where indicated.
   2. Use polyethylene sheet not less than 6 mils thick or other materials resistant to decay when tested according to ASTM E154.

PART 3 EXECUTION

3.01 FORMS

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

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

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

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

E. Provide temporary opening where interior area of formwork is inaccessible for clean out, for inspection before concrete placement, and for placement of concrete.

MDT Project No. CIP010-CT1-TR12
DIVISION 03 – CONCRETE
RPQ No. 265910-R
03 10 00 – 5 of 7
1. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar.
2. Locate temporary openings on forms at inconspicuous locations.

F. At chamfers exposed to view, provide corners and edges with 1/2" radius PVC accessories to produce uniform smooth lines and tight edge joints, unless otherwise indicated or accepted by the Engineer.

G. Form Ties:

1. Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
2. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least 1-1/2" inside concrete.
3. Unless otherwise shown, provide form ties that will not leave holes larger than 1 inch diameter in concrete surface.

H. Provisions for Other Trades:

1. Provide openings in concrete formwork to accommodate work of other trades.
2. Determine size and location of opening, recesses, and chases from trades providing such items.
3. Accurately place and securely support items built into forms.

I. Cleaning and Tightening:

1. Thoroughly clean forms and adjacent surfaces to receive concrete.
2. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed.

3.02 JOINTS

A. Construction Joints: Locate and install construction joints not shown on drawings to not impair strength and appearance of the structure, as acceptable to the Engineer.

B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs, and between walls and footings. Accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.

D. Waterstops:

1. Provide waterstops in construction joints as indicated.
2. Install waterstops to form continuous diaphragm in each joint.
3. Make provisions to support and protect exposed waterstops during progress of work.
4. Fabricate field joints in waterstops according to manufacturer's printed instructions.

E. Isolation Joints in Slabs-on-Ground:

1. Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
2. Joint filler and sealant materials are specified in Division 7 sections of these specifications.

F. Contraction (Control) Joints in Slabs-on-Ground:

1. Construct contraction joints in slabs-on-ground to form panels of patterns as shown.
2. Use inserts 1/4" wide x 1/4 of slab depth, unless otherwise indicated.

G. Form contraction joints by inserting premolded hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured, remove inserts and clean groove of loose debris.

1. Contraction joints may be formed by saw cuts as soon after slab finishing as possible without dislodging aggregate.

3.03 RE-USE OF FORMS

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

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

END OF SECTION
SECTION 03 20 00
CONCRETE REINFORCEMENT
PART 1 GENERAL

1.01 QUALITY ASSURANCE

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

1. ACI 117/117R-90 Tolerances for Concrete Construction and Materials.
2. ACI 301-08 Specifications for Structural Concrete for Buildings.
3. ACI 315-91 Details and Detailing of Concrete Reinforcement.
4. ACI 318-08 Building Code requirements for Reinforced Concrete.
5. ACI 439.3R-91 Mechanical Connection of Reinforcing Bars.
6. AWS D1.4-79 Structural Welding Code Reinforcing Steel.
8. CRSI, Placing Reinforcing Bars, 1983.

1.02 REFERENCES

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

1. A82-95a Specification for Steel Wire, Plain, for Concrete Reinforcement.
4. A496-95a Specification for Steel Wire, Deformed, for Concrete Reinforcement.
5. A497-95 Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
6. A615/A96a Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

1.03 SUBMITTALS

A. General:

1. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement.
   a. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement and accessories.
   b. Include special reinforcement required at openings through concrete structures.
2. Shop drawings made from sepias (or other reproductive methods) of the structural drawings will not be accepted and shall be cause for resubmittal.

B. Selection of splices: Splices shall be full tension, unless noted otherwise.

1. Splices noted on the drawings to be compression splices shall be furnished by one of the following:
   a. Compression lap splices according to ACI 315.
   b. Mechanical compression only connectors according to ACI 439-3R, staggered 1/2 Class "C" lap length and maintaining not less than 1/4 the total tensile capacity of any column face.
   c. Full penetration welds staggered not less than 18 diameters.

2. Splices shown on the drawings as either Class "A" or Class "B" may be one of the following:
   a. Class "B" lap splices.
   b. Class "A" (but not less than compression lap) lap splices staggered not less than one Class "B" lap length.
      1) Exception: This shall not be allowed when shown as class "B" in a location, which by design, has already accounted for other continuing bars or staggered splices.
   c. Appropriate mechanical connectors according to ACI 439-3R staggered not less than 24 diameters.
   d. Full penetration welds staggered not less than 24 diameters.

3. Unless otherwise noted in the drawings, reinforcing shall be spliced to develop the full strength of the bar in either tension or compression. Those splices shall be furnished by one of the following:
   a. Class "B" lap splices where only 1/2 of the total rebars are spliced at any one floor.
   b. Full penetration welds staggered not less than 36 diameters.
   c. Appropriate mechanical connectors according to ACI 439-3R staggered not less than 36 diameters.

4. Total steel at lap splices shall not exceed 8 percent for columns or shear wall cores containing the spliced bars.
   a. All bars may be lapped at one section for up to 4 percent steel.
   b. 1/2 of the bars may be lapped for up to 5.3 percent steel.
   c. 1/3 of the bars may be lapped for up to 6 percent steel.
   d. Above 6 percent steel, other splice choices shall be used.
5. Where staggered lap splices are used, provide a mixture of bar sizes as appropriate where vertical bar size changes on the drawings.

6. Where different size bars are lap spliced, the length of splice may be based on the smaller bar size. If there is a larger quantity of the smaller bar size, the splice length shall be based on the larger bar.

7. It shall be the responsibility of the reinforcing detailer to determine the concrete strength at the point of a lap splice, the bar position (top or other), bar spacing, confinement condition based on ties or stirrups or edge condition to select the proper lap length.

8. Increase laps for bundled bars according to ACI 318, with number based on total bars in group including lapped bars.

C. Detailing of Splices: Placing shop drawings shall specifically show splice lap lengths where they occur. Bar diameter lap tables and references to other charts are not acceptable.

D. Staggered Laps Required: Provide staggered laps in any member as necessary to keep space between bars within splice zone at least 1 inch or 1 bar diameter clear.

E. Detailing of Bar Placement: For any bar other than those placed at an edge condition, between edge condition or openings, or any other location where the bar cannot be shifted longitudinally, a dimension shall be shown from an identifiable building grid, wall, or edge to at least one end of the bar.

F. Congested Areas of Placement: For any conditions resulting in bar spacing less than 2 diameters clear or where the placement of bars in one member requires critical templating to allow bar placement in an intersecting member, furnish details of sufficient scale to show clearances, spacing, and arrangements for properly placing those bars.

G. Accessories: Show accessories, supports, chairs, bolsters, and spacers necessary to complete the installation. Where supports are beyond the scope of CRSI detailing standards and custom designed supports are required, provide engineering calculations demonstrating the capacity of the system.

H. Flat Plates: Provide not less than 3 separate drawings of each plate separately showing bottom bars, top bars, and accessories.

I. Welding Submittals:

1. If welding of reinforcing bars is to be included as part of the work, submit the following:

   a. A complete welding procedure specification according to AWS D1.4.
   b. A certified chemical analysis of the steel to be welded.
c. Carbon equivalence calculations according to AWS D1.4.
d. Qualification papers for welders who will be employed on the project. Welders shall have passed a qualification test within a 12 month period before the work or furnish a statement from a testing agency acceptable to the Engineer that they have observed or tested that welder's work under similar requirements within the past 6 months.

1.04 SUBSTITUTIONS

A. Reinforcing Splicing:

1. Splices shown in the drawings shall be considered mandatory for base bid purposes.
2. Alternative methods of providing for splices are available within the constraints of this specification and ACI 318.
3. If alternative splices are desired, the shop drawing submitted shall clearly indicate the change and include authorization by any other subcontractors involved in the change.

PART 2 PRODUCTS

2.01 REINFORCING MATERIALS

A. Comply with Chapter 5 of ACI 301.

B. Reinforcing Steel:

1. Bars #3 through #11 shall be deformed bars according to ASTM A615 Grade 60 and according to the additional requirements of Paragraph 5.2.2.1 of ACI 301.
2. Bars #2 in size shall be plain round meeting A615/A76a Grade 40.
4. Unless indicated otherwise the minimum concrete protective cover specified in Paragraph 5.7.1 of ACI 301 is the specified cover for this project unless indicated otherwise.

C. Epoxy-Coated Reinforcing Bars: ASTM A775.

D. Form-Saving Splice Connectors: Flanged devices to allow insertion of threaded reinforcing bars into a previously formed face. Available products include, but are not limited to:

1. Form Saver by Lenton.
2. DB- SAЕ Splices System by Richmond.
3. Rebar Flange Coupler by Williams.

E. Mechanical Connectors and Splice Devices: Proprietary products suitable for the use intended and listed in ACI 439-3R-83.
F. Steel Wire: ASTM A82, plain, cold-drawn, steel.

G. Fabricated Deformed Steel Bar Mats: ASTM A184.

H. Welded Steel Wire Fabric: ASTM A185.

I. Deformed Steel Wire: ASTM A496.


K. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI Class C or Class A as required acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces and with legs of supports in contact with forms, provide supports with legs, either plastic protected according to CRSI, Class 1 or stainless steel protected according to CRSI, Class 2.
3. Provide custom supports as required to support top layer of mats and other special conditions not provided for within CRSI standards.

L. Fiber Reinforcement:

1. Manufacturers:
   a. Fibermesh by Synthetic Industries, Chattanooga, TN
   b. Ferro by Forta Corporation, Grove City, PA.

2. Comply for use in plain concrete as defined in ACI 318.1. and the following:
   a. Fibers shall not be used as a replacement for any reinforcement required for structural purposes.
   b. Blend fibers into the concrete mix according to manufacturers written instructions.
   c. Provide control joints according to Section 5.2 of ACI 318.1.
   d. Fibers shall comply with ASTM C1116-95.

PART 3 EXECUTION

3.01 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as specified.
B. Clean reinforcement of loose rust and mill scale, dirt, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers as required.

D. When any reinforcing bar is placed projecting either horizontally or vertically from a given element to subsequently lap with other reinforcing bar, verify the detailed lap length will be achieved.

   1. Report any deviation to the Engineer for correction before placing concrete in the first element.
   2. Bar projections resulting in laps shorter than the detailed laps shall be considered rejected, and corrective measures shall be taken at the direction of the A/E with no additional cost to the Board.

E. Place reinforcement to obtain at least minimum coverages for concrete protection.

   1. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
   2. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

F. Install welded wire fabric in as long lengths as practicable.

   1. Lap adjoining pieces at least one full mesh plus 2 inches and wire splices.
   2. Offset end laps in adjacent widths to prevent continuous laps in either direction.

G. Provide the Engineer with not less than 48 hours notice before starting any welding of reinforcing bars.

   1. Welding of reinforcing bars shall only be allowed under the direct supervision of the Engineer.
   2. Welding of crossing reinforcing bars is not allowed.
   3. Any bars with unauthorized or unacceptable welds shall be replaced at no additional cost to Miami-Dade Transit.

   END OF SECTION
SECTION 03 30 00
CAST-IN-PLACE CONCRETE
PART 1 GENERAL

1.01 SUMMARY
A. Related Sections:
   1. 03 10 00 - Concrete Formwork.
   2. 03 20 00 - Concrete Reinforcement
   3. 03 31 20 - Concrete Testing.
   4. 07 90 00 - Joint Protection.
   5. Built-in items furnished under other sections.

1.02 REFERENCES
A. American Society for Testing and Materials (ASTM):
   1. A615/A-96a Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   2. C78-94 Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).

1.03 SUBMITTALS
A. Submit shop drawings for reinforcement and accessories:
   1. Detail beams and reinforcing in elevation and not in schedules.
   2. Show slab reinforcing in plan view, similar to the structural drawings, not scheduled, and drawn to a minimum scale of 1/8" = 1'-0". Show reinforcing on the plan view along with size, quantity, marks, and spacing.
   3. Detail walls and reinforcing in elevation and not in schedules.
   4. Other items may be detailed as needed.
5. The engineer will not review drawing submitted not complying with these requirements. Contractor shall verify detailing proceeds as specified to avoid untimely reinforcing arrival.

B. Materials and methods of curing.

C. Concrete materials and mix designs.

D. Certifications required for admixtures (chloride and solids).

E. Chlorides in concrete.

F. Test reports.

G. Waterstops and premolded joint fillers.

H. Curing compounds.

1.04 STANDARDS

A. Concrete work shall comply with requirements of ACI 301- Specifications for Structural Concrete for Buildings, except as specified.

B. The Contractor shall familiarize himself with the requirements of ACI 301 and this specification.

C. The requirements that follow are listed in the sequence of chapter numbers of ACI 301 for ready reference purposes.

D. Florida Building Code (FBC).

PART 2 PRODUCTS

2.01 MATERIALS

A. Comply with Chapter 1 of ACI 301.

2.02 MATERIALS FOR CONCRETE

A. Comply with Chapter 2 of ACI 301 and the following:

1. Cement: Type I or III complying with ASTM C150.
2. Admixtures:
a. Water Reducing Admixture: The admixture shall comply with ASTM C494, Type A, and not contain more chloride ions that are present in municipal drinking water.

   1) Eucon WR-75 by Euclid Chemical Co.
   2) Pozzolith 200N by Master Builders.
   3) Plastocrete 160 by Sika Chemical Corp.

b. Water Reducing, Retarding Admixture: The admixture shall comply with ASTM C494, Type D, and not contain more chloride ions that are present in municipal drinking water.

   1) Eucon Retarder-75 by Euclid Chemical Co.
   2) Pozzolith 100XR by Master Builders.
   3) Plastiment by Sika Chemical Corp.

c. High Range Reducing Admixture (Superplasticizer): The admixture shall comply with ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.

   1) Eucon 37 by Euclid Chemical Co.
   2) Sikament by Sika Chemical Corp.

d. Non-Chloride Accelerator: The admixture shall comply with ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water.

   1) Accelguard 80 by Euclid Chemical Co.
   2) Darex Set Accelerator by W.R. Grace.

4. Calcium Chloride: Calcium chloride or admixture containing more than 0.1 percent chloride ions are not allowed.

B. Certification: Written compliance to above-mentioned requirements and the chloride ion content will be required from the admixture manufacturer (include admixtures) before mix design review by the engineer.

2.03 PROPORTIONING

A. Comply with Chapter 3 of ACI 301 and the following:

   1. Strength: Normal weight concrete - see drawings.

      a. Concrete slabs, designated as "Concrete Pavement": 28-day compressive strength not less than 4,000 psi and a flexural strength (modulus of rupture) of not
less than 650 psi when tested according to "Method of Test for Flexural Strength of concrete (using simple beam with third point loading)", ASTM C78. Include curb or curb and gutters.

2. Durability:

a. Pumped Concrete:

1) Testing shall be completed at the final discharge location after pumping.
2) Testing shall be completed at the truck before pumping.
3) Samples shall include samples for both slump and strength tests.
4) Adding of water to transit mixers/agitators.

a) Contractor shall maintain a maximum time limit of 90 minutes on the introduction of water into the cement.
b) Only 1 addition of water on the site to bring the mix to the producer's mix slump criteria is allowed.

b. Design Mixes:

1) Design mixes for concrete intended to be placed as-is from the truck shall be designed as such.
2) Design mixes for concrete intended to be pumped shall be made on one of the following bases:

a) The mix shall be designed as a truly plastic mix by proper proportioning. See ACI 304.2R - Placing Concrete By Pumping Methods for guidelines for a pumpable plastic workable mix. Trial batches shall be made, and without a device to test pumping ability, results of field trials shall be used.
b) Water shall not be added at the pump. One addition of water at the truck to meet the design slump (at the truck) is allowed.
c) A super plasticizer may be used.

c. Concrete slabs placed at temperatures below 40 degrees F. shall contain the "Non-Chloride Accelerator".
d. Concrete required to be air entraining shall contain the "Air Entraining Admixture", and air content shall comply with table 3.4.1 of ACI 301.
e. Pumped concrete and concrete with a water/cement ratio less than 0.50 shall contain the "High Range Water Reducing Admixture".
f. The "Water Reducing", Type A, or "Water Reducing and Retarding", Type D admixtures complying with ASTM C494 may be used at the option of the Contractor.
g. Concrete containing the "High Range Water Reducing Admixture" (superplasticizer) shall have a max. slump of 8 inches unless otherwise
directed by the A/E. The concrete shall be proportioned for a slump of 2 to 3 inches, be verified, then the high range water reducing admixture added to increase the slump to the approved level.
h. All other concrete shall be proportioned to have a maximum slump of 4 inches.

3. Normal weight concrete shall be air-entrained. Amount of air-entraining shall be according to Table 3.4.1.
4. Requirements for Other Concrete: The requirements of Paragraph 2.03 D(1).

2.04 FORM WORK

A. Comply with Chapter 4 of ACI 301 and the following:

1. Earth cuts shall not be used as forms for vertical surfaces. Natural rock formations maintaining a stable vertical cut may be used as side forms. Comply with OSHA’s "Trench Safety Act".
2. Design and Installation of Formwork: Form ties that leave through holes in the concrete are not allowed.
3. Removal Strength:
   a. Wall forms and column forms may be removed 12 hours after pouring.
   b. Slabs supported by precast joists may have forms removed as follows:
      1) Joist spacing 4'-6" or less, 24 hrs.
      2) Joist spacing between 4'-6" and 6'-8", 48 hrs.
      3) Joist spacing between 6'-8" and 8'-8", 72 hrs.
   c. Beams and other slabs shall not have forms removed until the concrete has achieved 75 percent of its design strength. Beams shall be reshored immediately upon removal of forms.
   d. In addition to the above, flat slab forms and stair slab forms shall not be removed for 5 days. Upon removal of forms, reshores shall be placed and remain in place until concrete is 14 days old.

2.05 REINFORCEMENT

A. Comply with Chapter 5 of ACI 301 and Section 03 20 00 - Concrete Reinforcement.

2.06 FIBER REINFORCEMENT

A. Comply for use in plain concrete as defined in ACI 318.1.

2.07 JOINTS AND EMBEDDED ITEMS

A. Comply with Chapter 6 of ACI 301 and the following:
1. Expansion Joints:
a. Premolded joint fillers shall be preformed bituminous type, ASTM D1751 for joints without sealant.
b. Premolded expansion joint fillers for pavements, for joints with sealant and where indicated shall be non-extruding and resilient type of ASTM D1752, compatible with urethane joint sealant compounds.

2. Waterstops:

a. Waterstops and fittings shall be manufactured from PVC. The waterstops shall be as manufactured by Greenstreak or accepted equivalent.
b. For construction joints, 4 inch serrated typed with Centerbulb, RS 316-4 or RB316-4 shall be used.
c. For expansion joints, 6 inch serrated type with Centerbulb, RB38T6 or RSB386 shall be used.
d. Make splices using splicing unions according to manufacturer's instructions. Make waterstop intersections using factory molded fittings.
e. Provide #14 tie wire at 2'-0" center to center embedded in base pour for waterstop support.

3. Safety Nosings For Exterior Concrete Stairs:

a. Cast abrasive aluminum 3 inches wide, equipped with manufacturer's standard continuous anchors.
b. Length shall be 6 inches less than the full width of stairs.
c. Provide factory-applied reinforced protective tape on exposed surfaces of nosings.
d. Manufacturers:
   1) Model No.101 by Wooster Products Inc.
   2) Model "A" by American Abrasive Metals.
   3) Model "AX" by Safety-T-Metal Co., Inc.

2.08 PRODUCTION OF CONCRETE

A. Comply with Chapter 7 of ACI 301 and following:

1. Ready-Mixed Concrete:

a. Provide copies of each delivery ticket to the A/E. Include mix designation on delivery ticket.
b. Do not place concrete over 90 minutes old from the time it was batched.

2. Weather Conditions:

a. Where the relative humidity is less than the corresponding concrete temperature as placed, or intended to be placed, as indicated in the following Table, the
Contractor shall follow the recommendations of ACI 305R, "Hot Weather Concreting".

<table>
<thead>
<tr>
<th>Concrete Temperature (F)</th>
<th>Minimum Relative Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>100°</td>
<td>80</td>
</tr>
<tr>
<td>95°</td>
<td>70</td>
</tr>
<tr>
<td>90°</td>
<td>60</td>
</tr>
<tr>
<td>85°</td>
<td>50</td>
</tr>
<tr>
<td>80°</td>
<td>40</td>
</tr>
<tr>
<td>75°</td>
<td>30</td>
</tr>
</tbody>
</table>

b. The above Table is based upon a wind speed of 10 mph. For ambient wind speeds more than 10 mph, the Contractor shall follow the recommendations of Fig.2.1.5 of ACI 305R if the relationships of air temperature, wind velocity, relative humidity, and concrete temperature indicate a rate of evaporation more than 0.2 pounds per sq.ft. per hour.

c. Concrete having a temperature more than 100 degrees F. shall not be placed.
d. The requirements of Paragraph 7.6.1.2 of ACI 301 (cooling of concrete ingredients are not waived).

2.09 PLACING

A. Comply with Chapter 8 of ACI 301 and the following:

1. Protection: When the temperature of the concrete exceeds the minimum relative humidity relationship specified in Paragraph "Production of Concrete", the requirements of Paragraph "Production of Concrete" shall control.

2.010 REPAIR OF SURFACE DEFECTS

A. Comply with Chapter 9 of ACI 301 and the following:

1. With prior approval of the A/E, as to method and procedure, repair defective areas according to ACI 301, Chapter 9, except that the bonding compound Euco Weld by the Euclid Chemical Company or Weldcrete by the Larsen Company must be used.
2. Defects designated as "structural" by the engineer shall be repaired with prior approval of the engineer, as to method and procedure, using the epoxy adhesive epoxy mortar as furnished by the Euclid Chemical Company or Sika Chemical Corp.

2.011 FINISHING OF FORMED SURFACES

A. Comply with Chapter 10 of ACI 301 and the following:

1. Finishes:
   a. All concrete shall be "rough form finish" according to Paragraph 10.2 of ACI 301, except concrete that will be exposed to view shall be "smooth form finish".
2.012 SLABS

A. Comply with Chapter 11 of ACI 301 and the following:

1. Finishes: Finishes shall be according to Paragraph 11.8 of ACI 301 except as specified.
2. Maximum allowable tolerances for floor slabs not receiving ceramic or quarry tile shall be 1/8" in a 10 foot radius.
3. Exterior slabs receiving tile, pavers, or similar covering shall be troweled finish.

2.013 CURING AND PROTECTION

A. Comply with Chapter 12 of ACI 301 and the following:

1. Preservation of moisture according to Paragraph 12.2 of ACI 301.
2. Curing and Sealing Compound: Super Floor Coat or Super Pliocure by the Euclid Chemical Company or Masterseal 66 by Master Builders. The compound shall comply with ASTM C309, Type 1 or Type 1D, 30 percent solids content minimum, and have test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per sq.cm. when applied at a coverage rate of 300 sq.ft. per gallon. Manufacturers certification required.
3. Curing and Hardening Compound: "Eucosil" by the Euclid Chemical Company or "Curetox" by Toch Brothers. The compound shall be sodium silicate type.
4. Apply compounds according to manufacturer's directions.
5. Slabs receiving carpet or are of exposed concrete in the finished structure shall receive the "Curing and Sealing Compound". Exclude exterior walks and pavements.
6. Slabs receiving resilient tile or cementitious or other toppings are to receive the "Curing and Hardening Compound".
7. Verify the compatibility of the compound with the applied coverings or toppings.
8. Submit manufacturer's data.
9. Application of Curing and Sealing and Curing and Hardening Compound: Apply compound to concrete floors and slabs according to manufacturer's directions and as follows:

   a. After fresh placed concrete surface has been finished and will not be marred by application, uniformly apply undiluted compound by spray, brush or squeegee without allowing compound to collect in low spots.
   b. Keep traffic off surface for 24 hours or until surface is completely dry.
   c. Within 1 week of a date set by the A/E, thoroughly clean and wash exposed concrete interior floors, then apply a second uniformly applied coat of the specified Curing and Sealing Compound without allowing compound to collect in low spots. Keep traffic off surface for 24-hours following the second coat, or until surface is completely dry. Exclude walks, pavements, and exterior slabs.

B. Temperature, Wind, and Humidity: The requirements of "Production of Concrete" shall decide the conditions and precautions for hot weather concreting.
2.014 TESTING

A. Comply with Chapter 16 of ACI 301, Section 03312 - Concrete Testing, and the following:

1. Testing Agencies: The cost of testing services unless specified otherwise, will be as follows:
2. Services described in Paragraphs 16.3.1, 16.3.2, and 16.3.3 of ACI 301 (review or check test Contractor's materials and mix design, secure and test production samples at plants or stock piles) will be paid by Miami-Dade Transit, as required by the engineer.
3. Services described in Paragraphs 16.3.4, 16.3.5, and 16.3.6 of ACI 301 (strength, slump, and temperature tests of concrete) will be paid by Miami-Dade Transit.
4. If air entrained concrete is specified, tests according to Paragraphs 16.3.5 and 16.3.6 of ACI 301 (air content will be paid by Contractor.
5. Services described in Paragraph 16.5 of ACI 301, additional testing and inspection because of changes proposed by Contractor, additional testing because of failure to meet specifications shall be paid by Contractor.

B. Testing Services:

1. For strength test of concrete, mold, cure, and test 5 specimens. Test 1 at 3 days, 1 at 7 days, 2 at 28 days, and one reserve.
2. Make 1 strength test for each 50 cubic yards or fraction thereof placed in any 1 day.

2.015 EVALUATION AND ACCEPTANCE OF CONCRETE

A. Comply with Chapter 17 of ACI 301.

2.016 ACCEPTANCE OF STRUCTURE

A. Comply with Chapter 18 of ACI 301.

PART 3 - NOT USED.

END OF SECTION
SECTION 03 31 20

CONCRETE TESTING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, necessary equipment, services, and related work to complete the concrete testing work including, but not necessarily limited to, the following:

2. Sampling and testing of concrete.
3. Testing of grout.

1.02 REFERENCES

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

1. C31/C-96 Practice for Making and Curing Concrete Test Specimens in the Field.
7. C231-97 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

1.03 QUALITY ASSURANCE

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

1. ACI 301-89 Specifications for Structural Concrete for Buildings.
2. ACI 318-10 Code Requirements for Reinforced Concrete.
3. ACI 347-88 Recommended Practice for Concrete Formwork.

B. Testing Laboratory Qualifications:

1. Testing laboratory shall comply with state and local requirements.
2. Compression testing machines shall comply with ASTM C39.
PART 3 EXECUTION

3.01 SAMPLING FRESH CONCRETE

A. Comply with ASTM C172, except for slump to comply with ASTM C94.

B. Slump: ASTM C143, at each sample for strength tests, at each load for concrete of specified strength of 6,000 psi and greater, and at intervals not exceeding 10 minutes for concrete containing ASTM C494, Type F admixture. Perform visual slump evaluation of each load and perform test when questionable.

C. Air Content: One for each set of compressive strength test specimens and at every load where concrete is subject to hydrostatic pressure, according to the following.

1. ASTM C173 Volumetric method for lightweight or normal weight concrete
2. ASTM C231 Pressure for normal weight concrete.

D. Concrete Temperature:

1. Test hourly when air temperature is 40 degrees F. and below.
2. Test hourly when air temperature is 80 degrees F. and above.
3. Each time a set of compression test specimens is made.

E. Compression Test Specimens: ASTM C31;

1. Number of Cylinders per Set:
   a. One set of 5 standard cylinders for each compressive strength test.

2. Frequency of Sampling:
   a. One set for each 50 cubic yards or fraction thereof of each concrete class placed in any one day or for each 5,000 square feet of slab surface area placed.
   b. When frequency of testing will provide less than 5 strength tests for a given class of concrete, take samples from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

3. Point of Sampling:
   a. Samples may be taken at the discharge of the truck except when concrete is placed by conveyor or pumping, take samples at point of final placement of concrete within the structure at intervals not exceeding every 150 cubic yards placed.
   b. Samples taken at point of final placement may be in place of samples at intervals required above, or samples may be taken at point of final placement, at option of testing agency.
4. Handling:

   a. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

3.02 COMPRESSIVE STRENGTH TESTS

A. Comply with ASTM C39.

B. Time of tests:

   1. 1 specimen at 3 days, 1 specimen at 7 days.
   2. 2 specimens tested at specified age and 1 reserve.

3.03 REPORTS

A. Reports of compressive strength test shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for tests.

3.04 ACCEPTANCE

A. When strength of field-cured cylinders is less than 85 percent of companion laboratory cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

B. Strength level of concrete will be considered satisfactory if averages of sets of 3 consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

3.05 ADDITIONAL TESTS

A. The testing service will make additional test of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the engineer.

   1. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed.
   2. Contractor shall pay for such tests conducted and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION
SECTION 04100

GROUT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes grouting of sills, thresholds, frames, and other equipment shown on drawings

1.02 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM C 91 - Standard Specification for Masonry Cement
   2. ASTM C 150 - Standard Specification for Portland Cement
   3. ASTM C 270 - Standard Specification for Mortar for Unit Masonry
   5. ASTM C 476 - Specification for Grout for Masonry
   6. CRD-C621 - Corps of Engineers - Specifications for Non-Shrink Grout

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland cement: ASTM C 150, Type 1
B. Masonry cement: ASTM C 91
C. Sand: ASTM C 144
D. Water: Potable
E. Pre-Mixed Grout: Masterflow 928, manufactured by Master Builders Technologies.

PART 3 - EXECUTION

3.01 GENERAL

A. Grout spaces solid, filling the entire void between the item being set and the substrate.
   1. CRD-C588, non-shrink, compressive strength per specialty engineer, for glass door sills.

B. Mix: ASTM C 270, Type M (2500 psi).

3.02 MIXING

MDT Project No. CIP010-CT1-TR12
DIVISION 4 – MASONRY

RPQ No. 265910-R
04100 - 1 of 2
A. Ensure accurate proportioning of ingredients; mix materials until the entire batch is homogeneous and of proper consistency.

B. Retempering: Use grout within 1-1/2 hours of initial mixing and discard after it has begun to set. Do not retemper mixes in which setting has begun.

3.03 CLEANING

A. Protect items being grouted and adjacent surfaces from smears and adhesions. If necessary, use masking tape.

B. After grouting is completed, before it hardens wipe or wash off all traces from exposed surfaces.

END OF SECTION
SECTION 04851
LIMESTONE VENEER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Limestone veneer at exterior walls.
B. Metal anchors and supports.
C. Joint sealing and water repellent application.

1.02 REFERENCES


1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on stone, mortar products, and sealant products.
C. Samples: Submit two stone samples 12x12 inch in size, illustrating color range and texture, markings, and surface finish.
D. Samples: Submit mortar color samples.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with ILI Indiana Limestone Handbook.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.05 MOCK-UP

A. Construct stone wall mock-up, 4 feet high by 6 feet wide, including stone anchor accessories, sill and head flashings, window frame, corner condition, typical control joint.
B. Locate where directed.

C. Approved mock-up will be used to govern quality of stone veneer installation for whole project.

D. Mock-up may remain as part of the Work, if site-approved by Architect.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store stone panels vertically on edge, resting weight on panel edge, off the ground.

B. Protect stone from discoloration.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not place stone work when temperature is below 40 degrees F.

PART 2 - PRODUCTS

2.01 STONE

A. Limestone: As indicated on the drawings.

2.02 MORTAR


2.03 ANCHORS AND ACCESSORIES

A. Anchors and Other Components in Contact with Stone: Stainless steel, ASTM A 666, Type 304.
   1. Sizes and configurations: As required for vertical and horizontal support of stone and applicable loads.
   2. Wire ties are not permitted.

B. Support Components not in Contact with Stone: Steel, ASTM A36, galvanized after fabrication to ASTM A23 1.25 oz/sq ft.

C. Setting Buttons and Shims: Lead type.

D. Flashings: galvanized.

E. Weep/Cavity Vents: Preformed plastic tubes.

F. Bond Breaker 10 mil (0.25 mm) thick plastic sheet.
G. Sealant: Type specified in Section 07900; white color.
H. Cleaning Solution: Type which will not harm stone, joint materials, or adjacent surfaces.

2.04 STONE FABRICATION
A. Thickness: 4 inches.
B. Panel Size: Varying sizes, as indicated on drawings
C. Fabricate units for uniform coloration between adjacent units and over the full area of installation.
D. Where corner detail is not indicated, form external corners to square joint profile.
E. Slope exposed top surfaces of stone and horizontal sill surfaces for natural wash.
F. Cut drip slot in bottom surface of work projecting more than 1/2 inch over wall openings. Size slot not less than 3/8 inch wide and 1/4 inch deep; full width of projection.

2.05 WATER REPELLANT
A. Series 626, Durapell spray-applied water repellent, manufactured by Chemprobe.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Verify that support work and site conditions are ready to receive work of this section.
B. Verify that items built-in under other sections are properly located and sized.

3.02 PREPARATION
A. Clean stone prior to erection. Do not use wire brushes or implements which will mark or damage exposed surfaces.

3.03 INSTALLATION
A. Install fleshings of longest practical length and seal watertight to back-up. Lap end joint minimum 6 inches and seal watertight.
B. Set stone with consistent joint widths of 3/8 inch to 1/2 inch.
C. Install anchors and place setting buttons to support stone and to establish joint dimensions.
D. Install weep/cavity vents in vertical stone joints at 32 inches on center horizontally, immediately above horizontal fleshings, above shelf angles and supports, at bottom of walls, and at top of each cavity space; do not permit mortar accumulation in cavity space.

E. Fill joints with pointing mortar. Pack and work into voids.

F. While mortar is still moist, rub joints with a burlap sack to blend into the surrounding stone faces, to produce a uniform, rustic, rubbed stone appearance, to match agreed-upon mock-up texture, commonly referred to as "sack joint" or "smear joint" texture.

G. Add mortar to surface as required to match mock-up texture, color, and overall appearance.

3.04 TOLERANCES

A. Positioning of Elements: Maximum 1/4 inch from true position.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet; 1/2 inch in 50 feet.

C. Maximum Variation Between Face Plane of Adjacent Panels: 1/16 inch.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in any two stories.

3.05 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting any item not so indicated on Drawings.

B. Do not impair appearance or strength of stone work by cutting.

3.06 CLEANING

A. Remove excess mortar and sealant upon completion of work.

B. Clean soiled surfaces with cleaning solution.

3.07 WATER REPELLANT APPLICATION

A. Allow mortar to cure a minimum of twenty one (21) days prior to application of water repellent.

B. Remove all loose material from the surface of the masonry, leaving the surface sound, dry, and free of cracks, dirt, oils, paint, or other contaminants that may negatively affect the penetration of water repellent into the masonry.

C. Surface and air temperature must be above 40 degrees F during application of material.

D. Perform a test application to determine the exact coverage rate required for the type and porosity of limestone installed in this project.
E. Follow manufacturers written application instructions, using approved techniques for a successful application, including precautions regarding safe application of this material.

F. Perform a water test to ensure thorough saturation of all masonry surfaces has been accomplished.

G. Repeat application if necessary to produce a water repellent surface.
SECTION 04 22 00

CONCRETE UNIT MASONRY

PART I GENERAL

1.01 SUMMARY

A. Related Sections:

1. 03 30 00 – Cast-In-Place Concrete.
2. 08 11 00 – Metal Doors and Frames.
3. 09 50 00 – Metal Studs, Lath, Suspension Ceiling, Plaster, and Stucco.
4. Furnishing of other items to be built-in - Under respective sections.

1.02 REFERENCES

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

1. A82-95a Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. C55-96a Specification for Concrete Brick.
3. C90-96a Specification for Loadbearing Concrete Masonry Units.
5. C129-96a Specification for Non-Loadbearing Concrete Masonry Units.
9. C331-94 Specification for Lightweight Aggregates for Concrete Masonry Units.

1.03 SUBMITTALS

A. Submit properly identified product data on masonry units and each type of metal anchor and accessory, before starting work.

1.04 QUALITY ASSURANCE

A. Certifications: Provide certification from concrete unit masonry manufacturer stating the materials supplied meet specifications.

B. Mock-Ups: Erect, at a minimum or as otherwise directed by the engineer for size or quantity, a 6 foot long by 4 foot high by full thickness sample wall panel to represent completed exterior and interior masonry work for qualities of appearance, materials, and construction. Retain sample wall during construction for standard for completed masonry work.

C. U-block is not allowed.
1.05 PROJECT CONDITIONS

A. Environmental Conditions

   1. Temperature: 40 degrees F. minimum and rising.
   2. Weather: No application during precipitation.

PART 2 PRODUCTS

2.01 LOAD BEARING CONCRETE UNIT MASONRY

A. Weight: Normal.

B. Size: 8 inches x 16 inches x thickness indicated, 2 cell stretcher type with vertical mortar keys at each end.

C. Texture: Medium.

D. Grade: ASTM C90, Type I or II.

E. Unit Linear Shrinkage: Type I, 0.03 percent, ASTM C90.

F. Shapes: Appropriate to suit conditions.

2.02 NON-LOAD BEARING CONCRETE UNIT MASONRY

A. Weight: Normal.

B. Size: 8 inches x 16 inches x thickness indicated, 2 cell flush end type.

C. Texture: Medium.

D. Grade: ASTM C129, Type I or Type II.

E. Unit Linear Shrinkage: Type I, 0.03 percent, ASTM C90.

F. Shapes: Appropriate to suit conditions including partition top closures.

2.03 CONCRETE BRICK

A. Grade: ASTM C55, Grade N-I or N-II.

B. Size: Appropriate to suit conditions.

2.04 MORTAR

A. Portland Cement: ASTM C150, Type I, domestic.
B. Masonry Cement: ASTM C91, domestic.

C. Sand: ASTM C144.

D. Water: Potable.

E. Mortar Mix: ASTM C270, Type S, 1800 psi for above grade use, and Type M-2500 psi for below grade use. Mix accurately in following proportions by volume:

<table>
<thead>
<tr>
<th>Type S</th>
<th>Type M</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 part masonry cement</td>
<td>1 part masonry cement</td>
</tr>
<tr>
<td>1/2 part Portland cement</td>
<td>1 part Portland cement</td>
</tr>
<tr>
<td>4 parts sand</td>
<td>4-1/2 parts sand</td>
</tr>
</tbody>
</table>

2.05 REINFORCEMENT, ANCHORS, TIES, AND ACCESSORIES

A. Horizontal Joint Reinforcement: Continuous 9 gage truss design, deformed, galvanized steel, including preformed welded corners according to ASTM A82. Widths to suit thickness of block to within 1 inch of each face.

   1. Acceptable manufacturers:

      a. Blok-Trus by A.A. Wire Products.
      b. Standard Truss by Dur-O-Wal.
      c. Trus-Mesh by Hohmann and Barnard, Inc.

B. Buck Anchors: 16 gage corrugated galvanized steel, 1-1/4" wide, 8 inch long leg, with 2 inch upturned end, punched for fastenings, complete with No.10 galvanized machine screws and metal expansion anchors for securement to concrete.

C. Dovetail Slots: 22 gage galvanized with filler, 1 inch wide x 1 inch deep.

D. Dovetail Anchors: 16 gage corrugated galvanized steel, 1 inch wide x 5-1/2" long, sized to fit dovetail slots.

PART 3 EXECUTION

3.01 LOCATION OF MASONRY SYSTEMS

A. Load Bearing Units: For partitions and walls 8 inches or greater.

B. Load Bearing Lightweight Units: For partitions and walls as indicated.

C. Non-Load Bearing Units: For partitions 4 or 6 inches.

D. Concrete Brick: Filling-in to suit conditions.
E. Corners and Special Shapes: As required to suit conditions, including corners, returns, offsets, and to maintain bond.

3.02 LOCATION OF REINFORCEMENT, ANCHORS, TIES, AND ACCESSORIES

A. Horizontal Joint Reinforcement:

1. Provide at every second course and at first joint above and below openings, for all masonry, interior or exterior.
2. Use Standard No.8 ladder type and truss type for all other masonry construction.

B. Buck Anchors: Every second block course for masonry walls and partitions abutting precast concrete and wherever dovetail anchors cannot be incorporated. Secure upturned ends to concrete with specified screws and anchors.

C. Dovetail Anchors: Every second block course for masonry walls and partitions abutting cast-in-place concrete with continuous dovetail anchor slots.

3.03 ERECTION

A. Laying Units:

1. Lay masonry plumb, true to line, with level and accurately spaced courses.
2. Keep bond plumb throughout.
3. Lay corners and reveals plumb and true.
4. Avoid overplumbing of corners and jambs to fit stretcher units after they are set in position.
5. Where adjustment must be made after mortar has started to harden, remove mortar and replace with fresh mortar.
6. Use concrete brick to course out walls concealed in the finished work.
7. Cut masonry units dry.
8. Use masonry saws for cuts exposed in the finished work.

B. Tolerances:

1. Plumb masonry work within tolerance of + 1/8" in 5 feet.
2. Level courses within tolerance of 1/4" in length of any run.

C. Bond:

1. Provide common bond, with vertical joints centered over masonry unit below, except where other bonds are indicated. (Provide stack bond with vertical joints centered over joints below).
2. Bond masonry at corners and intersections.

D. Joint Treatment:
1. Block Exposed to View: (Tooled concave joints) (float finished joints) mortar thoroughly compacted and pressed against edges of units and float finish joints.
2. Concealed Block: Joints struck flush.
3. Joint Thickness: 3/8".

E. Jointing Methods:

1. Where concrete block cores are indicated to be filled with concrete, lay in full mortar beds and full mortar end joints.
2. Lay all other concrete block with full beds of mortar on vertical and horizontal face shells.
3. Furrowing of mortar not allowed.
5. Finish tooled joints to uniformly straight and true lines and surfaces, smooth and free of tool marks.
6. Uniformly rake joints between masonry and door frames to 3/8" depth to receive caulking or sealant.
7. Rake joints around flush electrical outlets in wet locations to receive caulking or sealant.

F. Mortar Filled Units:

1. First cell of blocks abutting door jambs and window frames.
2. Cells of blocks at free ends of partitions and walls.
3. Where necessary for embedment of anchors, and where otherwise shown.
4. Voids around ducts, pipes, and other items passing through masonry work.
5. Hollow metal door frames and elevator hoistway door frames in masonry walls and partitions: Grout solid with mortar as masonry is laid. Include tops of door frames.

G. Load Bearing Masonry Walls:

1. Erect masonry before reinforced concrete building frame.
2. Close masonry top course cores under poured concrete beams with paper stuffing or metal caps.
3. Do not use flush end type units against columns or poured concrete walls.

H. Non-Load Bearing Masonry Wall and Partition Anchorage:

1. Erect masonry after steel and concrete frames are in place, and after concrete floors and roof decks are in place.
2. After forms are stripped, remove slot fillers.
3. At edges of non-bearing interior masonry walls and partitions abutting concrete columns and poured concrete walls, provide corrugated dovetail type anchors.
4. Grout dovetail slots and space between end of masonry units and concrete solid.
5. Point up all joints solid and flush on both sides of partitions.
I. Partition Heights:

1. Partitions to be continuous from floor to underside of floor or roof construction above where so indicated.
2. Full height partitions and walls to be wedged tight with tile or brick set in mortar.
3. Use brick or solid units for top masonry course.
4. Point up all joints solid and flush on both sides of walls and partitions.
5. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be terminated approximately four inches above the ceiling level.

J. Concrete Fill for Masonry Cores:

1. Fill top courses of concrete masonry walls with concrete before placing or use concrete brick for top courses to assure solid masonry.

K. Pipe Chase Walls and Partitions: Erect after pipes are in place, tested, and accepted.

L. Slots, Chases, Recesses and Openings: Provide as required for work of other trades.

M. Setting of Items Furnished Under Other Sections: Set anchors, bolts, sleeves, access panels, door frames, and other items occurring in masonry as the work proceeds.

N. Securing Hollow Metal Door Frames: Set in hollow metal frames on floor, floor clips secured and frames braced in proper position. Grout anchors into masonry joints as walls are erected.

O. Lintels: Set reinforced precast concrete or coordinate installation of cast-in-place concrete lintels as indicated. Precast concrete lintels to be set in full mortar beds with 8 inches minimum bearing each end.

P. Installation of Horizontal Wall Reinforcement:

1. In masonry areas indicated to have concrete filled cores, provide reinforcement in every horizontal joint.
2. At other areas, provide reinforcing in every second block course joint and at first joint above and below openings for exterior and interior masonry.
3. Cut corners and intersections as recommended by manufacturer.
4. Extend reinforcement 6 inches into concrete tie columns and concrete encasement of steel columns poured after block is in place.
5. Unless walls have cast-in-place concrete corner tie columns, make wall and partition joint reinforcing continuous around corners and at intersections according to manufacturer's published directions.
6. Lap splices in joint reinforcement no less than 6 inches. Reinforcement shall not be continuous through expansion joints.
Q. Covers: At work stoppage, provide waterproof covers secured over exposed wall tops for weather protection.

R. Pointing: Point holes in masonry. Cut out and point up defective joints.

END OF SECTION
SECTION 04 23 00
REINFORCED UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. Related Sections:

1. 03 10 00 - Concrete Formwork
2. 03 20 00 - Concrete Reinforcement
3. 03 30 00 - Cast-in-Place Concrete

1.02 QUALITY ASSURANCE

A. Comply with provisions of applicable codes, specifications, and standards, except where more stringent requirements are shown or specified, as referred to in Sections 03 30 00 and 04 22 00.

B. Certifications: Provide certification from concrete unit masonry manufacturer stating the materials supplied meet specifications.

C. Mock-Ups: Erect, at a minimum, a 6 foot long by 4 foot high by full thickness sample wall panel to represent completed exterior and interior masonry work for qualities of appearance, materials, and construction. Retain sample wall during construction for standard for completed masonry work.

D. U-block is not allowed.

1.03 SUBMITTALS

A. Comply with applicable submittal requirements of Sections 03 30 00 and 04 22 00.

PART 2 PRODUCTS

2.01 MATERIALS

A. Formwork: Comply with applicable requirements of Section 03 10 00 Concrete Formwork.
B. Reinforcement: Comply with applicable requirements of Section 03 20 00 Concrete Reinforcement.
C. Grout: Comply with applicable portions of Section 04 22 00.
D. Masonry Materials and Accessories: Comply with applicable requirements of Section 04 22 00 Concrete Unit Masonry.
PART 3 EXECUTION

3.01 FORMWORK

A. GENERAL: Refer to Section 04 22 00 for general installation requirements of unit masonry.

B. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements. Design, erect, support, brace and maintain formwork.

C. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar grout, or concrete. Brace, tie, and support as required to maintain portion and shape during construction and curing of reinforced masonry.

D. Do not remove forms and shores until reinforced masonry member has hardened sufficiently to carry its own weight and all other reasonable temporary loads that may be placed on it during construction.

3.02 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, dirt, or other materials capable of reducing bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross section due to excessive rusting or other causes.

B. Position reinforcement accurately at the spacing shown. Support vertical bars are shown in close proximity. Provide a clear distance between bars of not less than the nominal bar diameter or 1 inch whichever is greater.

1. For columns, piers, and pilasters, provide a clear distance between vertical bars as shown, but not less than 1-1/2 times the nominal bar diameter or 1-1/2", whichever is greater. Provide lateral ties as shown.

C. Splice reinforcement bars where shown and according to applicable provisions of Section 03200, Concrete Reinforcement. Do not splice at other points unless acceptable to the A/E. Provide lapped splices, unless otherwise shown. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

D. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 5/8" on exterior face of walls and 1/2" at other locations.

E. Embed prefabricated horizontal joint reinforcing as the work progresses, with a minimum cover of 5/8" on exterior face of walls and 1/2" at other locations. Lap units not less than 6 inches at ends. Use prefabricated "L" and "T" units to provide continuity at corners and
intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

F. Anchoring:

1. Anchor reinforced masonry work to supporting structure as indicated.
2. At intersections of reinforced masonry walls with non-reinforced masonry, provide anchorage as shown.

3.03 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. General:

1. Do not wet concrete masonry units (CMU).
2. Lay CMU units with full face shell mortar beds.
3. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells.
4. Solidly bed cross-webs of starting courses in mortar.
5. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.
6. Where solid CMU units are shown, lay with full mortar head and bed joints.

B. Walls:

1. Pattern Bond: Lay CMU wall units in 1/2 running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated.
2. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams, and other special conditions.
3. Maintain vertical continuity of core or cell cavities, to be reinforced and grouted, to provide minimum clear dimensions indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
4. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

C. Columns, Piers, and Pilasters:

1. Use CMU units of the size, shape, and number of vertical core spaces shown. If not shown, use units providing minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.
3. Where bonded pilaster construction is shown, lay wall and pilaster units together to maximum pour height specified.

D. Grouting, General:

1. Use "Fine Grout" only where allowed by Section 04 22 00.
2. Use "Coarse Grout" for typical reinforced masonry construction. Use high-slump where height of any lift exceeds 4 feet.
3. Grouting Technique: At the Contractor's option, use either low lift or high-lift grouting techniques subject to the requirements as specified.

E. Low-Lift Grouting:

1. Provide minimum clear dimension of 2 inches and clear area of 8 square inches in vertical cores to be grouted.
2. Place vertical reinforcement before laying of CMU. Extend above elevation of maximum pour height as required to allow for splicing. Support in position at vertical intervals not exceeding 160 bar diameters.
3. Lay CMU to maximum pour height. Do not exceed 4 feet height, or if bond beam occurs below 4 feet height stop pour at course below bond beam.
4. Pour grout using container with spout or by chute. Rod or vibrate grout during placing. Place grout continuously. Do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2" below top course of pour.
5. Bond Beams: Stop grout in vertical cells 1-1/2" below bond beam course. Place horizontal reinforcing in bond beams. Lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

F. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension is 3 inches and 10 square inches, respectively.
2. Provide clean-out holes in first course at all vertical cells to be filled with grout.
   a. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
3. Construct masonry to full height of maximum grout pour specified, before placing grout.
4. Limit grout lifts to a maximum height of 4 feet and grout pour to a maximum height of 12 feet, for single wythe hollow concrete masonry walls, unless otherwise indicated.
5. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of
masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 10 feet.

a. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.

b. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing shown.

6. Place horizontal beam reinforcement as the masonry units are laid.
7. Embed lateral tie reinforcement in mortar joints where shown. Place as masonry units are laid, at the vertical spacing shown.

a. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than No.2 bars or 8 gage wire ties spaced 16 inches o.c. for members with 20 inches or less side dimensions, and 8 inches o.c. for members with side dimensions exceeding 20 inches.


9. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.

10. Place grout by pumping into grout spaces unless alternate methods are acceptable to the engineer.

11. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation.

a. Place grout in lifts that do not exceed 4 feet.

b. Allow not less than 30 minutes, nor more than one hour between lifts of a given pour.

c. Rod or vibrate each grout lift during pouring operation.

d. Place grout in lintels or beams over openings in one continuous pour.

12. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1 inch of vertically reinforced cavities, during construction of masonry.

13. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top
course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Metal angle corner guards.
4. Metal edgings.
5. Miscellaneous metal trim.
6. Stainless steel trim, closures, bases, corner guards and accent strips.

B. Note: Steel used in this project is required to be in compliance with 49 CFR PART 661 - BUY AMERICA REQUIREMENTS.

1.02 SUBMITTALS

A. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide templates for anchors and bolts specified for installation under other Sections.

B. Product Data for galvanized paints.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and qualifications of personnel.

E. Qualification Data: For firms and persons specified in "Quality Assurance" in 1.03 to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Design Professionals and owners, and other information specified.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:
1. AS D1.1, "Structural Welding Code - Steel."
4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.05 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.02 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
D. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
F. Malleable-Iron Castings: ASTM A 47, Grade 32510.
G. Gray-Iron Castings: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

H. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153.

I. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.03 ALUMINUM
   A. Aluminum Extrusions: ASTM B 221, alloy 6063-T6.

2.04 PAINT

2.05 FASTENERS
   A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
   B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
   C. Anchor Bolts: ASTM F 1554, Grade 36.
   D. Machine Screws: ASME B18.6.3.
   E. Lag Bolts: ASME B18.2.1.
   I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in.
concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.06 GROUT

A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

B. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.07 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements in Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.08 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32”, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.09 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. General: Provide steel framing and supports indicated and as necessary to complete the Work.

C. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4" wide by 1/4" thick by 8" long at 24" o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

D. Galvanize miscellaneous framing and supports, exterior, and interior where indicated.

2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6" from each end, 6" from corners, and 24" o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior: All steel items
2. Interior, where indicated.

2.12 STAINLESS STEEL WORK

A. General: Provide metals free from surface blemishes where exposed to view in finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

B. Form metal to required shapes and sizes, with true curves, lines, and angles. Provide components in sizes and profiles indicated, but not less than that needed to comply with requirements indicated for structural performance.

C. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Drill and tap for required fasteners, unless otherwise indicated. Use concealed fasteners where possible.

D. Comply with AWS for recommended practices in shop welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of all flux, and grind smooth all exposed and contact surfaces.

E. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

F. Finish exposed surfaces to smooth, sharp, well-defined lines and arris. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Remove or blend tool and die marks and stretch lines into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches.

2.13 FINISHES
A. GENERAL

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Finish metal fabrications after assembly.

B. STEEL AND IRON FINISHES

1. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   a. ASTM A 123, Grade 50 (2.0 oz./sq.ft.), for galvanizing steel and iron products.

2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
   a. Exterior and Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
   a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

C. ALUMINUM FINISHES

1. Finish designations prefixed by MDAD comply with the system established by the Aluminum Association for designating aluminum finishes.


D. STAINLESS STEEL FINISHES

1. No. 4 Satin finish, unless otherwise noted.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

### 3.02 SETTING BEARING AND LEVELING PLATES


B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.03 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
3.04 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09900, Painting.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION
SECTION 05 10 00
METAL FRAMING
PART 1 GENERAL

1.01 SUMMARY

A. Related Sections:
   1. 033000 – Cast-in-Place Concrete
   2. 042200 – Concrete Unit Masonry

1.02 REFERENCES

A. America Society for Testing and Materials (ASTM):
   6. A385-80(96) Practice for Providing High Quality Zinc Coatings (Hot Dip).
   7. A490-93 Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
   8. A500-93 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

1.03 QUALITY ASSURANCE

A. Florida Building Code (FBC).
C. American Welding Society (AWS); Structural Welding Code, AWS D1.1.
D. Steel Structures Painting Council (SSPC).
E. Where requirements of AWS are in conflict with requirements of AISC, requirements of AISC shall take precedence.
1.04 SUBMITTALS

A. Submit both shop and erection drawings with indexes for structural steel for review before starting work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rolled Shapes and Plates: ASTM A36.
B. Anchor Bolts: ASTM A307, with regular series hexagonal head nuts, unless otherwise specified, hot dipped galvanized where noted.
C. Nuts and Bolts Except Anchor Bolts: ASTM A325, washers as required. Bolts connecting galvanized members shall also be galvanized.
D. Electrodes: E70 or F7 Series, as appropriate.
E. Shop Paint: Manufacturer's standard, compatible with finish coats.
F. Structural Tubing: ASTM A500, Grade B, Fy=46KSI.
G. Pipe: ASTM A501, Fy=36 ksi or ASTM A53, type E or S, Grade B, Fy=35 ksi.

PART 3 EXECUTION

3.01 INSPECTION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

3.02 INSTALLATION

A. Unless otherwise specified, comply with AISC specifications and "Standards" for fabrication and erection.
B. Connections:
   1. Shop connections shall be welded or bolted at the option of the Contractor, unless otherwise indicated.
   2. Field connections shall be bolted except where specifically indicated to be welded. Field moment connections may be welded.
   3. Bolts shall be ASTM A325, friction type, unless otherwise indicated.
   4. Connections shall be as generally indicated where the complete connection is shown.
   5. Connections not detailed will be designed by the Contractor for the controlling stresses indicated using AISC requirements.
   6. Minimum connection is two 3/4” diameter ASTM A325, bolts or equivalent in weld, (15.5K).
7. For framed connections in non-composite construction and for beams without concentrated loads, where reactions are not indicated, design the connection for one-half of the total uniform load capacity of the beam shown in "Tables for Allowable Loads on Beams", AISC.

8. Where moment connection or continuous framing is indicated, design connections for the moment indicated, but not less than 50 percent of the moment capacity, however, where the design moment is not given, design the connection for 100 percent of the moment capacity. Moment connections shall be Type 1, rigid frame.

9. Columns shall be detailed as indicated, bearing surfaces shall be finished (planed).

10. Moment connections, shop or field, shall not have bolts through the top flange plates to avoid interference with the metal decking.

11. Stiffened seats, unless indicated, are not allowed unless the Contractor verifies architectural clearances are maintained and interferences with any elements of the building will not occur.

C. Shop Cleaning: Clean steel to the requirements of SSPCSP2.

D. Shop Painting: Shop paint steel except steel intended to be encased in concrete and steel to be hot dipped galvanized.

E. Erection Marks:

1. Column marks shall be the column number assigned on the structural drawings supplemented by tier or level number.
2. Beam marks shall be prefixed by floor or level number.

F. Hot Dip Galvanize After Fabrication: According to ASTM A123, ASTM A385, and ASTM A123, all steel exposed to the weather, namely. Erect those members with galvanized ASTM A325 bolts. Seal weld all members to be hot dipped galvanized.

G. Camber: Shop or mill camber beams indicated.

3.03 TESTING

A. Miami-Dade Transit may elect to inspect work in shop or field or both by nondestructive means as specified.

1. Contractor shall make no claim for extra work or delay using as a basis the inspection of work by the Miami-Dade Transit.

B. Welding Inspection:

1. Inspector designated by Miami-Dade Transit will assume the duties and responsibilities of "Inspector" specified in Chapter Six of AWS D1.1-79.
2. Acceptance Criteria:
   a. Visual: AWS D1/1, Para.3.7 and 8.15.
   b. Radiographic, Ultrasonic, Magnetic Particle, and Dye Penetrant: AWS D1.1, Para.8.15.
c. Where more than one type of testing is used, acceptance criteria is "passing" all testing procedures used.

3. Inspector will spot inspect by ultrasonic means, 100 percent (one spot per weld) of all tension groove welds and 50 percent of all compression groove welds shop and field.

   a. Where metal thickness is less than 5/16", radiographic spot testing will be used.

4. Inspector will inspect welds by visual rules.

5. Inspector may use radiographic means where ultrasonic testing is not feasible.

6. Inspector may supplement any testing with dye penetrate, magnetic, radiographic, or ultrasonic plans.

7. Contractor shall be responsible for associated costs of inspections including handling, surface preparation and repair of discontinuities.

C. Provide ladders or other appropriate means for inspecting personnel to properly gain access to field joints.

D. Bolting Inspection: Inspector will test bolts both in the shop and in the field by methods specified in "Structural Joints Using ASTM A325 or ASTM A490 Bolts".

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Wood blocking, nailers, grounds, furring, shims, window and door opening sub-frames.
2. Rough hardware, fasteners, metal framing anchors.
3. Plywood sheathing, sleeves and liners.
4. Miscellaneous rough carpentry, shown or required for completion of work, or reasonably inferable.

1.02 REFERENCES

A. MIL-L-19140-C - Lumber and Plywood, Fire Retardant Treated.
B. MIL-V-13518C(1) - Wood Preservative: Tetrachlorophenol and Pentachlorophenol, Surface Sealing Compound.
C. PS 1 - Construction and Industrial Plywood.

1.03 QUALITY ASSURANCE

A. Lumber: Visible grade stamp of agency certified by National Forest Products Association (NFPA).

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber: PS 20; Douglas fir, longleaf Southern Yellow Pine, or Hemlock, graded in accordance with established grading practices and rules for intended use; maximum moisture content 19 percent, pressure treated where exposed to the weather or in contact with concrete or masonry, and unless otherwise specified, surfaced on four sides. Sizes for materials other than lumber to conform to requirements of the rules or standards under which they are produced. Nominal and actual sizes to be within manufacturing tolerances allowed by standard under which product is produced.
B. Wood blocking, nailers, grounds, etc.: No. 2 Common LL Southern Pine or Construction Grade Douglas fir.

1. Shims: Western Red Cedar.
2. Rough Hardware: Galvanized for exterior use and prime coated for interior use.

C. Plywood for General Use: PS 1 exterior type, maximum moisture content 19 percent, bearing APA grade mark. Grade C-C plugged EXT-APA, or better. Thickness to be as indicated or required.

D. Plywood for Permanent, Exposed to View Uses: APA PS 1, EXT-DFPA-A-A or PS 1-66 INT-DFPA-A-A grade for exterior and interior application, respectively, or as indicated on the drawings. See Structural Drawings for exposed roof sheathing requirements.

E. Grading and Marking: Lumber and plywood to bear grade mark, stamp, or other identifying marks indicating grade of material and rules or standards under which they are produced, including requirements for qualifications and authority of inspection organization, usage of authorized identification, and information included in identification. Inspection agency for lumber shall be certified by Board of Review, American Lumber Standards Committee, to grade species used. Except for plywood and lumber, bundle marking or certificates will be permitted in lieu of marking each individual piece.

F. Nails, Spikes and Staples: Stainless steel at fascia and all other exterior locations exposed to weather; Galvanized for other exterior or high humidity locations and treated wood; stainless steel nails at wood trellis; plain finish for other interior locations; size and type to suit application in accordance with FS FF-N-105. Provide 8-penny minimum for nailing 1\" thick nominal lumber and for toe nailing 2\" thick nominal lumber and 16-penny minimum for nailing 2\" nominal lumber.

G. Bolts, Nuts, Washers, Lags, Pins and Screws: Medium carbon steel; sized to suit application, galvanized for exterior or high humidity locations and treated wood; cadmium or zinc plated finish for interior locations, sizes suited or indicated for intended use. See Structural Drawings for additional requirements.

H. Fasteners: As shown on the drawings or equal approved by the Engineer.

I. Clip Angles: 3/16\" thick galvanized steel, sizes best suited for intended use; or galvanized steel patented commercial clips specifically designed for type of wood connections required.


K. Glue: All glue shall be waterproof, of best quality.

L. Wood Preservatives for On-Site Use: Pentachlorophenol 5% solution in light petroleum vehicle, water repellent, tinted for framing lumber, clear for exposed locations, or equal approved.
2.02 WOOD TREATMENT

A. Fire Retardant: Where indicated on drawings. Chemically treated and pressure impregnated in accordance with MIL-L-19410 or AWPA recommended practice C20, capable of providing a maximum flame spread rating of 25. Mark each piece except where natural or transparent finish is scheduled.

B. Pressure Treated Lumber: Stress grade (f 1500) Southern Pine, clearly labeled as pressure treated in accordance with specifications of the American Wood Preservers Association for a minimum retention of 6 lbs. per cubic foot and full penetration.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Carpentry: True, tight and well-nailed or connected, with all members assembled in accordance with drawings and NFPA Manual for House Framing, and pertinent Codes and regulations.

B. Select structural members, choosing individual pieces so that knots and obvious defects will not interfere with placing bolts, nailing, or making connections.

C. Discard lumber that contains defects which will render it unable to serve its intended function.

D. Jointing: Make joints to conceal shrinkage. Miter exterior corners. Cope interior corners. Miter or scarf end-to-end joints. Install trim in pieces as long as possible, jointing only where solid support is obtained. Use Liquid Nails at all joints.

E. Fastening: Nail trim with finish nails of proper dimension to hold member firmly in place without splitting. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the published requirements of metal framing anchor manufacturer.

F. Finishing: Dress and machine sand exposed woodwork surfaces where required to receive finish without machine or tool marks, abrasions, raised grain or other defects. Set exposed nails for putty and countersink with a nail punch.

G. Lumber may be rejected by the Architect, whether it has been installed or not, for excessive warp, twist, bow, mildew, fungus, or decay, as well as for improper cutting and fitting.

H. Blocking: Install blocking and backing as shown on drawings or as required to support items of finish.

I. Nails: Do nailing without splitting wood, preboring as required. Replace split members.

J. Bolts: See Structural Drawings for requirements.
1. Bolt threads shall not bear on wood; use washers under head and nut where both bear on wood; use washers under all nuts.

K. Wood sub-frames for Metal Window and Door Jambs: Pressure treated, one-piece and filling the jamb cavity of the aluminum frame. Frame openings out to the required dimension, square and plumb.

L. Wood Doors: Fitted, hung and trimmed, with clearances of 1/16" at sides and head, undercut 3/8" above the finish Flooring or as noted on drawings, plumb, true and easy-swinging.

3.02 FURRING

A. Except where indicated to be furnished under other sections, furnish and install required wood furring.

B. Use preservative pressure treated lumber in contact with concrete or masonry.

C. Install in flat plane using shims to provide true surface for finishes to be applied.

D. Use concrete nails for fastening to concrete and concrete block.

END OF SECTION
SECTION 07415
STANDING SEAM METAL ROOFING

PART 1 - GENERAL

1.01  SUMMARY

A. Section includes preformed, prefinished standing seam metal roofing, flashings, miscellaneous trim, closures, drip flashing, accessories, sealant and fastening devices.

1. Note: Steel used in this project is required to be in compliance with 49 CFR PART 661 - BUY AMERICA REQUIREMENTS.

1.02  REFERENCES

A. American Iron & Steel Institute (AISI) Specification for the Design of Cold-formed Steel Structural Members.

B. ASTM A-525 Steel Sheet, Zinc-Coated (Galvanized).

C. ASTM E-1680.

D. ASTM E-1646.

E. ASTM E-1592.

F. Spec Data Sheet — Galvalume Sheet Metal by Bethlehem Corp.


1.03  ASSEMBLY DESCRIPTION

A. The roofing assembly includes preformed sheet metal panels, related accessories, valleys, hips, ridges, eaves, corners, rakes, miscellaneous flashing and attaching devices.

1.04  SUBMITTALS

A. Submit detailed drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories. Show details of weatherproofing, terminations, and penetrations of metal work.

B. Submit a sample of each type of roof panel, complete with factory finish.

C. Submit results indicating compliance with minimum requirements of the following performance tests:
1. Air Infiltration — ASTM E 283
2. Water Infiltration — ASTM E 331
3. Hydrostatic-Head Resistance – ASTM E 2140
4. Structural Performance – ASTM E 1592
5. Vertical Deflection – Not greater than L/240 of the span.
6. Wind Uplift — U.L. 90
7. Structural performance test per ASTM E 1592. Vertical deflection shall not be greater than L/240 of the span.

D. Submit calculations with registered engineer seal, verifying roof panel and attachment method resists wind pressures imposed on it pursuant to the Florida Building Code.

E. Submit Miami-Dade County Notice of Acceptance: Provide a current Miami-Dade County Notice of Acceptance in support of configurations, sizes and design pressures for the roofing system to be provided.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in Architectural Sheet Metal Products with ten (10) years minimum experience.

B. Installer shall be trained and approved by manufacturer

C. Testing agency shall meet qualifications per ASTM E 329 for testing indicated.

D. Source Limitations: All components listed in this section shall be provided by a single manufacturer or approved by the primary roofing manufacturer

E. No product substitutions shall be permitted without meeting specifications.

F. Substitutions shall be submitted 10 Days prior to Bid Date and acceptance put forth in an addendum.

G. No substitutions shall be made after the Bid Date.

1.06 DELIVERY, STORAGE AND HANDLING

A. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness.

B. Panels should be stored in a clean, dry place. One end should be elevated to allow moisture to run off.

C. Panels with strippable film must not be stored in the open, exposed to the sun.

D. Stack all materials to prevent damage and to allow for adequate ventilation.

1.07 WARRANTY
A. Provide manufacturers full-system warranty on material and installation with single source coverage and no monetary limitation where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.

1. Duration: Twenty (20) years from the date of completion.

B. Paint finish shall have a twenty year guarantee against cracking, peeling and fade (not to exceed 5 N.B.S. units).

C. Applicator shall furnish guarantee covering watertightness of the roofing system for the period of two (2) years from the date of substantial completion.

PART 2 - PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

A. Series 300, 22 Gage Structural Galvalume Steel Roof System, as manufactured by Innovative Metals Company, Tucker, GA (NOA 09-224.04), is established as Basis of Design and shall serve to establish a standard of comparison for quality and product composition or construction. The use of a manufacturer's proprietary product names to designate materials and finish is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Subject to compliance with requirements of this section, at the sole discretion of the Architect, products by other manufacturers may be acceptable.

B. Products of the following manufacturers will be considered, providing their products equal or exceed the quality specified; and they can provide products of the type, size, function, and arrangement required.

1. Architectural Metal Systems, Inc., Eufaula, Alabama
2. Berridge Manufacturing Co., Houston, Texas
5. Met Roofing, Inc., Miami, Florida
6. Copper Sales Inc., Uni-Clad, Pompano Beach, Florida

C. Preformed metal roofing shall consist of minimum 1-1/2" high, vertical leg field crimped, standing seam panels, 16" O.C., with concealed fasteners.

D. Finish to be factory applied Galvalume “Plus” coating over thoroughly cleaned and pretreated galvanized coated. Coating to be applied prior to fabrication of roofing components.

E. When required, panel assembly to bear Underwriters Laboratories Label UL90, pursuant to Construction Number 296 & 297 and/or Fire Ratings.

F. Manufacture's standard sections as required for support and alignment of metal panel system shall be provided.
2.02 ACCESSORY MATERIALS

A. Fasteners: Stainless Steel with washers where required.

B. Sealant: As specified in Section 07900 and roofing manufacturer. Seam sealant must be compatible with panel materials, non-staining, and do not damage panel finish.

C. Vinyl insert as required by NOA.

Sealant tape be provided where required for weather-tight installation. Sealant tape shall be permanently elastic, non-sag, nontoxic, non-staining tape with release-paper backing.

2.03 FABRICATION

A. Metal panels and accessories shall be fabricated and finished at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill performance requirements demonstrated by laboratory testing.

B. All exposed adjacent flashing shall be of the same material and finish as the roof panels.

C. Fabrication of flashing and trim shall comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual".

D. Hem all exposed edges of flashing on underside, 1/2".

PART 3 - EXECUTION

3.01 INSPECTION

A. Substrate:

1. Examine plywood or metal deck to ensure proper attachment to framing.
2. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves or projections, level to +/- 1/4" in 20', and properly sloped to valleys and eaves.
3. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

3.02 INSTALLATION

A. Comply with manufacturer’s standard instructions and conform to standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.

B. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.

C. Install starter and edge trim before installing roof panels.
D. Remove protective strippable film prior to installation of roof panels.

E. Attach panels using manufacturer’s standard clips and fasteners, spaced in accordance with approved shop drawings.

F. Install sealants for preformed roofing panels as approved on shop drawings.

G. All required flashing and trim be provided as necessary for a weather-tight panel system.

H. Closure strips be provided where required to ensure weather-tight construction.

I. Do not allow panels or trim to come into contact with dissimilar materials.

J. Do not allow traffic on completed roof. If required, provide cushioned walk boards.

K. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.

L. Remove and replace any panels or components which are damaged beyond successful repair.

3.03 CLEANING

A. Clean any grease, finger marks or stains from the panels per manufacturer’s recommendations.

B. Remove all scrap and construction debris from the site.

END OF SECTION
SECTION 07540

THERMOPLASTIC POLYOLEFIN SINGLE PLY MEMBRANE ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes thermoplastic single-ply roofing

1.02 REFERENCES

A. Factory Mutual (FM Global) - Approval Guide
B. Underwriters Laboratories (UL) - Roofing Systems and Materials Guide (TGFU R1306)
C. American Society for Testing and Materials (ASTM) - Annual Book of ASTM Standards
D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual
E. National Roofing Contractors Association (NRCA)
F. American Society of Civil Engineers (ASCE)
G. Florida Building Code

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.04 PERFORMANCE REQUIREMENTS

A. Provide an installed roofing membrane and base flashing system that does not permit the passage of water, and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.
B. GAFMC shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.
C. Comply with Miami-Dade County Product Approval.

1.05 SUBMITTALS

A. Product Data: Provide product data sheets for each type of product indicated in this
section.

B. Shop Drawings: Provide manufacturers standard details and approved shop drawings for the roof system specified.

C. Samples: Provide samples of fasteners, membrane materials and accessories for verification of quality.

D. Certificates: Installer shall provide written documentation from the manufacturer of their authorization to install the roof system, and eligibility to obtain the warranty specified in this section.

E. Miami-Dade County Product Approval

1.06 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: GAFMC shall provide a roofing system that meets or exceeds all criteria listed in this section.

B. Installer’s Qualifications:

1. Installer shall be classified as a Master Select® contractor as defined and certified by GAFMC.

C. Source Limitations: All components listed in this section shall be provided by a single manufacturer or approved by the primary roofing manufacturer.

D. Final Inspection

1. Manufacturer’s representative shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed.

1.07 PRE-INSTALLATION CONFERENCE

A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, GAFMC representative and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions and agreements reached (or disagreements), and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to roofing work.

1.08 REGULATORY REQUIREMENTS

A. All work shall be performed in a safe, professional manner, conforming to all federal, state and local codes.

1.09 DELIVERY, STORAGE AND HANDLING
A. Deliver all roofing materials to the site in original containers, with factory seals intact. All products are to carry either a GAFMC or BMCA® label.

B. Store all pail goods in their original undamaged containers in a clean, dry location within their specified temperature range.

C. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.

D. Remove manufacturer supplied plastic covers from materials provided with such. Use “breathable” type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each work day. Do not remove any protective tarpaulins until immediately before the material will be installed.

E. Materials shall be stored above 55°F (12.6°C) a minimum of 24 hours prior to application.

1.10 PROJECT CONDITIONS

A. Weather

1. Proceed with roofing only when existing and forecasted weather conditions permit.
2. Ambient temperatures must be above 45°F (7.2°C) when applying hot asphalt or water based adhesives.

1.11 WARRANTY

A. Provide Manufacturers standard WeatherStopper® Diamond Pledge® Guarantee with single source coverage and no monetary limitation where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.

1. Duration: Twenty-Five (25) years from the date of completion.

B. EverGuard® TPO Reflectivity Limited Warranty: GAFMC warrants to the original building owner, that the EverGuard® TPO white roof membrane will meet or exceed the initial and “aged” ENERGY STAR® reflectivity requirements for low slope roofing membranes (65% initial, 50% aged) when installed and maintained in accordance with GAFMC’s requirements. The aged reflectivity shall meet or exceed these requirements when measured after cleaning the membrane in accordance with GAFMC recommendations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER
A. Products by GAF Materials Corporation - 1361 Alps Road, Wayne, NJ 07470 are established as Basis of Design and shall serve to establish a standard of comparison for quality and product composition or construction. The use of a manufacturer's proprietary product names to designate materials and finish is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Subject to compliance with requirements of this section, at the sole discretion of the Architect, products from other manufacturers may be acceptable.

2.02 MEMBRANE MATERIALS

A. Everguard TPO FB Ultra, smooth type, polyester scrim reinforced thermoplastic polyolefin membrane, fleece-backed, with a nominal 0.060 inch (60 mil) thickness, for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed, FM Approved, Miami-Dade County Product Approval No. 14-0128.02, Florida Building Code Approved. White membrane is CRRC Listed and Title 24 Compliant.

1. Color: White

2.04 FLASHING MATERIALS

A. A smooth type, polyester scrim reinforced thermoplastic polyolefin membrane with a nominal 0.060 inch (60 mil) thickness, for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed, FM Approved, Miami-Dade County Product Approval No. 08-0221.09, Florida Building Code Approved. White membrane is CRRC Listed and Title 24 Compliant.

1. Color: White

2.05 ADHESIVES, SEALANTS and PRIMERS

A. Water-based Bonding Adhesive: Water based rubberized adhesive for use with EverGuard TPO membranes, LRF Adhesive O Bonding Adhesive, by GAFMC.

B. Solvent based liquid, required to protect field cut edges of EverGuard TPO membranes. Applied directly from a squeeze bottle, EverGuard TPO Cut Edge Sealant, by GAFMC.

C. Solvent based primer for preparing surfaces to receive butyl based adhesive tapes, EverGuard Primer, by GAFMC.

D. Solvent based seam cleaner used to clean exposed or contaminated seam prior to heat welding, EverGuard TPO Seam Cleaner, by GAFMC.

E. One part butyl based high viscosity sealant suitable for sealing between flashing membrane and substrate surface behind exposed termination bars and for sealing between roofing membrane and drain flange. EverGuard® Water Block, by GAFMC.

F. 100% solids epoxy based two-part sealant suitable for filling sealant pans at irregularly-shaped penetrations. Epoxy is part A. Polyamide is part B. EverGuard® 2-Part Pourable
2.06 ACCESSORIES

A. Extruded aluminum termination bar with angled lip caulk receiver and lower leg bulb stiffener. Pre-punched slotted holes at 6” on center or 8” on center. 3/4” x 10’ with 0.090” cross section, EverGuard® Lip Termination Bar, by GAFMC.

B. A smooth type, unreinforced thermoplastic polyolefin based membrane for use as an alternative flashing/reinforcing material for penetrations and corners. Required whenever preformed vent boots cannot be used, White, 0.055 inches (55 mils) nominal thickness, EverGuard® TPO UN-55 Detailing Membrane, by GAFMC.

C. An 8" (20 cm) wide smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip for use as a cover strip over coated metal and stripping-in coated metal flanges and general repairs: 0.045 inches (45 mils) nominal thickness, White and Hartford GreenEverGuard®TPO 45 mil Utility Flashing Strips, by GAFMC.

D. 24 gauge steel with 0.025” thick TPO based film. Factory supplied in sheets and required for fabrication into metal gravel stop and drip edge profiles, metal base and curb flashings, sealant pans, and scupper sleeves, available in White, EverGuard® TPO Coated Metal, by GAFMC.

E. 0.075” thick molded TPO membrane sized to accommodate most common pipe and conduits, (1” to 6” diameter pipes), including square tube. Hot-air welded directly to EverGuard TPO membrane, supplied with stainless steel clamping rings, EverGuard® TPO Preformed Vent Boots by GAFMC.

F. 0.45” thick molded TPO membrane boots are split to accommodate most common pipes and conduits and available in three standard sizes, EverGuard® TPO Preformed Split Pipe Boots, by GAFMC.

G. 0.060” thick molded TPO membrane designed to accommodate both inside and outside corners of base and curb flashing. Hot-air welds directly to EverGuard TPO membrane. Size 4” x 4” with 6” flange, EverGuard® TPO Preformed Corners by GAFMC.

H. .055” thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints. EverGuard® UN-55 T-Joint Patches, by GAFMC.

I. Universal style expansion joint covers fabricated to accommodate both wall and field applications, made of .060” thick reinforced TPO membrane. EverGuard® TPO Preformed Expansion Joint Covers, by GAFMC.

J. .045” reinforced TPO membrane with pressure sensitive adhesive, to be installed on horizontal surfaces using plates and fasteners as a base attachment in fully adhered systems. Size 6” x 100’, EverGuard® RTS (Roof Transition Anchor) Strip, by GAFMC.

K. .045” thick reinforced TPO membrane fabricated corners. Four corners are required to
L. 8” diameter, nominal .050” unreinforced TPO membrane for use in flashing outside corners of base and curb flashings, EverGuard® TPO Fluted Corner, by GAFMC.

M. 1/8” thick extruded and embossed TPO roll 30” x 50’, heat welds directly to roofing membrane. Unique herringbone traction surface. Gray in color, EverGuard® TPO Walkway Rolls, GAFMC.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that the surfaces and site conditions are ready to receive work.

B. Verify that the deck is supported and secured.

C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.

D. Verify that the deck surfaces are dry.

E. Verify that all roof openings or penetrations through the roof are solidly set, and that all flashings are tapered.

3.02 SUBSTRATE PREPARATION

A. Concrete

1. Concrete surfaces shall be dry and properly cured.
2. The roof system shall be installed immediately following deck curing to prevent damage from exposure to precipitation. The deck manufacturer determines the minimum curing time and maximum exposure limitations.
3. If concrete deck receives precipitation prior to installation of the roof membrane, the deck must be checked for moisture content and dryness.
4. After removal of wet or deteriorated materials patch concrete decks with patching materials approved by the roofing manufacturer.

3.03 INSTALLATION - GENERAL

A. Install GAFMC’s EverGuard® TPO roofing system according to all current application requirements in addition to those listed in this section.

B. GAFMC EverGuard® TPO Specification #: T-FA-N-N-60FB

C. Start the application of membrane plies at the low point of the roof or at the drains, so that the flow of water is over or parallel to, but never against the laps.
3.04 MEMBRANE APPLICATION

A. Fully Adhered:

1. Place membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent attachment. Roof membrane shall be fully adhered immediately after it is rolled out, followed by welding to adjacent sheets.

2. Overlap roof membrane a minimum of 3” (15 cm) for side laps and 3” (15 cm) for end laps.

3. Install membrane so that the side laps run across the roof slope lapped towards drainage points.

4. All exposed sheet corners shall be rounded a minimum of 1”.

5. Use full width rolls in the field and perimeter region of roof.

6. Use appropriate bonding adhesive for substrate surface, applied with a solvent-resistant roller, brush or squeegee.

7. Apply bonding adhesive at 5 squares of finished, mated surface area per 5 gallons (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition.

8. Prevent seam contamination by keeping the adhesive application a few inches back from the seam area.

9. Adhere approximately one half of the membrane sheet at a time. One half of the sheet’s length shall be folded back in turn to allow for adhesive application. Lay membrane into adhesive once the bonding adhesive is tacky to the touch.

10. Roll membrane with a weighted roller to ensure complete bonding between adhesive and membrane.

11. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.

12. Weld shall be a minimum of 1-1/2” in width for automatic machine welding and a minimum 2” in width for hand welding.

13. All cut edges of reinforced membrane must be sealed with EverGuard® TPO Cut Edge Sealant.

14. Supplemental membrane attachment is required at the base of all walls and curbs, and where the angle of the substrate changes by more than five (5) degrees (1” in 12”). Roofing membrane shall be secured to the structural deck with appropriate Drill-Tec® screws and plates spaced every 12” o.c. The screws and plates must be installed no less than ½” from the membrane edge. Alternatively, the roofing membrane may be turned up the vertical plane a minimum of 3” and secured with screws and termination bar fastener spacing is the same as is used for in-lap attachment. The termination bar must be installed within 1-1/2” to 2” of the plane of the roof membrane, with a minimum of 1” of membrane extending above the termination bar.

15. Supplemental membrane attachment to the structural deck is required at all penetrations unless the insulation substrate is fully adhered to the deck. Roofing membrane shall be secured to the deck with appropriate Drill-Tec® screws and plates.

16. Fasteners must be installed to achieve the proper embedment depth. Install fasteners without lean or tilt.

17. Install fasteners so that the plate or termination bar is drawn down tightly to the
membrane surface. Properly installed fasteners will not allow the plate or termination bar to move (underdriving), but will not cause wrinkling of the membrane (overdriving).

3.07 FLASHINGS

A. General:

1. All penetrations must be at least 24” (61 cm) from curbs, walls, and edges to provide adequate space for proper flashing.
2. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
3. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.
4. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2” wide (hand welder) weld is required.
5. All cut edges of reinforced membrane must be sealed with EverGuard® TPO Cut Edge Sealant.
6. Consult the EverGuard® Application and Specifications Manual or GAFMC Contractor Services for more information on specific construction details, or those not addressed in this section.

B. Coated Metal Flashings:

1. Coated metal flashings shall be formed in accordance with current EverGuard construction details and SMACNA guidelines.
2. Coated metal sections used for roof edging, base flashing and coping shall be butted together with a ¼” gap to allow for expansion and contraction. Hot-air weld a 6” wide reinforced membrane flashing strip to both sides of the joint, with approximately 1” on either side of the joint left un-welded to allow for expansion and contraction. 2” wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
3. Coated metal used for sealant pans, scupper inserts, corners of roof edging, base flashing and coping shall be overlapped or provided with separate metal pieces to create a continuous flange condition, and pop-riveted securely. Hot-air weld a 6” wide reinforced membrane flashing strip over all seams that will not be sealed during subsequent flashing installation.
4. Provide a ½” hem for all exposed metal edges to provide corrosion protection and edge reinforcement for improved durability.
5. Provide a ½” hem for all metal flange edges whenever possible to prevent wearing of the roofing and flashing membranes at the flange edge.
6. Coated metal flashings shall be nailed to treated wood nailers or otherwise mechanically attached to the roof deck, wall or curb substrates, in accordance with construction detail requirements.

C. Reinforced Membrane Flashings:

1. The thickness of the flashing membrane shall be the same as the thickness of the roofing membrane.
Membrane flashing may either be installed loose or fully adhered to the substrate surface in accordance with “Construction Detail Requirements”.

Where flashings are to be fully adhered, apply bonding adhesive at a rate resulting in 60 square feet/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 square feet/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 square feet per gallon (Solvent Based) and 250 square feet per gallon (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.

Apply the adhesive only when outside temperature is above 40°F. Recommended minimum application temperature is 50°F to allow for easier adhesive application.

The membrane flashing shall be carefully positioned prior to application to avoid wrinkles and buckles.

D. Un-reinforced Membrane Flashings:

1. Un-reinforced membrane is used to field-fabricate penetration or reinforcement flashings in locations where preformed corners and pipe boots cannot be properly installed.

2. Penetration flashings constructed of un-reinforced membrane are typically installed in two sections, a horizontal piece that extends onto the roofing membrane and a vertical piece that extends up the penetration. The two pieces are overlapped and hot-air welded together.

3. The un-reinforced membrane flashing shall be adhered to the penetration surface. Apply bonding adhesive at a rate resulting in 60 square feet/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 square feet/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 square feet per gallon (Solvent Based) and 250 square feet per gallon (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.

E. Roof Edges:

1. Roof edge flashings are applicable for gravel stop and drip edge conditions as well as for exterior edges of parapet walls.

2. Flash roof edges with metal flanges nailed 4” O.C. to pressure-treated wood nailers. Where required, hot-air weld roof membrane to coated metal flanges.

3. When the fascia width exceeds 4”, coated metal roof edging must be attached with a continuous cleat to secure the lower fascia edge. The cleat must be secured to the building no less than 12” O.C.

4. Alternatively, roof edges may be flashed with a 2-piece snap on fascia system, adhering the roof membrane to a metal cant and face nailing the membrane 8” on center prior to installing a snap-on fascia.
5. Flash roof edge scuppers with a coated metal insert that is mechanically attached to the roof edge and integrated as a part of the metal edging.

F. Parapet and Building Walls:

1. Flash walls with EverGuard® TPO membrane adhered to the substrate with bonding adhesive, loose applied (Less than 18” in height) or with coated metal flashing nailed 4” on center to pressure-treated wood nailers.
2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars shall be mechanically fastened 8” on center; termination bars that are counter flashed shall be fastened 12” on center.
3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
   a. Fully / Self Adhered Systems 12” on center

4. All coated metal wall flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
5. Metal counterflashings may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with EverGuard® caulking.
6. Flash wall scuppers with a coated metal insert that is mechanically attached to the wall and integrated as part of the wall flashing.

G. Curbs and Ducts:

1. Flash curbs and ducts with EverGuard® TPO membrane adhered to the curb substrate with bonding adhesive, loose applied (Less than 18” in height) or with coated metal flashing nailed 4” on center to pressure-treated wood nailers.
2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the curb/duct surface and membrane flashing underneath all termination bars. Exposed termination bars shall be mechanically fastened every 8”o.c.; termination bars that are counter flashed shall be fastened 12” on center.
3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
   a. Fully / Self Adhered Systems 12” on center

4. All coated metal curb flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
5. Metal counterflashings may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with EverGuard® caulking.
H. Roof Drains:

1. Roof drains must be fitted with compression type clamping rings and strainer baskets. Original-type cast iron and aluminum drains, as well as retrofit-type cast iron, aluminum or molded plastic drains are acceptable.

2. Roof drains must be provided with a minimum 36” x 36” sump. Slope of tapered insulation within the sump shall not exceed 4” in 12”.

3. Extend the roofing membrane over the drain opening. Locate the drain and cut a hole in the roofing membrane directly over the drain opening. Provide a ½” of membrane flap extending past the drain flange into the drain opening. Punch holes through the roofing membrane at drain bolt locations.

4. For cast iron and aluminum drains, the roofing membrane must be set in a full bed of water block on the drain flange prior to securement with the compression clamping ring. Typical water block application is one 10.5 ounce cartridge per drain.

5. Lap seams shall not be located within the sump area. Where lap seams will be located within the sump area, a separate roof membrane drain flashing a minimum of 12” larger than the sump area must be installed. The roof membrane shall be mechanically attached 12” on center around the drain with screws and plates. The separate roof drain flashing shall be heat welded to the roof membrane beyond the screws and plates, extended over the drain flange, and secured as above.

6. Tighten the drain compression ring in place.

3.08 TRAFFIC PROTECTION

A. Install walkway pads/rolls at all roof access locations and other designated locations including roof-mounted equipment work locations and areas of repeated rooftop traffic.

B. Walkway pads must be spaced 2” apart to allow for drainage between the pads.

C. Fully adhere walkway pads/rolls to the roof membrane with solvent-based bonding adhesive, applied at the rate of 1 gal. per 100 sq. ft. to both the walkway and roof membrane surfaces. Press walkway in position once adhesive is tacky to the touch.

D. Alternatively, walkway pads/rolls may be hot-air-welded to the roof membrane surface continuously around the perimeter of the pad/roll.

3.09 ROOF PROTECTION

A. Protect all partially and fully completed roofing work from other trades until completion.

B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.

C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.
D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.10 CLEAN-UP

A. All work areas are to be kept clean, clear and free of debris at all times.

B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.

C. All tools and unused materials must be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.

D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.

E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.

F. Clean and restore all damaged surfaces to their original condition.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes filling of openings in floors, walls, and fire-rated partitions where pipe, conduit, ducts, and other installations (penetrations) are passing through fire-rated construction; and required fillers and accessories. Include both empty openings and openings containing penetrating items.

1.02 PERFORMANCE REQUIREMENTS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor and roof assemblies.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

1. Penetrations located outside wall cavities.
2. Penetrations located outside fire-resistive shaft enclosures.
3. Penetrations located in construction containing fire-protection-rated openings.
4. Penetrating items larger than 4-inch diameter nominal pipe or 16 sq. in. in overall crosssectional area.

D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moistereresistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide through penetration firestop
systems capable of supporting floor loads involved either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.03 SUBMITTALS

A. Product data for each type of through-penetration firestop system specified.

B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include through penetration firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Product test reports from and based on tests performed by qualified independent testing laboratory evidencing compliance of through-penetration firestop systems with requirements including fire performance characteristics.

D. Manufacturer's Certificates - signed by manufacturers of through-penetration firestop systems:

1. Certification that products meet or exceed specified requirements. Evidence of UL Certification, Warnock Hersey, or Factory Mutual Systems Approval.

2. Certification that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

E. Installer Qualification Data attesting that installer has completed through-penetration firestopping systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. In addition, Installer has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors" and successfully trained for product installation by through-penetration firestop system manufacturer

1. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to
Installer engaged by Contractor does not in itself confer qualification on buyer.

F. Submit copies of field quality-control testing and inspection reports.

G. Provide manufacturer's engineering judgment identification number and drawing details when there is no UL, Warnock Hersey or OPL system available for an application. Engineering judgment must include both project name and the contractor's name who will install through penetration firestop system as described in judgment drawing.

H. Submit copy of Warranty specified herein.

1.04 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide through-penetration firestop system 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.

B. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements to achieve a fire rating as noted on Drawings:

1. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
2. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following: UL in "Fire Resistance Directory."

C. Single Source Responsibility: Provide through-penetration firestop systems, primers, and accessories from a single manufacturer.

D. Installer Qualifications: Company specializing in installation of firestopping specified, licensed, trained and approved by manufacturer of firestop materials submitted, with experience on at least five projects of similar nature

1. Installer must provide evidence of performance on at least three successful similar size and type projects.
2. Installer must be FM approved per FM Standard 4991.
3. Installer must be licensed by the state or local authority where applicable.
4. Installer must be a member in good standing of the Firestop Contractor=s International Association (FCIA).

E. All through-penetration firestop systems will be installed by one company that will coordinate with all trades requiring through-penetration firestop systems to complete their respective installations.

F. Inspection Requirements: ASTM E 2174-01 - Standard Practice for On-Site Inspection of Installed Fire Stops.
G. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy".

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01310 - "Project Management and Coordination."

I. Information within construction documents referring to specific design designations of through penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop systems to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.07 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become
concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

1.08 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Submit written agreement on through-penetration firestop system manufacturer's standard form, signed by manufacturer, installer, and contractor, agreeing to repair or replace defective materials that do not comply with these specifications or fail to provide the fire-stopping requirements of the referenced standards for a period of three (3) years after the date of Substantial Completion and Owner Final Acceptance.

C. When available submit written agreement on through-penetration firestop system manufacturer's standard form, signed by manufacturer, agreeing to repair or replace defective materials that fail to provide an air and watertight condition after materials have cured for a period of five (5) years after the date of Substantial Completion and Owner Final Acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The following manufacturers are approved for use upon condition of submittal of shop drawings with UL assembly designations equivalent to the types indicated on the drawings. Final Record Documents will reflect the appropriate UL assembly designations for the selected manufacturer:

1. Hilti, Inc. (800) 562-2728 www.us.hilti.com
2. 3M Brand Fire Protection Products (800) 328-1687 www.solutions.3m.com

2.02 FIRESTOPPING - GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

1. For penetrations involving CPVC piping, provide through-penetration firestop systems which include materials that have been tested to be compatible with CPVC piping.

B. Accessories: Provide components for each through-penetration firestop system that are
needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-/-rock-wool-fiber insulation.
   b. Ceramic Fiber.
   c. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   d. Fire-rated form board.
   e. Fillers for sealants.

2. Temporary forming materials.
5. Steel sleeves.

C. Under normal environmental conditions, all material used shall be non-corrosive to metal and compatible with synthetic cable jackets.

D. Provide all miscellaneous items required to attach materials as specified and shown on Drawings.

2.03 FILLER MATERIALS

A. Pliable, hand applied, putty-like or foamed material, with enough consistency to retain its shape during and after installation, and which provides an immediate fire seal, is incombustible, emits no hazardous or toxic fumes when exposed to fire or high temperatures, and complies with requirements of the following standards:

1. Underwriters Laboratories classification standards for 3-hour fire rating and 3-hour cold side temperature rating or fire-ratings as required for the project.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

1. Use intumescent putties utilizing graphite-based expansion agents in lieu of sodium silicate to prevent degradation by rain or high humidity.


H. Putty Pads: Wall opening protective materials for use with UL listed metallic and specified nonmetallic outlet boxes.

I. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of plastic or glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated through penetration firestop system limits use to nonsag grade for both opening conditions.

2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.

3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces

L. Firestop Mortar based on fire-resistant microsilica compounds.

2.04 MISCELLANEOUS MATERIALS

A. Backup fillers, support frames, backup board for single access openings, primers, etc., as recommended and approved by the filler manufacturer.

B. Primer: Type recommended by through-penetration firestop system manufacturer for specific substrate surfaces.

C. Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

2.05 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of
uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

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

C. Clean opening to be sealed and remove loose material. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

1. Remove laitance and form release agents from concrete.

D. Anchor, position, and secure in place materials passing through the opening.

E. Make sure there is enough clearance between materials passing through and none are resting against the side of the opening, so that filler material can surround each item.

F. Protect adjacent finished surfaces.

3.02 INSTALLATION

A. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces. Apply primer and materials in accordance with manufacturer's instructions. All products used must be from same manufacturer for all applications.

B. Make sure there is enough clearance between materials passing through and none are resting against the side of the opening, so that filler material can surround each item.

C. Install material at walls or partition openings which contain penetrating sleeves, piping, duct work, conduit and other items, requiring through-penetration firestop system.

D. Apply through-penetration firestop system material in sufficient thickness to achieve rating to uniform density and texture.

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
E. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

F. Examine installation including sealant materials and any damming or support materials to verify integrity of installation. Where system design permits, remove damming or support materials only after it has been determined that sealant materials have fully cured or dried.

3.03 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner may engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.

1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.

B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.

C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements of tested and listed system design.

D. After installation is complete, qualified independent inspecting agency shall submit inspection findings in writing with certification that Systems and Designs were installed in compliance with requirements of tested and listed firestop system.

3.04 REPAIRS AND MODIFICATIONS

A. Identify damaged, improperly installed or reentered seals for repair or modification.

B. Modifications to penetrants shall be accomplished as per the through penetration firestop manufacturer's recommendations.

C. Only materials used in the original seal and designated by the manufacturer as suitable for said repair, shall be used for this purpose.

3.05 CLEANING AND PROTECTION
A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion and Owner Final Acceptance. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION
SECTION 07900

SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes sealing the perimeter of exterior openings where joints occur, joints on exterior of building, and other locations where shown on the drawings.

1.02 SUBMITTALS

A. Product Data: Manufacturer's literature describing performance, limitations, recommended practice, and instructions for application. Include product data sheets for backing and bond breaker materials.

B. Standard color chips for selection by the Architect/Engineer.

C. Current Miami-Dade County Product Notice of Acceptance.

D. Certificates: Submit letter of certification from manufacturer or certified test laboratory reports that materials meet the following:

1. Sealant materials are chemically compatible with each other and proposed substrate, comply with Specification requirements, and are intended for applications indicated.

2. Sealant, primers, and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

1.03 QUALITY ASSURANCE

A. Structural performance and testing, including all applicable deflection limitations, shall meet requirements of ASTM E 330.

1.04 WARRANTY

A. Exterior Silicone Sealants:

1. Manufacturer: Warrant materials for minimum 20 year period.

2. Installer: Warrant installation against air and water leakage for minimum 2 year period.

PART 2 - PRODUCTS

2.01 SEALANTS

A. Sealant for General Use: Low modulus, one-part silicone sealant, conforming to Federal
Specifications TT-S-001543A and TT-S-00230C, color to be selected by the Architect/Engineer from stock range.

1. Acceptable Sources:
   
   a. Dow Corning: 790 
   b. General Electric: Silpruf 
   c. Pecora: 862.

2.03 ACCESSORY MATERIALS

A. Solvents: Oil free, recommended by sealant manufacturer

B. Primers: Masonry or metal primers designed for use with the sealant selected and compatible with the material on which they will be used.

C. Backer Rod and Joint Filler: Flexible closed cell expanded polyethylene or neoprene.
   
   1. Rod Diameter: 125 to 150 percent of joint width.
   2. Joint Filler width: 100 to 125 percent of joint width.

D. Bond Breaker: Pressure sensitive adhesive polyethylene tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.01 APPLICATION

A. Joint Dimensions: Depth of caulking bead not less than 1/4" nor more than 1/2". Width not to exceed 1" except where otherwise noted on the drawings. Maintain a ratio of 2:1 in width over depth of sealant. Fill joints over 1/2" deep with foamed plastic fillers. Provide bond breaking tape in joints over 3/4" wide.

B. Surface Preparation: Clean and prime joint surfaces as recommended by the manufacturer of the sealant.
   
   1. Use masking tape to protect adjacent finished surfaces and keep joint edges straight and sharp.

C. Installation of backer rod
   
   1. Install backing material in joints using blunt instrument to avoid puncturing.
   2. Do not twist rod while installing.
   3. Install backing to form joint depth of 50 percent of joint width, minimum of 1/4" deep.

C. Apply the compound using nozzles of proper size and shape to fit openings, with sufficient pressure to fill the joint full, without breaks or bubbles.
D. Seal joints in warehouse control joints by filling level with joint top, leaving surface flat or concave, not convex.

E. Finishing and Cleaning: Tool joints only where required to obtain a clean, sharp joint, with a properly designed tool. Remove excess materials from adjacent surfaces, leaving a sharp edge, clean joint.

F. Apply sealant in accordance with the instructions of the manufacturer and the details on the drawings. Take special care to obtain complete adhesion of the sealant to both faces of the joint.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This section includes the following:

1. SDI Level 4 (maximum-duty Level A according to ANSI A250.8) Model 1A Full Flush, non-fire-rated doors and frames for exterior locations, of standard galvanized steel construction as indicated.
2. Door louvers for steel doors as indicated.

B. Note: Steel used in this project is required to be in compliance with 49 CFR PART 661 - BUY AMERICA REQUIREMENTS.

1.02 SUBMITTALS

A. Product Data: Submit for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, profiles and finishes.

B. Shop Drawings:

1. Submit for fabrication and installation of doors and frames.
2. Include details of frame, elevations of door, conditions at opening, details of construction, location, and installation requirements of finish hardware and reinforcements, and details of joints and connections.
3. Show anchorage and accessory items.

C. All exterior doors and frames require submission of copy of Product Control division, Notice of Acceptance in compliance with the Florida Building Code.

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. Steel Door and Frame Standard: Comply with ANSI A250.8.

1.04 DELIVERIES, STORAGE AND HANDLING

A. Delivery:

1. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage.
2. Provide additional protection to prevent damage to factory-finished doors and frames.
3. Inspect doors and frames on delivery for damage.
4. Minor damages may be repaired, provided refinished items are equal in all respects to new work and acceptable to the Architect.
5. Remove and replace damaged items as directed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames: Provide doors manufactured by one of the following manufacturers:

1. Ceco Door Products
2. Curries Co.
3. Firedoor
4. Mesker Door Co.
5. Steelcraft

2.02 MATERIALS

A. Steel:

1. Cold-Rolled Steel Sheets: Commercial Quality carbon steel, complying with ASTM A366, Type B, stretcher-leveled standard for flatness.
2. Galvanized Steel Sheets: Zinc-coated carbon steel, Commercial Quality cold rolled steel, comply with ASTM A653/A, Type B, with A40 (ZF126) zinc-iron alloy (galvannealed) coating; stretcher-leveled standard for flatness.

B. Anchors and Fasteners:

1. Supports and Anchors: Fabricate of min..042" steel, galvanized where used with galvanized frames.
2. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, comply with ASTM A153, Class C or D, as applicable.

C. Shop-Applied Paint for Steel Doors and Frames:

1. Rust-inhibitive primer enamel or paint, either air-dried or baked, suitable as base for specified finish paints.
2. Comply with ANSI A224.1, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

2.03 FABRICATION

A. General:

1. Fabricate door and frame units to be rigid, neat in appearance and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles.
Weld exposed joints continuously; grind, fill, dress, and make smooth, flush and invisible. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at Project site.

2. Wherever practicable, fit and assemble units in manufacturer's plant.

3. To assure proper assembly at Project site, clearly identify work that cannot be permanently factory-assembled before shipment,

4. Comply with ANSI/SDI-100 requirements.

5. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

6. Clearances:
   a. Max. 1/8" at jambs and heads; except max, 1/4" between nonfire-rated pairs of doors.
   b. Max. 3/4" at bottom,

7. Finish Hardware Preparation:
   a. Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier.
   b. Comply with applicable requirements of ANSI A115 Series Specifications for door and frame preparation for hardware.
   c. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.
   d. Reinforce doors and frames to receive surface-applied hardware.
   e. Drilling and tapping for surface-applied finish hardware may be done at Project site.
   f. Locate finish hardware as shown on final shop drawings or, if not shown, in accordance with Recommended Locations for Builder's Hardware, published by Door and Hardware Institute.

C. Steel Frame Construction:

1. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold-rolled steel or stainless steel.

2. Frame Thickness - Steel Doors:
   a. Level 4: 0.0747" - Exterior (Galvanized)

3. Door Silencers: Except on weather-stripped frames, drill stops to receive 3 silencers on strike jambs of single door frames and 2 silencers on heads of double door frames.

4. Plaster Guards: Provide min. 0.0179" thick steel plaster guards or mortar boxes frame, at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
D. Shop-Painting Steel Doors and Frames:

1. Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
3. Apply shop coat of prime paint of even consistency to provide uniformly-finished surface ready to receive finish paint per ANSI A250.10.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as specified.

B. Placing Frames:

1. Comply with provisions of SDI-105, Recommended Erection Instructions for Steel Frames, unless otherwise indicated.
2. Place frames before construction of enclosing walls and ceilings.
3. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
4. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
5. Masonry Construction: Locate 3 wall anchors per jamb at hinge and strike levels.

D. Door Installation:

1. Fit hollow metal doors accurately in frames within clearances specified in ANSI A250.8 and shim as required to comply with SDI 122 and ANSI/DHI Al 15.1G.

3.02 ADJUSTING AND CLEANING

A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply compatible air-drying primer touch-up.

B. Protection Removal: Immediately before final inspection, remove protective plastic wrappings from pre-finished doors.

C. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION
SECTION 08800

GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes glass in curtain wall.

1.02 SUBMITTALS

A. Product data the each glass product and glazing material indicated.

B. A sample for verification purposes of 10" square samples of the type of glass indicated and for the type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.

C. Product test reports for each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.

1.03 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. FGMA Publications: "FGMA Glazing Manual."
2. LSGA Publications: "LSGA Design Guide."

PART 2 - PRODUCTS

2.01 GENERAL

A. Glass: Meet the requirements of Fed. Spec. DD-G-451a for its type, and the Florida Building Code, for exterior application, quality equal to corresponding products of AFG Industries Inc., PPG Industries, Guardian Industries or approved equal. Glass shall be tempered or heat strengthened as necessary to meet impact loads.

2.02 MATERIALS

A. Laminated Glass:

1. 9/16" thick laminated glass consisting of an outer lite of 1/4" thick Viracon Solex Grey tempered glass plus an inner layer of clear PVB, thickness as required to meet impact loads, plus an inner lite of 1/4" thick clear tempered glass.
1. Glazing Compound: Silicone sealant, color to be selected, compatible with all materials with which it will come in contact, equal to Tremco Proglaze.
2. Dry Glazing: Extruded neoprene gaskets, black or grey.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Cut glass accurately to fit the openings and set with equal bearing around the entire pane. Conform to glazing standards of the Flat Glass Jobbers Association.

B. Provide adequate setting blocks and resilient clips as required.

3.02 CLEANING

A. At completion, clean glass and leave work in perfect condition. Remove setting compound or putty from exposed face of glass and surrounding metal.

3.03 COMPLIANCE LABEL

A compliance label shall be etched in a corner of the laminated glass, which is visible to the inspector after the mullions and framing is in place in its finished state, which states that the glass is in compliance with the requirements stated in PART 2 of this specification.

END OF SECTION
SECTION 08900
GLAZED CURTAIN WALL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes aluminum tube framing system for curtain wall.

1.02 REFERENCES

A. American Architectural Manufacturers Association:

3. AAMA - Curtain Wall Manual #10 - Care and Handling of Architectural Aluminum From Shop to Site.
4. AAMA 501 - Methods of Test for Metal Curtain Walls.
5. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls and Sloped Glazing Systems for Water Leakage.

B. American Society for Testing and Materials:

1. ANSI/ASTM A 36 - Structural Steel.
2. ASTM A 123 - Zinc Coating (Hot-Dip Galvanized) on Iron and Steel Products.
3. ANSI/ASTM A 446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
5. ANSI/ASTM B 221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
6. ANSI/ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
9. ASTM E 413 - Classification for Determination of Sound Transmission Class.

C. American Society of Civil Engineers: ASCE 7-02 Minimum Design Loads for Buildings and other Structures.

D. Florida Building Code

1.03 SYSTEM DESCRIPTION
A. Design Requirements: Glazed aluminum curtain wall system includes tubular aluminum sections with self supporting-supplementary support framing, shop fabricated, factory prefinished, vision glass; related flashings, anchorage and attachment devices.

B. Performance Requirements:

1. Design and size components to withstand dead and live loads caused by positive and negative wind acting normal to plane of wall as calculated in accordance with the Florida Building Code to establish design wind pressure.
2. Limit mullion deflection to 3/4"; with full recovery of glazing materials.
3. Allowable Stress: 1.65 safety factor.
4. System to accommodate, without damage to system, components or deterioration of seals; movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; deflection of structural support framing, shortening of building concrete structural columns, creep of concrete structural members and mid-span slab edge deflection of 1.2".
5. Air Infiltration: Completed wall system shall have 0.01 cfm/min/sq.ft .maximum allowable infiltration in accordance with ASTM 283 at differential static pressure of 6.24 PSF measured in accordance with ANSI/ASTM E 283.
6. Water Leakage: None, when measured in accordance with ASTM E 331 at a static pressure of 20PSF.
7. System to provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental affect to system components.
8. In addition to requirements shown or specified comply with applicable provisions of the Aluminum Curtain Wall Design Manual for design, fabrication and installation.

C. Comply with the Florida Building Code. The contractor shall be fully responsible for all testing and compliance requirements of the code. Nothing in this Section shall be construed as allowing or requiring noncompliance with code.

1.04 SUBMITTALS

A. Shop Drawings:

1. Submit signed and sealed shop drawings signed by a registered professional engineer in the State of Florida.
2. Submit signed and sealed structural calculations for all exterior glazing systems demonstrating compliance with the wind load impact resistance requirements by a registered professional engineer in the State of Florida.
3. Indicate system dimension, framed openings requirements and tolerance, anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and any welding requirements.
4. Building Plan, elevations, sections and details of glazing installation at framing OPENINGS.
members including head, mullions, transoms, jambs, and sills.
5. Submit member profiles, dimensions, anchorage, glazing, and building construction interface.
6. Typical unit elevations at 1/2" inch scale and details at full scale.
7. Design system to incorporate adequate provisions for guttering, weeping condensate and infiltrated water from system to exterior.

B. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details; submit framing member structural and physical characteristics, dimensional limitations, and special installation requirements; submit manufacturers installation instructions indicating special installation procedures.

C. Samples: Submit 12" samples of extrusions illustrating prefinished aluminum surface; submit specified glass, glazing materials illustrating edge and corner.

D. Quality Control Submittals:
1. Test Reports: Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and other supportive data.
2. Certificates: Submit written certification signed by a registered Professional Engineer experience in design of this work and licensed in State where Project is located that the structural support framing components and curtain wall system comply with load requirements specified herein.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer: Company specializing in fabrication of aluminum curtain wall with minimum 10 year experience. Engineer who does structural design shall have minimum 10 year experience designing aluminum curtain wall and be licensed in the State of Florida.
2. Qualifications - Installer: Company specializing in installation of aluminum curtain wall systems with minimum five years documented experienced; approved by manufacturer.

B. Mock-Ups:
1. Provide 10'-0" wide x 6'-0" high mockup as indicated in the drawings, including mullion, intermediate mullion, complete head detail assembly and vision glass lights. Assemble to illustrate complete component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.
2. Mockup may not remain as part of Work.

C. Pre-Installation Conference: Convene one week prior to commencing work of this Section at Project site with curtain wall system manufacturer, installer, and other interested parties to review procedures, schedules, and coordination of
installation with other elements of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle work of this Section in accordance with AAMA - Curtain Wall Manual #10.

B. Protect prefinished aluminum surfaces with manufacturers wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.07 PROJECT CONDITIONS ENVIRONMENTAL REQUIREMENTS

A. Environmental Requirements:
   1. Do not install sealants when ambient temperature is less than 40 degrees F.
   2. Maintain this minimum temperature during and after installation of sealants.

1.08 WARRANTY

A. Special Assembly Warranty: Standard form in which manufacturer and Installer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.

   2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products by YKK America AP are established as Basis of Design and shall serve to establish a standard of comparison for quality and product composition or construction. The use of a manufacturer's proprietary product names to designate materials and finish is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Subject to compliance with requirements of
this section, at the sole discretion of the Architect, the following manufacturers are also acceptable:

B. Acceptable Manufacturers: Subject to Compliance with requirements, acceptable glazed curtain wall manufacturers that may be incorporated into the work include but are not limited to manufacturers listed below.

1. Kawneer Co., Inc.
2. Trulite Glass & Aluminum Solutions

2.02 COMPONENTS

A. Basis of Design: YKK America AP: YHC-300 SSG

B. Nominal dimension for vertical members and for horizontal members; thermally broken with interior tubular section insulated from exterior pressure plate; matching stops and pressure plate of sufficient size and strength to provide adequate bite on glass and infill panels; drainage holes; deflector plates and internal flashings to accommodate internal weep drainage system; internal mullion baffles to eliminate "stack effect" air movement within internal spaces.

C. Flashings: Aluminum to match curtain wall mullion sections where exposed, secured with concealed fasteners.

D. Firestopping: Specified in Section 07840.

E. Glass, Spandrel and Glazing Materials: As specified in Section 08800.

F. Sealant and Backing Materials: As specified in Section 07900.

2.03 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTMB209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
2.04 FRAMING

A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

2. Glazing System: Retained mechanically with gaskets on four sides.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

D. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

F. Framing Sealants: Manufacturer's standard sealants.

2.05 GLAZING

A. Glazing: Comply with Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.06 FABRICATION


B. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.
C. Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system are not permitted.

D. Fabricate curtain wall components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

E. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

F. Prepare components to receive anchor devices.

G. Reinforce framing members for external imposed loads.

H. Arrange fasteners and attachments to ensure concealment from view.

2.07 FINISHES

A. Aluminum Clear Anodic Coating: AAMA AA-M12C22A41 Class I, 7.0 mil thickness, anodized to clear color complying with AAMA 607.1.

B. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A 123 to 2.0 oz/sq.ft.

C. Protective Coating: Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as instructed by manufacturer.

B. Verify dimensions, tolerances, and method of attachment with other work.

C. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.02 INSTALLATION


B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building
structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings.

G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

H. Install glass in accordance with Section 08800, to glazing method required to achieve performance criteria.

I. Install perimeter sealant to method required to achieve performance criteria in accordance with Section 07900.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06" every 3'-0" non-cumulative or 0.5" per 100'-0", whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32".

3.04 FIELD QUALITY CONTROL

A. Testing Laboratory Will Perform Field Check for Water Penetration:
   1. Check wall for water penetration by hose method in accordance with AAMA 501.2.
   2. Areas to be tested and number of tests will be determined by Owner, including but not necessarily limited to one test at 10 percent, one test at 50 percent, and one test at 75 and 90 percent completion of curtain wall.

B. Manufacturer's Field Services: Curtain wall and glass product manufacturers to provide field surveillance of installation of their products.

3.05 CLEANING

A. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

B. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for exterior Portland cement plaster (Stucco).

1.02 REFERENCES

A. The current version of all reference standards shall be used.

B. American Society for Testing and Materials.


1.03 SUBMITTALS

A. Product Data.

1. Submit manufacturer's descriptive literature, written recommendations, mixes and installation instructions for all stucco materials intended for use on this project.
2. Submit specific plaster materials and proportions for job-mixed Portland Cement Based Plaster intended for use on this project.
3. Submit AIA 305 Contractors Qualification Statement with bid.
4. Samples.
   a. Submit 12" x 12" samples showing full range of colors, textures, and patterns available for each type of finish indicated.
   b. Submit 6" long samples of each type of control joint and plaster accessories intended for use on this project.
5. Certifications.
a. Submit written certification that aggregate complies with the requirements of ASTM C897.
b. Submit written certification that lath, plaster materials and accessories complies with the provisions of ASTM C 926, ASTM C847 and ASTM C1063.

1.04 QUALITY ASSURANCE

A. Prospective contractor shall be a company with a minimum of ten (10) years experience in the application of Portland Cement Plaster.

B. Prospective contractor shall provide, with their bid, a list of at least ten (10) Exterior Portland Cement Plaster (Stucco) projects of similar scope, and size. List shall include the name and address of the project, and the name and address and telephone number of the Owner, Architect, and General Contractor.

C. Prospective contractor shall be responsible for obtaining and conforming to Reference Standards.

D. Mock-Up.

1. Construct a 12’-0” high by 12’-0” wide field mock-up from specified materials and accessories using the same tools and techniques which will be used for the work.
2. Mock-up location shall be where directed by the project superintendent.
3. Show color, texture and workmanship of finished work.
4. Mock-up shall be constructed and remain as part of the competed work upon acceptance by the Design Professional and Owner. The mock-up shall not be altered until directed by the Owner.

E. Pre-Installation Conference.

1. Prior to start of installation of plaster systems, the general Contractor shall organize and conduct a Pre-Installation Conference at the job site with the Plastering contractor, and include all other trades involved with related work, such as but not limited to Masonry, Electrical, Mechanical, Sheet Metal, Waterproofing, and Painting sub contractors.
2. Review areas of potential interference and conflicts, coordinate layout and support provisions for interfacing work, and coordinate schedule with other trades.

1.05 DELIVERY, STORAGE AND HANDLING

A. Packaged materials shall be delivered in factory-sealed, unopened, and unbroken packages, containers or bundles.

B. Bulk materials shall be delivered in clean transport vessels, free of contaminates.

C. Weather-sensitive materials shall be kept in a dry condition until ready for use.
D. Bulk materials shall be stored to prevent contamination and damage.

1.06 PROJECT/SITE CONDITIONS

A. Environmental Conditions.

1. Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.

2. Warm-Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

3. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Stucco

1. Florida Stucco Cement Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Rinker
   b. Florida Rock
   c. Cemex
   d. Tarmac

B. Plaster Accessories

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Amico Building Products
   b. Alabama Metal Industries.
   c. Dale/Incor Industries, Inc.
   d. Fry Reglet
   e. Plastic PC Components Inc.
   f. United States Gypsum Co.
   g. Vinyl Corporation

2.02 PLASTER MATERIALS

B. Lime: ASTM C206, Type S.
D. Masonry Cement: ASTM C91, Type N.
E. Fibers: ASTM C1116.
F. Water: Clean, fresh, potable and free of mineral or organic matter.

2.03 LATH
A. Expanded Metal Lath
   2. Lath shall be 3.4 lb/sq. yd, self furring, galvanized, diamond mesh.

2.04 ACCESSORIES
A. General: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thicknesses and number of plaster coats required.
   2. Zinc-Alloy Components: ASTM B 69, 99 percent pure zinc, minimum 0.0207" thick.
   3. Vinyl: High impact PVC, ASTM D 1784 or D 4216.
   4. Aluminum: ASTM B 221
B. Control Joints and other plaster accessories shall be zinc alloy, aluminum or vinyl.
   1. Provide removable protective tape on plaster face of control joints.
C. Reveals: Anodized aluminum, Model No. PCS-75-200, as manufactured by Fry Reglet Co., Norcross, Georgia, or equal, where indicated on the drawings

2.06 MISCELLANEOUS MATERIALS
A. Bonding agent shall comply with the requirements of ASTM C932.
B. Sealant: ASTM C920, Silicone Type S, Grade NS, Class 100/50, Use NT.

PART 3 - EXECUTION
3.01 EXAMINATION, GENERAL
A. Examine substrate to verify compliance with ASTM C 926 A1.6, including the following:
1. Surfaces to receive plaster are straight and true within 1/4" in 10'.
2. Masonry joints have been stuck flush and surface is ready to receive work of this section.

B. Verify that no bituminous or water repellent coatings exist on masonry surface.

C. Verify that surfaces and areas to be plastered are free from form release agents, curing compounds, dust, loose particles, oil or other petroleum-based products and other foreign matter that would affect bond of the plaster. Clean surface if necessary.

D. Verify that items within walls for other Sections of work have been installed.

E. Verify that mechanical and electrical services within walls have been tested and approved.

F. Immediately notify the General Contractor in writing of all unsatisfactory conditions of the substrate or out of sequence work that would cause work of this Section not to be accomplished in accordance with the standards of ASTM C 926.

G. Do not apply plaster until all unsatisfactory conditions are corrected.

H. Commencing the beginning of preparation and installation of plaster/stucco/accessories means installer accepts condition of substrate.

### 3.02 SUBSTRATE PREPARATION

A. All honeycombs in concrete shall be filled flush, and surface shall be acceptable to receive work of this Section.

B. Protect surfaces near the work of this Section from damage or disfiguration.

### 3.03 INSTALLATION OF ACCESSORIES

A. Install lath and plaster accessories in accordance with ASTM C1063.

B. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and in alignment during plastering. Install accessories of type indicated at following locations:

1. External Corners: Install corner reinforcement at external corners.
2. Terminations of Plaster: Install casing beads, unless otherwise indicated.
3. Control Joints: Install at locations shown on the drawings. Type of accessory shall be as shown on the drawings. Some of these locations are:

   a. Where an expansion or contraction joint occurs in substrate directly behind plaster membrane.
   b. Plaster membrane on metal lath - Distance between Control Joints: Not to exceed 18 feet in either direction or a length-to-width ratio of 2-1/2 to 1.
   c. Plaster membrane on metal lath - Wall: Not more than 144 sq. ft.
d. Plaster membrane on metal lath - Horizontal Surface: Not more than 100 sq. ft.
e. Where plaster panel sizes or dimensions change, extend joints full width or height of plaster membrane.
f. At intersections of horizontal and vertical joints, terminate horizontal members at vertical members. The vertical members shall be continuous through the horizontal member. The vertical members shall not be interrupted by the horizontal member.

C. Install building paper, or peel-and-stick, behind junctions of corner beads and expansion joints.

D. Verify that all joints and intersections of control joints and plaster accessories are set in a Silicone bed sealant.

E. Install metal or plastic accessory joints in bed of caulking.

1. Caulking shall be installed prior to the stucco application by the stucco applicator.

F. Where dissimilar base materials abut and are to receive a continuous coat of plaster, the juncture shall be covered with a 6" wide strip of 3.4 lb/ft², galvanized, self furring metal lath or 6" wide strip of Ultra Lath, extending 3" on either side of the juncture.

3.04 EXAMINATION OF PREPARED SUBSTRATE

A. Examine construction, grounds, furring and lathing, and accessories to ensure finished plaster surfaces will be true to line, level and plumb without requiring additional thickness of plaster.

3.05 PLASTER PROPORTIONS

A. Shall be in accordance with ASTM C926, Tables 2, 3 & 4.

B. The method of measuring materials for the plaster shall be such that proportions are controlled and accurately maintained.

C. Use measuring devices of known volume such as a one cubic foot (1 ft³) container for measuring cement, lime and sand, and a five (5) gallon bucket to measure water. Successive batches shall be proportioned alike.

D. Measurement by shovel is not permissible.

3.06 PLASTER MIXING

A. Mix plaster using sufficient water to produce a workable consistency.

B. Add mixes shall be proportioned, mixed and applied in strict accordance with the add mix manufacturers latest printed instructions.

C. All plaster shall be prepared in a mechanical mixer. Hand mixing is not permissible. Clean mixer after each batch.
D. Fibers 1/2" to 2" in length may be added. The quantities per batch shall be in strict accordance with the fiber manufacturer's instructions. No more that 1 lb. of fiber should be used per cubic foot of cementitious material.

E. It is permissible to temper base-coat plaster one time only. Plaster not used within 1-1/2 hours after start of mixing shall not be used.

F. Do not use frozen, caked or lumpy materials.

G. The amount of water used in the plaster mix shall be determined by the Plasterer. Do not use excessive water.

3.07 MIXING SEQUENCE

A. Place appropriate quantity of water into mixer.

B. Add fibers and ensure fiber disbursement without lumps

C. Add 1/2 of required aggregate

D. Add cement

E. Add lime/masonry cement if required for mix.

F. Add remainder of aggregate.

G. Mix for 5 minutes after all ingredients have been placed in the mixer.

H. Add additional water to create workable consistency as directed by Plasterer.

3.08 ACHIEVING BOND

A. The stucco contractor has the responsibility of achieving bond to the substrate of concrete and/or block. To achieve bond he should follow the directions outlined in ASTM C 926, Item 5, and if needed he shall use the appropriate option listed under Item 5 to assure bond.

B. Application of a dash bond coat is preferred to the bonding agent, if it will achieve good bond.

C. If a bonding agent is to be used it must meet the requirements of ASTM C 932.

3.09 APPLICATION

A. Surface Conditioning: Immediately before plastering, dampen concrete and concrete unit masonry surfaces that are indicated for direct plaster application, except where a bonding agent has been applied. Determine and apply the appropriate amount of moisture so that the will result in optimize suction for plastering

B. Apply plaster by hand to the nominal thickness specified in ASTM C926, Table 1.
C. Plaster nominal thickness shall be measured from the back plane of the metal plaster base, or from the face of the solid backing with or without metal plaster base, to the outer surface exclusive of texture variations.

D. Each plaster coat shall be applied to an entire wall panel, starting at the top and working down, without interruption to avoid cold joints and abrupt changes in the uniform appearance of succeeding coats.

E. Wet plaster shall abut set plaster at naturally occurring interruptions is the plane of the plaster, such as corner’s, rustications, openings and control joints.

F. If necessary, joining of set plaster with wet plaster shall be cut square and straight and not less than 6" away from a joining in the preceding coat.

G. Scratch Coat (First Coat) Application.
   1. Apply scratch coat with sufficient material and pressure ensure tight contact with the solid base or to form keys through, and to embed the metal lath. Plaster thickness shall be sufficient for complete coverage of the solid base, completely embed the metal lath and to allow for scoring the surface.
   2. When the scratch coat becomes firm, the entire surface shall be scored in one direction. Vertical surfaces shall be scored horizontally.

H. Brown Coat (Second Coat) Application.
   1. The scratch coat shall be sufficiently rigid to support the application of the brown coat without damage to the monolithic continuity or the key of the scratch coat.
   2. Apply brown coat with sufficient material and pressure to ensure tight contact with the scratch coat and to bring the thickness to the nominal thickness shown in Table 1 of ASTM C926.
   3. Straighten to true, even plane with rod and or straightedge, filling surface defects in plane.
   4. Float the surface uniformly to promote densification of the brown coat and to provide a surface receptive to bonding of the finish coat.

I. Finish Coat (Third Coat) Application.
   1. Apply finish coat with texture as selected matching the approved mock-up.
   2. The finish coat shall be applied with sufficient material and pressure to ensure tight contact with, and complete coverage of the brown coat and to the nominal thickness shown in Table 1 of ASTM C926.
   3. Avoid use of excessive amounts of water.

J. Time Between Coats and Curing.
   1. Time between coats and curing shall be in accordance with ASTM C926.

3.10 ADJUSTING

A. Upon completion, point-up plaster around trim and other locations where plaster meets dissimilar materials.

B. Cut out and patch defective or damaged plaster.
C. Match patch of defective or damaged plaster to existing work in form, texture and color.

D. After cleaning is complete, all joints and intersections of control joint and plaster accessories shall be sealed with silicone sealant.

3.11 CLEANING

A. Remove plaster and protective materials from control joints, perimeter beads and adjacent surfaces.

B. Remove stains and imperfections from plaster surfaces that would adversely affect subsequent finishes.

3.12 PROTECTION

A. Protect finished surfaces installed prior to plastering, maintain protection in place until completion of work.

B. Provide temporary or permanent protection to prevent water intrusion behind the completed work.

END OF SECTION
SECTION 09310
TILE

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes wall tile.

1.02 REFERENCES
A. American National Standards Institute:
   1. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
   2. ANSI A108.10 - Installation of Grout in Tilework.
B. American Society for Testing and Materials
   1. ASTM C 33 - Specification for Concrete Aggregates.
   2. ASTM C 144 - Specification for Aggregate for Masonry Mortar.

1.03 SUBMITTALS
A. Product Data: Provide instructions for using adhesives and grouts; include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes for each type of product specified.
B. Provide grout color samples for selection.
C. Provide tile sample for color confirmation.
D. Certification:
   1. Certification signed by manufacturer and installer that products meet or exceed ANSI A137.1.
   2. Submit master grade certification stating grade, kind of tile and identification marks.
1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer's: Regularly engaged in manufacture of materials for minimum ten years.
   2. Installer: Five years minimum documented experience in installation of materials and systems specified in commercial installations.

B. Mock-Ups
   1. Construct mockup, 5'-0" x 5'-0", with waterproofing, membrane finish grout, and specified accessories.
   2. Locate where directed by Architect.
   3. Obtain Architect's acceptance of mock-up before start of work.
   4. Mockup may remain as part of Work.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

B. Comply with requirements of ANSI A137.1 for labeling sealed tile packages.

C. Prevent damage or contamination to materials by water, freezing, excessive heat, foreign matter and other causes.

1.06 MAINTENANCE

A. Extra Materials: Furnish full-size units equal to 3 percent of amount installed but not less than one unopened carton of each type and color tile specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide tile as manufactured by Crossville, Inc. P.O. Box 1168, Crossville, TN 38557 (931) 484-2110.

B. Products equal in appearance and functional characteristics by the following manufacturers may be provided subject to approval by the Architect and compliance with requirements of this section.

   1. Florida Tile Industries, Inc.
   2. Metropolitan Ceramics

C. Acceptable Setting Material Manufacturer's

   1. Laticrete International.
   3. SGM, Inc.
2.02  TILE MATERIALS

A. Porcelain Wall Tile: Crossville Porcelain Stone - Strong, 2" x 12" x 3/8" thick wall tile including bullnose trim tile and other shapes as required as manufactured by Crossville, Inc. or equal product by Florida Tile or Metropolitan Ceramics. Color to be selected by the Architect from manufacturer's standard colors.

2.03  SETTING MATERIALS

A. Preblended Sand/Cement/Latex Additives - Thinset: Comply with ANSI A118.4.
   1. Acceptable Products:
      a. 211 Crete Filler Powder with Laticrete 4237 by Laticrete International
      b. Crete Mix with Keracrete by Mapei Corporation.

B. Preblended Sand/Cement/Latex Additives - Flexible Thinset: Comply with ANSI A118.4.
   1. Acceptable Products:
      a. Kerabond Dry-Set Mortar with Keralastic by Mapei Corporation.
      b. Lastoflex System by PCI-USA.

C. Preblended Sand/Cement/Latex Additives – Flexible Thinset: Comply with ANSI A118.4.
   1. Acceptable Products:
      a. Kerabound Dry-Set mortar with Keralastic by Mapei Corporation.
      b. Lastoflex System by PCI-USA.

D. Commercial Portland Cement Grout: Integral colored grout containing mineral oxide pigments compatible for use with portland cement.
   1. Color to be selected by the Architect from manufacturer standard colors.
   2. Acceptable Products:
      a. Laticrete Dry-Set Wall Grout with Laticrete Grout Adix by Laticrete International.

2.04  ACCESSORIES

A. Primers and Bond Coats: As recommended by manufacturer of mortar, grout or sealant materials.

B. Flashing Cement: As recommended by membrane manufacturer.
2.05 MORTAR AND GROUT MIXES

A. Mortar - Preblended Mixes: Comply with ANSI A118.4.

1. Portland Cement - Latex Thinset Mortar Mix and Leveling Bed/Scratch Coats:
   b. Five gallons latex thinset mortar additive, mix in accordance with manufacturer's printed instructions.

2. Portland Cement - Flexible Thinset Mortar Mix:
   b. Three to four gallons latex thinset mortar additive, mix in accordance with manufacturer's printed instructions.

B. Grout - Preblended Mixes: Comply with ANSI A118.6.

1. 50 Pounds Factory Mixed Commercial Portland Cement Grout With/Without Sand:

2. One gallon latex grout additive, mix in accordance with additive manufacturer's printed instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin work until surfaces and conditions are ready to accept Work of this Section.

B. Verify that areas to receive tile installed by thinset method have wood float finish, are true to within 1/8" in 10'-0", and are pitched to drains where required.

C. Verify surface is firm, dry, clean and free of oily or waxy films, mortar and soil.

D. Verify grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile are installed.

3.02 PREPARATION

A. Protect surrounding work from damage or disfiguration.

B. Vacuum floor surfaces and damp clean floor and wall surfaces.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
D. Apply sealer and conditioner to substrate surfaces in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - THINSET METHOD

A. Install Setting Materials and Tile as Follows:

1. Concrete Block or Masonry Walls: TCA W202 with ANSI A118.4 latex-portland cement mortar and ANSI A118.6 latex-portland cement grout.

B. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align joints as indicated on the drawings.

C. Place tile using 3/16" spacers, uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

D. Sound tile after setting. Replace hollow sounding units.

3.04 GROUTING

A. Allow tile to set for minimum of 48 hours prior to grouting.

B. Grout tile joints.

C. Before grouting, tiles must be firmly set, paper and glue removed from face of mounted tiles, and spacers, strings, ropes, or pegs removed.

D. Use caution when grouting to prevent damaging or scratching surface of installed tiles.

E. Install grout with uniform color in accordance with manufacturer's recommendations. Pack joints full, free of pinholes, voids or low spots, before mortar takes initial set.

F. Finish grout flush with surface of tile.

3.05 CLEANING

A. Clean excess mortar from surface of tile with wet cloth or sponge while mortar is fresh.

B. Remove grout haze following recommendations of mortar additive manufacturer. Do not use acids for cleaning.

3.06 PROTECTION

A. After setting, protect from dirt for 48 hours.

END OF SECTION
SECTION 09 50 00

METAL STUDS, METAL LATH, SUSPENSION CEILINGS, PLASTER, AND STUCCO

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Non-load bearing steel studs.
   2. Metal furring and lath.
   3. Ceiling suspension system.

B. Related Sections:
   1. 04 22 00 - Concrete Unit Masonry.
   2. 05 10 00 - Metal Framing.
   3. 06100 - Carpentry.
   4. 09900 - Painting.

1.02 REFERENCES

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

   2. A653/A-96 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron
      Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. A924/A-96a Specification for General Requirements for Steel Sheet, Metallic-Coated
      by the Hot-Dip Process.
   5. C645-96a Specification for Nonstructural Steel Framing Members.
   6. C754-96 Specification for Installation of Steel Framing Members to Receive Screw-
      Attached Gypsum Panel Products.
      Plasters.
   11. C1007-96a Specification for the Installation of Load Bearing (Transverse and
       Axial) Steel Studs and Related Accessories.
1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data for cementitious materials, lath, metal support components, and accessories.

B. Material Certificates:
   1. Submit producer's certificate for each kind of plaster aggregate indicated materials comply with requirements.
   2. Provide design calculations for metal support systems indicating load calculations, sizing of members, and anchorages for review.

1.06 QUALITY ASSURANCE

A. Design Criteria:
   1. Fire-Resistance Ratings:
      a. Where plaster systems with fire-resistance ratings are indicated, provide materials and installations identical with applicable assemblies tested per ASTM E119 by fire testing laboratories acceptable to authorities having jurisdiction.
      b. Provide plaster for fire-resistance rated systems having same aggregate as specified for similar non-rated work, unless specified aggregate has not been tested by accepted fire testing laboratories.
      c. Portland cement plaster/stucco shall not be used in areas requiring fire-rated construction. Use only accepted listed UL rated materials.
   2. Coordinate layout and installation of suspension system components for suspended ceilings with other work supported by or penetrating through ceiling.
   3. Clear bonding agents are not allowed.
   4. Metal corner beads are not allowed. Use plastic trim accessories.
   5. Prefabricated metal or plastic stucco reveals are not allowed. Strike final stucco coat to achieve score patterns. Slope bottom edge of horizontal score lines to dispel water.

B. Mockups:
   1. Before installation of plaster work, fabricate mockup panels for each type of finish and application required using materials, including lath and support system, indicated for final work.
   2. Build panels 4 feet x 4 feet x full thickness in location indicated, or if not otherwise indicated, as directed by A/E.
   3. Demonstrate proposed range of color, texture, and installation to be expected in completed work.
   4. Obtain A/E acceptance of panel's visual quality before start of work.
   5. Retain panel during construction as standard for judging completed work.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Supports:
   1. Dale/Incor.
   2. Dietrich.
   3. Gold Bond Building Products Division.
   4. Unimast Inc. (USG Co.)

B. Expanded Metal Lath:
   1. Dale/Incor.
   2. Gold Bond Building Products Div.
   3. South Lath Inc.
   4. Unimast Inc. (USG Co.)

C. Accessories:
   1. Dietrich.
   2. Fry Reglet Corp.
   4. Plastic Components Inc.
   5. South Lath Inc.
   6. United States Gypsum Co.
   7. Vinyl Corp., Miami, FL.

D. Portland Cement Plaster/Stucco:
   1. Florida Super Stucco by Lafarge Florida.
   2. Lonestar Products.
   3. Rinker Materials Corp.
   4. Southdown, Inc.
   5. United States Gypsum Co.

E. One Coat Veneer Plaster Over Cement Board: 3/32" Imperial Finish over 5/8" Durock cement board by US Gypsum Co. over metal framing at 16 inches o.c. maximum or accepted equivalent. UL U407 for 1 hour rating.

2.02 MATERIALS

A. Metal Supports - Suspended and Furred Ceilings or Soffits:
   3. Rod Hangers: Mild steel, zinc, or cadmium coated.
   4. Flat Hangers: Mild steel, zinc, or cadmium coated or protected with rust inhibitive paint.
   5. Channels:
a. Cold-rolled steel, minimum 0.0598" thickness of uncoated base metal, allowable bending stress of 18,000 psi. Protect with rust inhibitive paint or galvanizing complying with ASTM A924 for G60 coating designation.
b. Carrying Channels: 1-1/2" deep x 7/16" wide flanges, 475 lbs. per 1,000 feet painted, 508 lbs. per 1,000 feet galvanized.
c. Furring Channels: 3/4" deep x 7/16" wide flanges, 300 lbs. per 1,000 feet painted, 316 lbs. per 1,000 feet galvanized.
d. Provide galvanized channels for exterior installations.

6. Hanger Anchorage Devices:
   a. Screws, cast-in-place concrete inserts, or other devices appropriate for anchorage to the form of structural framing indicated and whose suitability for use intended has been proven through standard construction practices or certified test data.
   b. Size devices to develop full strength of hanger minimum 3 times calculated hanger loading, except size direct pullout concrete inserts for 5 x calculated hanger loading.

B. Steel Studs and Runners/Tracks:
   1. Non-Load (Axial) Bearing Studs and Runners:
      a. ASTM C645 and complying with following requirements for minimum thickness of uncoated base metal and other characteristics:
      b. Stud Thickness: 0.0179", unless otherwise indicated.
      c. Stud Depth: As indicated on the drawings.
   2. Load Bearing (Transverse and Axial) Studs and Runners:
      a. ASTM C955 and complying with following requirements for quality, grade, finish of steel sheet, design thickness of uncoated base metal, and other dimensional characteristics:
      c. Grade A - 33,000 psi Yield Point: Maximum 0.0359" design thicknesses.
      d. Grade D - 50,000 PSI Yield Point: Minimum 0.0598" design thicknesses.
      e. Stud Thickness: 0.0359", unless otherwise indicated.
      f. Stud Flange Width: 1-3/8".
      g. Stud Lip Depth: 1/4".
      h. Stud Depth: 3-1/2" minimum unless otherwise indicated.

C. Vertical Metal Furring:
   1. Channel Furring and Braces:
      a. Cold-rolled steel, minimum 0.0598" thickness of uncoated base metal.
      b. Allowable Bending Stress: 18,000 psi.
      c. Protected with rust inhibitive paint finish or galvanizing.
      d. 3/4" deep x 7/16" wide flanges.
      e. 300 lbs. per 1,000 feet with painted finish.
      f. 316 lbs. per 1,000 feet with galvanized finish.
2. Z-Furring Member:
   a. Manufacturer's standard screw-type zee-shaped furring members formed from zinc-coated steel sheet.
   b. Minimum 0.0179" uncoated base metal thickness, complying with ASTM A924, Coating G60.
   c. Design for mechanical attachment of insulation boards or blankets to monolithic concrete and masonry walls.
3. Furring Brackets: Serrated-arm type, minimum 0.0329" thickness of base (uncoated) metal, adjustable from 1/4" to 2-1/4" wall clearance for channel furring.

D. Metal Lath:
   1. Diamond Mesh Lath:
      a. Flat: 2.5 lbs. per sq.yd.
      b. Self-Furring: 2.5 lbs. per sq.yd.
      c. Paper Backing: Provide asphalt-impregnated paper factory-bonded to back and complying with Fed. Spec UU-B-790, Type I, Grade D vapor permeable, Style 2.
      d. Lath Attachment Devices:
         1) Devices of material and type required by referenced standards and recommended by lath manufacturer for secure attachment of lath to framing members and of lath to lath.
         2) Provide resilient clips for attachment of gypsum lath to steel at locations indicated.
   2. Welded Wire Fabric Lath:
      a. Weather Protected Exterior Horizontal Surfaces (Soffits, Ceilings, and Other Decorative Elements): Pyro K-Lath, Gun Lath, or accepted equivalent.
      b. Back of Ceramic Tile (Interior Usage Only): Aqua Lath or accepted equivalent.

E. Accessories for Portland Cement Stucco:
   1. Comply with material provisions of ASTM C926; coordinate depth of accessories with thickness and number of coats required.
   2. Plastic Trim Accessories: Corner beads, casing beads, control joints, and expansion joints with perforated flanges and fabricated from high impact polyvinyl chloride.

F. Portland Cement Plaster Materials:
   1. Base Coat Cements: Portland Cement, ASTM C150, Type I or III.
   3. Factory-Prepared Finish Coat:
      a. Manufacturer's standard product requiring addition of water only. White in color unless otherwise indicated.
   5. Aggregate - Finish Coats: ASTM C897, manufactured or natural sand, white in color.
6. Fiber - Base Coat:
   a. Alkaline-resistant glass fibers, 1/2" long, free of contaminants, manufactured for
      use in Portland cement plaster.

G. Miscellaneous Materials:
   1. Water for Mixing and Finishing Plaster: potable, free of substances capable of
      affecting plaster set or of damaging plaster, lath, or accessories.

2.3 MIXES

A. Portland Cement Plaster/Stucco Mixes and Compositions - Base Coats:
   1. Comply with ASTM C926 for Portland cement plaster base and finish coat mixes
      as applicable bases, materials, and other requirements indicated.
   2. Base Coat:
      a. Proportion materials for respective base coats in parts by volume for cementitious
         materials and in parts by volume per sum of cementitious materials for aggregates
         to comply with the following requirements for each method of application and
         plaster base indicated.
      b. Adjust mix proportions below within limits specified to attain workability.

3. Base Coats for Three-Coat Work Over Metal Lath:
   a. Contractor's Option 1:
      1) Scratch Coat: 1 part Portland cement, 2-1/2 to 4 parts sand.
      2) Brown Coat: 1 part Portland cement, 3 to 5 parts sand.
   b. Contractor's Option 2:
      1) Scratch Coat: 1 part Portland cement, 1 to 2 parts masonry cement, 2-1/2 to 4
         parts sand.
      2) Brown Coat: 1 part Portland cement, 1 to 2 parts masonry cement, 3 to 5 parts
         sand.
   c. Contractor's Option 3:
      1) Scratch Coat: 1 part masonry cement, 2-1/2 to 4 parts sand.
      2) Brown Coat: 1 part Portland cement, 1 parts masonry cement, 3 to 5 parts sand.

4. Two-Coat Work Over Concrete Unit Masonry:
   a. Contractor's Option 1:
      1) Base Coat: 1 part Portland cement, 3 to 4 parts sand.
   b. Contractor's Option 2:
      1) Base Coat: 1 part masonry cement, 3 to 4 parts sand.

5. Fiber Content:
   a. Add fiber to mixes above to comply with fiber manufacturer's directions,
      maximum 2 lbs. per cu. feet of cementitious materials.
   b. Reduce aggregate quantities accordingly to maintain workability.
B. Portland Cement Plaster/Stucco Mixes and Compositions - Finish Coats:
   1. Job-Mixed:
      a. Contractor's Option 1:
         1) 1 part Portland cement, 2-1/4 to 3 parts sand.
      b. Contractor's Option 2:
         1) 1 part Portland cement, 1 part masonry cement, 2-1/4 to 3 parts sand.
      c. Contractor's Option 3:
         1) 1 part masonry cement, 1-1/2 parts sand.
   2. Factory-Prepared Portland Cement Plaster/Stucco Finish Coats:
      a. Add water only.
      b. Comply with finish coat manufacturer's directions.

C. Mixing: Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3   EXECUTION

3.1 INSTALLATION

A. Lath and Furring:
   1. Interior Lath and Furring Installation Standard: Install lath and furring materials indicated for gypsum plaster to comply with ASTM C841.
   3. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar work to comply with details indicated or, if not otherwise indicated, to comply with applicable published recommendations of gypsum plaster manufacturer or, if not available, of Gypsum Construction Handbook, latest edition, published by United States Gypsum Co.
   4. Isolation:
      a. Where lath and metal support system abuts building structure horizontally, and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loading into work from building structure.
      b. Install slip or cushion type joints to absorb deflection but maintain lateral support.
      c. Frame both sides of control and expansion joints independently.
      d. Do not bridge joints with furring and lath or accessories.
B. Ceiling Suspension Systems:

1. Preparation and Coordination:
   a. Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure inserts and other structural anchorage provisions have been installed to receive ceiling hangers to allow development of their full strength and at spacing required to support ceiling.
   b. Furnish concrete inserts and other devices indicated, to other trades for installations before time needed for coordination with other work.
   c. Powder activated fasteners are not allowed.

2. Hanger: Attach hangers to structure above ceiling to comply with Metal Lath/Steel Framing Association (ML/SFA) Specifications for Metal Lath and Furring and with referenced standards.

3. Ceiling Suspension System:
   a. Install components of sizes and spacing’s indicated but not in smaller sizes or greater spacing’s than required by referenced lath and furring installation standards.
   b. Wire Hangers: Space maximum 48 inches o.c. parallel with, and maximum 36 inches perpendicular to, direction of carrying channels, with details indicated or, if not otherwise indicated, to comply with applicable published recommendations of gypsum plaster manufacturer or, if not available, of Gypsum Construction Handbook, latest edition, published by United States Gypsum Co.

4. Isolation:
   a. Where lath and metal support system abuts building structure horizontally, and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loading into work from building structure.
   b. Install slip or cushion type joints to absorb deflection but maintain lateral support.
   c. Frame both sides of control and expansion joints independently.
   d. Do not bridge joints with furring and lath or accessories.

C. Steel Stud Wall/Partition Support System:

1. Install components for steel stud wall/partition support systems to comply with directions of steel stud manufacturer for application indicated.


4. Steel Stud Systems to Receive Metal Lath: Comply with requirements of ML/SFA Specifications for Metal Lath and Furring applicable to each installation condition and type of metal system indicated.

5. Extend partition support systems to finish ceiling and attach to ceiling suspension members, unless otherwise indicated.

D. Vertical Metal Furring:

1. Metal Furring to Receive Metal Lath: Comply with requirements of ML/SFA Specification for Metal Lath and Furring applicable to each installation condition indicated.
E. Metal Lath:
1. Install expanded metal lath for following applications where plaster base coats are required.
2. Provide appropriate type, configuration, and weight of metal lath selected from materials indicated which comply with referenced lath installation standards.
3. Suspended and Furred Ceilings: Minimum weight of diamond mesh lath, 3.4 lbs. per sq.yd.

F. Plastering Accessories:
1. Comply with referenced lath and furring installation standards for provision and location of plaster accessories of type indicated.
2. Miter or cope accessories at corners and install with tight joints and in alignment.
3. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.
4. Accessories - Portland Cement Plaster:
   a. Corner Reinforcement: Install at external corners.
   b. Corner Bead: Install at external corners.
   c. Casing Beads: Install at termination of plaster work unless otherwise indicated.
   d. Control Joints: Install where an expansion or control joint occurs in surface of construction directly behind plaster membrane, where distance between control joints in plastered surface exceeds 10 feet in either direction, where area within Portland cement panels exceed 100 square feet, where Portland cement plaster panel sizes or dimensions change.

G. Plaster Application:
1. Two-coat plaster over gypsum lath.
2. Prepare monolithic surfaces for bonded base coats and used bonding compound or agent to comply with requirements of referenced plaster application standards for conditioning of monolithic surfaces.
3. Tolerances: Maximum 1/8" in 10'-0" from a true plane in finished plaster surfaces, as measured by 10'-0" straightedge placed at any location on surface.
4. Sequence plaster application with installation and protection of other work, so neither will be damaged by installation of other.
5. Plaster flush with metal frames and other built-in metal items or accessories that act as plaster ground, unless otherwise indicated.
6. Where plaster is not terminated at metal by casing beads, cut base coat free from metal before plaster sets and groove finish coat at junctures with metal.

H. Portland Cement Plaster/Stucco Application:
2. Number of Coats: Apply Portland cement plaster, of composition indicated.
3. Finish Coat: Floated finish unless otherwise indicated; match A/E's sample for texture and color.
4. Moist cure Portland cement plaster base and finish coats to comply with ASTM C926, including recommendations for time between coats and curing in ASTM C926 Annex A2 - Design Considerations.

3.2 ADJUSTING, CLEANING, AND PROTECTION

A. Cutting and Patching:
   1. Cut, patch, point-up, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections.
   2. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dryouts, efflorescence, sweat-out and similar defect, and where bond to substrate has failed.
   3. Sand smooth-troweled finishes lightly to remove trowel marks and arises.

B. Cleaning:
   1. Remove temporary protection and enclosure of other work.
   2. Promptly remove plaster from door frames, windows, and other surfaces that are not to be plastered.
   3. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering work.
   4. When plastering is completed, remove unused materials, containers, and equipment, and clean floors of plaster debris.

C. Protection: Provide final protection and maintain conditions, in manner suitable to Installer, that ensures plaster work being without damage or deterioration at time of Substantial Completion.

END OF SECTION
SECTION 09900
PAINTING

PART 1 - GENERAL

1.01 WORK REQUIRED

A. Paint all new exterior and interior surfaces exposed to view, except the following:

1. Floors, unless otherwise noted; walls where other finishes are scheduled; and parking area markings.
2. Non-ferrous metals.
3. Prefinished materials and equipment, unless otherwise noted.
4. Materials which are normally used in their natural finish, such as stone, tile, glass, etc.
5. Shop or mill priming coats specified elsewhere, factory or shop applied finishes.

B. Paint equipment hangers, support steel, ducts, access doors, panelboard covers, grilles, registers, louvers, and other metallic surfaces of the air conditioning, heating, ventilating, plumbing, and electrical installations where exposed to view, except in mechanical rooms.

1.02 QUALITY CONTROL

A. Provide materials of the best quality produced by the manufacturer for each type of coating. The Owner reserves the right to withdraw samples, at any time, from materials delivered to the site and submit them to a qualified independent testing laboratory for analysis of their composition to insure compliance with the manufacturer's formulation; and to perform dry film thickness tests. Materials and work failing to conform to manufacturer's standards or these Specifications will be rejected.

B. Guaranteed Coverage: Regardless of the number of coats and film thickness specified, guarantee that paint film after application and drying covers the surface with a solid, uniform, and even color of the shade, hue, and intensity of the color selected, and that completely hides the substrate from view. Provide additional work, if required to comply with this requirement, without increase in cost to the Owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Paints and coatings of Benjamin Moore & Co., Glidden, Pittsburgh Paint Co., Sherwin-Williams or Devoe, of quality equal to those specified in the application schedule may be provided without previous approval by the Architect. Materials of other manufacturers that will produce the same finish, and of the same quality as those listed, may be provided, subject to approval by the Architect. Schedule is based on products of Sherwin-Williams.
2.02 SPECIALTY MATERIALS

A. Wood Preservative: 5% pentachlorophenol solution in a petroleum base vehicle with penetrating agents, clear.

B. Galvanizing Repair Paint: High zinc dust content paint complying with Military Specifications MIL-P-21035 (Ships). Galvicon, RPM, and ZRC coatings are also acceptable.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Deliver materials in original containers, with labels intact and seals unbroken. Do not reduce or alter materials except as specified by the manufacturer. When more than one type of finish is specified for the same surface, the Architect shall select which finish is applied. Sand and smooth all woodwork before painting. Metal surfaces shall be wire brushed thoroughly to remove rust and scale. Do not start painting, including priming coats, until the surface is sufficiently dry; in the case of plaster and gypsum board, a moisture content not to exceed 12%.

B. Where existing surfaces require repainting due to new work, paint the entire panel bounded by interior or interior corners. Patch painting will not be accepted.

C. Colors shall be selected by the Architect. Prepare six (6) 8-1/2" x 11" color samples for approval. Also provide panels not less than 5' x 5' applied to a wall when requested by the Architect, and repeat the process as necessary to obtain the approval.

D. Store all material used on the job in a single place approved by the Architect. Remove oily rags, waste, etc., from the building each night and take every precaution necessary to avoid spontaneous combustion.

E. Work shall be done by skilled mechanics, in workmanlike manner, under favorable weather conditions, or conditions suitable for production of good durable work. Mix and apply materials according to manufacturer's directions for the particular material being used and surface being coated. Apply each coat evenly, without spots, runs, sags, brush marks, or holidays. When more than one coat is specified, make the next to the last of a slightly lighter shade than the last.

F. Application Methods: Machine spraying, rolling or hand brushing. Do not use the spraying method in locations where it may interfere with the work of other trades, the employees of the Owner or his tenants, or the public; deface equipment or materials that cannot be protected from overspray; or inject paint spray into operating air conditioning systems; unless approved by the Architect after appropriate precautions have been taken.

G. Minimum total dry film thickness unless otherwise indicated: 5 mils.

3.02 PREPARATORY WORK

A. Clean all greasy and oily metal surfaces with turpentine or mineral spirits and wipe dry before priming.
B. Fill nail holes, cracks, open joints, and other defects after priming or first coat is dry and before second coat is applied.

C. Allow all coats to dry thoroughly before applying succeeding coats and in all cases allow at least 24 hours between coats.

D. Prime finished work not shop coated when delivered to the job or as soon as possible thereafter. Back prime all woodwork erected against masonry or concrete before erection. Protect the tops and bottoms of all wood doors with a heavy coat of varnish after they have been fitted.

E. Clean and sand all surfaces between coats with 150 Fine sandpaper.

F. Remove electrical outlet and switch cover plates, finish hardware escutcheons and cover plates, air conditioning registers, and other finished items installed on surfaces to be painted during operations and replace afterwards. Protect items and surfaces which cannot be removed or that do not interfere with the painting, and leave clean and completely free of paint.

G. Preparation for Elastomeric Coating:
   1. Surface Preparations: Clean surfaces scheduled to receive elastomeric coating and "detail" all cracks, corners, penetrations and terminations as outlined in manufacturer's written literature.
   2. Parge surface prior to application of prime coat and/or apply block filler as required by manufacturer.
   3. Warranty: Provide a written warranty executed by the manufacturer and waterproofing contractor, covering a period of five years from the date of final acceptance of the project, against leaks or failure due to defects of materials or installation, with an agreement to repair or replace such defective work, without cost to the Owner.

3.03 APPLICATION TO EXTERIOR SURFACES

A. Stucco and Masonry

One coat of primer recommended by manufacturer.
Two coats of VIP Last-O-Coat Elastomeric Coating, 8000 series, applied as directed by manufacturer, minimum dry film thickness 8-10 mils each, total dry thickness minimum 16-20 mils.

B. Ferrous Metals, Except Galvanized Steel:

One Coat of Kem Kromik Metal Primer. On surfaces which have been shop coated, and on structural steel, omit this coat.
Two coats of Metalatex Semi-gloss Enamel.

C. Galvanized Steel, and Non-Ferrous Metals When so Indicated:

One coat of SW Galvanized Iron Primer.
Two coats of Metalatex Semi-gloss Enamel.

3.04 APPLICATION TO INTERIOR SURFACES

A. Gypsum Wallboard, Plaster, Exposed Concrete and Masonry:

One coat of SW Wall Primer and Sealer.
Two coats of Pro-Mar 400 Latex Semi-gloss Enamel.

B. Ferrous Metals, Except Galvanized Steel:

One coat of Kromik Metal Primer. On surfaces which have been shop coated, and on structural steel, omit this coat.
Two coats of Metalatex Semi-gloss Enamel.

C. Galvanized Steel; and Non-Ferrous Metals When So Indicated:

One coat of S.W. Galvanized Iron Primer.
Two coats of Metalatex Latex Semi-gloss Enamel.

3.05 PIPE, FITTINGS, EQUIPMENT, ACCESSORIES

A. Same coating as specified for metals above.

3.06 CLEANING

A. Upon completion of the work, remove staging, scaffolding and containers from the site. Remove paint spots, oil or stains from adjacent surfaces and leave the entire job clean and acceptable to the Architect.

END OF SECTION
SECTION 10999
MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Miscellaneous specialties work includes furnishing and installing items shop fabricated, job fabricated and manufactured items not part of other sections of these specifications, including the following:

1. Metal Sheet and Mesh
   b. Metal Mesh for Pedestrian Bridge Interior (Vertical Walls): Ellipse 14
   c. Metal Mesh for underside of Pedestrian Bridge: Ellipse 14
   d. Metal Mesh for Stair Railing - Guardrail Face: Ellipse 14

2. Stair Railing
   a. Stainless Steel Railing with Integral Lighting System.

B. Note: Steel used in this project is required to be in compliance with 49 CFR PART 661 - BUY AMERICA REQUIREMENTS.

1.02 SUBMITTALS

A. Product Data: Submit on each time prior to starting this work and sufficiently early to coordinate with other work. Samples may be submitted in lieu of literature if approved by Architect.

B. Shop Drawings: Submit shop drawings for Architect's review.Completeness of shop drawings shall be sufficient to indicate compliance with Contract Documents and to correlate with other materials. In general, they shall indicate size, material, quantity, finish, attachment methods, connections, weight, performance data, etc., depending on specifications.

1.03 QUALITY ASSURANCE

A. Catalog Standards: Manufacturer's catalog numbers or names may be indicated on drawings or specified for convenience in identifying certain miscellaneous specialties items. Unless modified by notation on drawings or otherwise specified, manufacturer's current catalog description for indicated number, together with indicated or specified in options or accessories, constitutes requirements for each such unit.

1. Use of catalog numbers, and specific requirements indicated on drawings and in specification, are not intended to preclude use of equivalent products by other acceptable manufacturers, but are given for purpose of establishing standard of design and quality for materials, construction and workmanship.
B. Certification: submit manufacturer's certificate stating that materials furnished comply
with specified requirements. Include supporting certified testing data indicating that
material meets specified requirements.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to protect site in original factory wrappings and containers, clearly
labeled with identification of manufacturer, brand name, model number and quality or
grade.

B. Store miscellaneous blocked off ground to prevent sagging and warping, in original
undamaged packages and containers, inside well-ventilated area protected from weather,
motion, soiling, extreme temperatures, and humidity.

C. Comply with instructions and recommendations of manufacturer for special delivery,
storage, and handling requirements.

1.05 PROJECT/SITE CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and
fabrication where possible, to ensure proper fitting of work. However, allow for
adjustments within specified tolerances where ever taking of field measurements before
fabrication might delay work.

B. Coordination: Furnish inserts and anchorages which must be built into other work for
installation of miscellaneous specialties and related work; coordinate delivery with other
work to avoid delay.

1.06 SEQUENCING AND SCHEDULING

A. Sequence delivery and installation of miscellaneous specialties items until construction is
ready for their installation to minimize possibility of damage.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Manufacturer(s) listed herein are included for convenience of Contractor in establishing
quality, performance, function, and aesthetic appearance acceptable to Architect.

1. Other manufacturers approved by Architect may be used whose qualities meet or
exceed specified manufacturer.

2.02 STAINLESS STEEL SHEET AND MESH

A. All mesh and attachments shall be type 316 stainless steel.

B. Metal Mesh for Pedestrian Bridge Exterior (Wave Pattern): **McNichols: 20 Gauge
Stainless Steel 1/4" Perforated, Staggered Pattern.**
C. Metal Mesh for Pedestrian Bridge Interior (Vertical Walls): **Ellipse 14**

D. Metal Mesh for underside of Pedestrian Bridge: **Ellipse 14**

E. Metal Mesh for Stair Railing - Guardrail Face: **Ellipse 14**

2.03 Stainless Steel Railing with Integral Lighting System

A. Provide Stainless Steel Railing System, V-Rail, IVR2-SP1 - as manufactured by Intense Lighting. Contact: Sesco Lighting, 954-474-9888.

2.04 MATERIALS

A. Metals:

1. General:
   a. Comply with standards indicated for forms and design of handrail and railing system components.
   b. Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finish units.

2. Stainless Steel:
   a. Provide stainless steel in form indicated.
   b. Tubing: ASTM A554, Grades MT 301, 302, or 304, as standard with manufacturer.
   c. Pipe: ASTM A312, Grade TP 304.
   d. Castings: ASTM A743, Grade CF 8 or 20.
   e. Plate: ASTM A167, Type 301, 302 or 304.

3. Steel and Iron:
   a. Provide steel and iron in form indicated.
   b. Tubing: Cold Formed, ASTM A500; or hot-rolled, ASTM A501.
   c. Pipe: ASTM A 53, Type E or S at manufacturer’s option, Grade A, Schedule 40; 1-1/4” diameter pipe.
   d. Steel Plates, Shapes, and Bars: ASTM A36.
   f. Malleable Iron Castings: ASTM A47, Grade as recommended by fabricator for type of use indicated.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

A. Miscellaneous Materials:

1. Nonshrink Nonmetallic Grout:
a. Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C621.
b. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this Section.

2. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS Specifications, and as required for color match, strength, and compatibility in fabricated items.

3. Fasteners:
   a. Use fasteners of same basic metal as fastened metal, unless otherwise indicated.
   b. Do not use metals which are corrosive or incompatible with materials joined.
   c. Provide concealed fasteners for interconnection of handrail and railing components and for their attachment or other work, except where otherwise indicated.
   d. Provide concealment fasteners for interconnection of handrail and railing components and for their attachment to other work, except where exposed fasteners are unavoidable or are standard fastening method for handrail and railing system indicated.
   e. Provide Phillips flathead machine screws for exposed fasteners, unless otherwise indicated.
   f. Use fasteners fabricated from Type 304 stainless steel.

4. Anchors and Inserts:
   a. Provide anchors of type, size, and material required for type of loading and installation condition shown, as recommended by manufacturer, unless otherwise indicated.
   b. Use nonferrous metal of hot-dipped galvanized anchors and inserts for exterior locations and elsewhere as required for corrosion resistance.
   c. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

5. Primer Paint for Steel and Iron:
   a. Manufacturer's standard rust-inhibiting primer; compatible with finish coats of paint.
   b. Coordinate selection of metal primer with finish paint requirements specified in Section 09900.

2.03 RAILING FABRICATION

A. General:

1. Fabricate handrail and railing systems to design, dimensions, and details shown.
2. Provide handrail and railing members in sizes and profiles indicated, with supporting posts and brackets of size and spacing shown, but not less than required to comply with requirements indicated for structural performance.
B. Shop Assembly:

1. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly.
2. Disassemble units only as necessary for shipping and handling limitations.
3. Clearly mark units for reassembly and coordinated installation.

C. Nonwelded Field Connections:

1. Fabricate railing and handrail systems for interconnection of members by means of railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated.
2. Fabricate members and fittings to produce flush smooth, rigid, hairline joints.
3. Fabricate splice joints for field connection using epoxy structural adhesive where this represents manufacturer's standard splicing method.

D. Welded Connections:

1. Fabricate handrail and railing systems of materials indicated below for interconnections of members by welding.
2. Use welding method which is appropriate for metal and finish indicated and develops strength required to comply with structural performance criteria.
3. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.
4. Provide welded connections for stainless steel pipe handrail and railing systems.

E. Rail Ends:

1. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
2. Close ends returns, unless clearance between end of railing and wall is 1/4" or less.
3. Close exposed ends of handrail and railing members by use of manufacturer's standard prefabricated end fittings.

F. Brackets, Reveals, Flanges, Fittings, and Anchors:

1. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors for interconnection of handrail and railing members to other work, unless otherwise indicated.
2. Fabricate anchorage devices which are capable of withstanding loadings imposed by handrail and railing systems.
3. Coordinate anchorage devices with supporting structure.

G. Stainless Steel Finishes: AISI No. 4 Finish, satin directional polish

1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.
3. Remove or blend tool and die marks and stretch lines into finish.
4. Grind and polish surfaces to produce uniform, directionally-textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece or as indicated on drawings.
5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.01 RAILING INSTALLATION

A. Install in accordance with manufacturer’s written instructions.

B. General:

1. Fit exposed connections accurately to form tight, hairline joints.
2. Perform cutting, drilling, and fitting required for installation of handrail and railing systems.
3. Set work accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of handrail and railing components which have been coated or finished after fabrication, and are intended for field connection by mechanical means without further cutting or fitting.
5. Adjust handrail and railing systems before anchoring to ensure matching alignment at abutting joints.
6. Space posts at interval indicated or, if not indicated, but not less than that required by design loadings.

C. Anchoring Posts:

1. Concrete-Anchored Posts in Core-Drilled Holes:
   a. Core-drill concrete to produce holes with min. 3/4" dia. larger than outside diameter of post and min. 5" deep or as indicated on the drawings and 3/4" greater than outside diameter of posts.
   b. Clean holes of all loose material, insert posts and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.

C. Anchoring Railing Ends:

1. Anchor railing ends into concrete or masonry with manufacturer's standard fittings designed for this purpose, unless otherwise indicated.
2. Anchor railing ends to metal surfaces with manufacturer's standard fittings using concealed fasteners, unless otherwise indicated.
3. Anchor railing ends to metal surfaces by welding using manufacturer's standard fittings, unless otherwise indicated.
4. Expansion Joints:
   a. Provide expansion joints at locations indicated or, if not indicated, at
max. 30 ft. intervals.

b. Provide slip-joint internal sleeve extending 2" beyond joint on either side; fasten internal sleeve securely to one side, locate joint within 6" of post.

**B. Attachment of Handrails to Walls:**

1. General: Secure handrails to walls with manufacturer's standard wall brackets and end fittings, unless otherwise indicated.
2. Concrete and Solid Masonry: Use drilled-in expansion shields and concealed hanger bolts, unless otherwise indicated.
3. Hollow Masonry Anchorage: Use toggle bolts with square heads, unless otherwise indicated.

**3.02 RAILING PROTECTION**

A. Protect finishes of railing systems and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer.

B. Remove protective covering at time of Substantial Completion.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work.

D. Return items which cannot be refinished in field to shop.

E. Make required alterations and refinish entire unit, or provide new units as required.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

A. Verification of Conditions: Examine the substrate conditions utilities under which units of miscellaneous hospital equipment are to be installed and notify 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 installer.

**3.02 PREPARATION**

A. Coordination: Coordinate work of this Section with related work of other Sections to obtain proper installation of items. Contractor shall acquaint himself with work of other Sections whose work abuts, adjoins, or is affected by or related to work under this Section.

**3.03 INSTALLATION**

A. Install units in accordance with manufacturer's instructions, using concealed fasteners appropriate to substrate and recommend by manufacturer of units. Install units plumb and level, firmly anchored in locations and at heights indicated.
3.04 FIELD QUALITY CONTROL
A. Test and Examinations: After installation, equipment shall be examined and sufficiently tested under operating conditions to determine that the unit has been installed correctly and will function properly. If inspection shows defects, such defects shall be corrected, defective material replaced, and inspection repeated. Such repairs shall be made with new material at no additional expense to the Owner.

3.05 CLEANING
A. At completion of installation clean and polish all exposed surface and units in strict accordance with manufacturer's instructions after removing temporary labels and protective coating.

3.06 PROTECTION
A. Protect installed units from damage and soiling until acceptance by Owner.

END OF SECTION
SECTION 142100 - ELECTRIC TRACTION ELEVATORS (MACHINE ROOM-LESS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes electric traction passenger elevators.

B. Note: Steel used in this project is required to be in compliance with 49 CFR Part 661 – BUY AMERICA REQUIREMENTS.

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Section 042200 "Concrete Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
3. Section 051000 "Metal Framing" for the following:
   a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
   b. Divider beams.
   c. Hoist beams.
   d. Structural-steel shapes for subsills.
4. Section 055000 "Metal Fabrications" for the following:
   a. Attachment plates and angle brackets for supporting guide-rail brackets.
   b. Divider beams.
   c. Hoist beams.
   d. Structural-steel shapes for subsills.
   e. Pit ladders.
   f. Cants in hoistways made from steel sheet.
1.03 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.04 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:
   1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
   2. Include large-scale layout of car-control station.
   3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Initial Selection: For finishes involving color selection.

D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; Samples of sheet materials; and trim.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and control closet layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

C. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data. Include the following:
   1. Owners Manual and Wiring Diagrams,
   2. Parts list, with recommended parts inventory.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard two-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
1.07 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.09 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

2. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ThyssenKrupp Elevator or comparable product.

1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.
2.02 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.03 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:

2. Rated Load: 3500 lb.
3. Rated Speed: 125 fpm (minimum)
5. Security Features: Keyswitch operation.
6. Dual Car-Control Stations: Provide two car-control stations in each elevator; equip only one with required keyswitches if any.
7. Car Enclosures:
   a. Inside Width: 92 inches (2337 mm) from side wall to side wall.
   b. Inside Depth: 65 inches (1651 mm) from back wall to front wall (return panels).
   c. Inside Height: 94 inches (2388 mm) nominal to underside of ceiling.
   d. Front Walls (Return Panels): Brushed stainless steel.
   e. Car Fixtures: Brushed stainless steel.
   f. Side and Rear Wall Panels: Brushed stainless steel.
   g. Reveals: Brushed stainless steel.
   h. Door Faces (Interior): Brushed stainless steel.
   i. Door Sills: Aluminum, mill finish.
   j. Ceiling: Brushed stainless steel.
   k. Handrails: 1-1/2 inches (38 mm) round, brushed stainless steel, at sides and rear of car.
   l. Floor: prepared to receive aluminum non-slip textured (5WL) material.

8. Hoistway Entrances:
   a. Width: 48 inches (1219 mm).
   b. Height: 84 inches (2134 mm).
   c. Type: Single-speed center opening.
   d. Frames at First Floor: Brushed stainless steel.
   e. Frames at Other Floors: Brushed stainless steel.
   f. Doors and Transoms at First Floor: Brushed stainless steel.
   g. Doors and Transoms at Other Floors: Brushed stainless steel.
   h. Sills at First Floor: Aluminum, mill finish.
i. Sills at Other Floors: Aluminum, mill finish.

9. Additional Requirements:
   a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from brushed stainless steel.

2.04 MACHINE ROOM-LESS TRACTION SYSTEMS

A. Elevator Machines: Compact energy efficient permanent magnet gearless traction type hoisting machine, consisting of permanent magnet AC motor, brake, and driving sheave.

   1. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
   2. Provide means for absorbing regenerated power when elevator system is operating on standby power.
   3. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.

B. Fluid for Hydraulic Buffers: If using hydraulic buffers, use standard hydraulic fluid.

C. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

D. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 055000 "Metal Fabrications" for materials and fabrication.

E. Car Frame and Platform: Bolted- or welded-steel units.

F. Guides: Roller guides. Provide guides at top and bottom of car and counterweight frames.

2.05 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.

B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators:

   1. Provide a separate battery powered unit that senses loss of power. Battery shall be 12 volt minimum, scaled nickel cadmium or gel cell construction. When loss of power occurs, elevator shall ascend or descend to nearest landing and open doors automatically. After a predetermined time, the doors shall close and the elevator shall remain inoperative until normal power is restored. The door open and alarm buttons shall operate under battery power. Reduced speed for evacuation on battery operation is permitted.

C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations. Key is removable only in deactivated position.

2.06 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.07 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with nonremovable wall panels, with removable car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor: Exterior grade plywood, not less than 7/8-inch (22.2-mm) nominal thickness.
2. Floor Finish: To be constructed of aluminum non-slip textured (5WL) material which curves upwards and is integral with the cab walls. Flooring to be welded vertically in ground smooth 6” on all side walls in order to contain spilled liquids from escaping the cab and seeping into the hoistway
4. Fabricate car with recesses and cutouts for signal equipment.
5. Fabricate car door frame integrally with front wall of car.
7. Sight Guards: Provide sight guards on car doors.
8. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.
9. Metal Ceiling: Flush panels, with LED downlights in the center of four low-voltage downlights in each panel. Align ceiling panel joints with joints between wall panels.
10. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.08 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252.

1. Fire-Protection Rating: 1-1/2 hours with 30-minute temperature rise of 450 deg F (250 deg C).

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Steel Subframes: Formed from cold- or hot-rolled steel sheet, with factory-applied enamel finish or rust-resistant primer. Fabricate to receive applied finish as indicated.
2. Stainless-Steel Frames: Formed from stainless-steel sheet.
3. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches (76 mm) high, on both inside surfaces of hoistway door frames.
5. Sight Guards: Provide sight guards on doors matching door edges.
6. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.
7. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.09 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LEDs.

B. General: Provide signal equipment designed for destination-based system. Fabricate lighted elements with LEDs.

C. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.

1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

D. Swing-Return Car-Control Stations: Provide car-control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.

1. Mark buttons and switches for function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

E. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset.
use. System is contained in an integral cabinet, with identification, instructions for use, and battery backup power supply. Communication shall be monitored per ASME A17.1, Requirement No. 2.27.1.1.6.

F. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified plans.

G. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

H. Hall Push-Button Stations: Provide one hall push-button station at each landing.
   1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
   2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
   3. Equip units with buttons for calling elevator and for indicating direction of travel or destination as required by system. Provide a signaling system to verify floor selection, where destination registration is required, and to direct passengers to appropriate car.
      a. Provide a means for passengers to indicate that they have disabilities so control system can allow extra room in assigned car.
      b. Provide for connecting units that require destination registration to building security access system so a card reader can be used to register calls.

I. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in plans.
   1. Possibly insert a provision for either an "In Use" signal or a digital display of car position for single elevators.

2.10 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

C. Stainless-Steel Bars: ASTM A 276, Type 304.

D. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.02 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and travel direction.

G. Set sills flush with finished floor surface at landing.

H. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

3.03 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
B. Operating Test: Load each elevator to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.

C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.04 PROTECTION

A. Temporary Use: None

3.05 DEMONSTRATION

A. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.06 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of 2 hours or less.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 142100
SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Roof drains.
      2. Miscellaneous storm drainage piping specialties.
      3. Cleanouts.
      4. Trench drains.
      5. Through-penetration firestop assemblies.
      6. Flashing materials.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE
   A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS
   A. Cast-Iron, Large-Sump, General-Purpose Roof Drains
      1. Manufacturers: Subject to compliance with requirements, Josam, J.R. Smith or Zurn Plumbing Products Group.

2.2 CLEANOUTS
   A. Floor Cleanouts:
1. **Basis-of-Design Product**: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   c. Zurn Plumbing Products Group; Light Commercial Products Operation.

2. Standard: ASME A112.36.2M, for cast-iron soil pipe with cast-iron ferrule cleanouts.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule
5. Body or Ferrule Material: Cast iron.
7. Outlet Connection: Inside calk.
8. Closure: Cast-iron plug.
9. Adjustable Housing Material: Cast iron
11. Frame and Cover Shape: Round.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

**B. Test Tees:**

1. **Basis-of-Design Product**: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
3. Size: Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure Plug: Countersunk.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

**C. Wall Cleanouts:**

1. **Basis-of-Design Product**: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.3 TRENCH DRAINS

A. Trench Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   c. Zurn Plumbing Products Group; Specification Drainage Operation.

5. Clamping Device: Required.
6. Outlet: Bottom.
7. Grate Material: Ductile iron.
8. Grate Finish: Cast iron.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. ProSet Systems Inc.

2. Standard: ASTM E 814, for through-penetration firestop assemblies.
3. Certification and Listing: acceptable to authorities having jurisdiction for through-penetration firestop assemblies.
4. Size: Same as connected pipe.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Special Coating: Corrosion resistant on interior of fittings.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer’s written installation instructions.
   1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   2. Install expansion joints, if indicated, in roof drain outlets.
   3. Position roof drains for easy access and maintenance.

B. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
   1. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
   2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
   3. Locate cleanouts at minimum intervals of 50 feet for piping 4 inches in diameter.
   4. Locate cleanouts at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.

E. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.

F. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

A. Comply with requirements for piping specified. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. (30-kg/sq. m) lead sheets, 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of 4.0-lb/sq. ft. (20-kg/sq. m) lead sheets, 0.0625-inch (1.6-mm) thickness or thinner.
   2. Copper Sheets: Solder joints of copper sheets.
B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches (250 mm) and with skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423
SECTION 233416 - CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: For each product.

1. Airfoil centrifugal fans.
2. Forward-curved centrifugal fans.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control reports.
1.5 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS
   A. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. AMCA Compliance:
      1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
      2. Operating Limits: Classify according to AMCA 99.
   B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   C. Capacities and Characteristics:
      1. Total Airflow: See fan schedule.
      2. External Static Pressure: See fan schedule
      3. Class: I.

2.2 MOTORS
   A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors, as per manufacturer recommendations.

2.3 SOURCE QUALITY CONTROL
   A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
   B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."
PART 3 - EXECUTION

3.1 INSTALLATION
A. Install centrifugal fans level and plumb.
B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
C. Lift and support units with manufacturer's designated lifting or supporting points.
D. Equipment Mounting:
   1. Comply with requirements for vibration isolation devices as per manufacturer recommendations.
E. Install units with clearances for service and maintenance.

3.2 CONNECTIONS
A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.
B. Install ducts adjacent to fans to allow service and maintenance.
C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3 FIELD QUALITY CONTROL
A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
C. Perform the following tests and inspections:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Adjust belt tension.
   6. Verify lubrication for bearings and other moving parts.
   7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   8. Remove and replace malfunctioning units and retest as specified above.
D. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416
SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. LEED Submittals:
1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS
A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.
1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: **One** for each air-handling unit.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:
   1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Architectural Sections.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:
   a. For Compressor: One year from date of Substantial Completion.
   b. For Parts: One year from date of Substantial Completion.
   c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements,

B. **Basis-of-Design Product:** Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:

1. **Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.**
2. Friedrich Air Conditioning Company.
3. Lennox International Inc.
4. Trane; a business of American Standard companies.
5. YORK; a Johnson Controls company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:

   1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in other Sections.

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

END OF SECTION 238126
SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Building wires and cables rated 600 V and less.
      2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For testing agency.
   B. Field quality-control reports.

1.5 QUALITY ASSURANCE
   A. Testing Agency Qualifications: Member Company of NETA or an NRTL.
      1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES
   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:
   B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
      1. Alcan Products Corporation; Alcan Cable Division.
2. Alpha Wire.
3. Belden Inc.
5. General Cable Technologies Corporation.

C. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658. All conductors shall be copper, #14 AWG and larger conductors shall be stranded.

D. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

2.2 CONNECTORS AND SPLICES

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. AFC Cable Systems, Inc.
2. Gardner Bender.
4. Ideal Industries, Inc.
5. Ilsco; a branch of Bardes Corporation.
6. NSi Industries LLC.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. 3M; Electrical Markets Division.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Wire or cables not installed inside a room or a building must be UL listed for wet locations.

B. Comply with NFPA 70.
PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Every wire or cable must be identified by print numbers at every panel, equipment, junction boxes, auxiliary gutters, device boxes, and every time the wire or cable is accessible. The numbers used must be of the polyolefin shrink tube numbering system. In addition the Fire alarm circuits shall be identified at terminals and shall comply with NEC Article 760.10.

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
   3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and
larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519
SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes grounding and bonding systems and equipment.
   B. Section includes grounding and bonding systems and equipment, plus the following special applications:
      1. Underground distribution grounding.
      2. Ground bonding common with lightning protection system.
      3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS
   A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
      1. Test wells.
      2. Ground rods.
      3. Ground rings.
      4. Grounding arrangements and connections for separately derived systems.
   B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert, AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches (600 mm) below grade.
C. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.
3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
   1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of area or item indicated.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.

2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:


H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
4. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 310000 "Earthwork" for construction of trenches for exterior ductbanks, manholes, and underground utility construction.
2. Section 260519 "Low Voltage Electrical Power Conductors and Cables" for low voltage system requirements.

1.3 DEFINITIONS

A. GRS: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS
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. Allied Tube & Conduit.
2. Anamet Electrical, Inc.
3. Electri-Flex Company.
5. Picoma Industries.
6. Republic Conduit.
7. Robroy Industries.
8. Southwire Company.
10. Western Tube and Conduit Corporation.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

   1. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

G. Joint Compound for IMC, GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS
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. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corporation.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; Hubbell.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. RTRC: Comply with UL 1684A and NEMA TC 14.

G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Fittings for LFNC: Comply with UL 514B.

I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

J. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 BOXES, ENCLOSURES, AND CABINETS

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. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
5. FSR Inc.
8. Kraloy.
10. Mono-Systems, Inc.
12. RACO; Hubbell.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures.
17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773 with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

K. Gangable boxes are prohibited.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Interior Panels: Steel, all sides finished with manufacturer's standard enamel.

M. Cabinets:

   1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 HAN DHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, or comparable product by one of the following:
   a. Armorcast Products Company
   b. Carson Industries LLC
   c. NewBasis
   d. Oldcastle Precast, Inc
   e. Quazite: Hubbell Power System, Inc
   f. Synertech Moulded Products

4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC."
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, or comparable product by one of the following:
a. Armorcast Products Company.
b. Carson Industries LLC.
c. NewBasis.
d. Nordic Fiberglass, Inc.
e. Oldcastle Precast, Inc; Christy Concrete Products.
g. Synertech Moulded Products.

5. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
6. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
7. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
8. Cover Legend: Molded lettering, "ELECTRIC."
10. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC direct buried or encased in concrete.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: GRC
2. Exposed, Not Subject to Severe Physical Damage: GRC.
3. Exposed and Subject to Severe Physical Damage: GRC:
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
G. Support conduit within 12 inches (300 mm) of enclosures to which attached.

H. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 2 inches (50 mm) <Insert dimension> of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from ENT to GRC.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Surface Raceways:
   1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

U. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a rain tight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Z. Locate boxes so that cover or plate will not span different building finishes.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.

DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of
60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDBOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07840 "Through-Penetration Firestop Systems."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533
SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
5. Silicone sealants.

B. Related Requirements:

1. Section 07840 "Through-Penetration Fire Stop Systems" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:
   2. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
      b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide > or comparable product by one of the following:
      a. Advance Products & Systems, Inc.
      b. CALPICO, Inc.
      c. Metraflex Company (The).
      d. Pipeline Seal and Insulator, Inc.
      e. Proco Products, Inc.

3. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.
2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
   a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.


C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
   2. Sealant shall have VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.
B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS
A. SVR: Suppressed voltage rating.
B. TVSS: Transient voltage surge suppressor.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.
   8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field Quality-Control Reports:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition operations and maintenance items required by MDT, include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member Company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.
1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407 NEMA PB 1.

1.9 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).


B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet (2000 m).

1.10 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface mounted cabinets.

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1
   b. Outdoor Locations: NEMA 250, Type 3R

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

6. Finishes:
   a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Galvanized steel
   c. Retain first subparagraph below for installations in humid tropical environments.
   d. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.


B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:


2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.


2. Main and Neutral Lugs Mechanical type.

3. Ground Lugs and Bus-Configured Terminators: Mechanical type.

4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.


2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 DISTRIBUTION PANELBOARDS

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

E. Mains: Circuit breaker.


G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407 - NEMA PB 1.1.
B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Mount top of trim 80 inches above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

H. Comply with NECA 1.

3.3 IDENTIFICATION

A. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

B. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
   c. Instruments and Equipment:
      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Receptacles, receptacles with integral GFCI, and associated device plates.
      2. Weather-resistant receptacles.
      3. Wall-switch and exterior occupancy sensors.
      4. Communications outlets.

1.3 DEFINITIONS
   A. EMI: Electromagnetic interference.
   B. GFCI: Ground-fault circuit interrupter.
   C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
   D. RFI: Radio-frequency interference.
   E. TVSS: Transient voltage surge suppressor.
   F. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
   C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS
   A. Field quality-control reports.
1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5361 (single), 5362 (duplex).
2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. **Products**: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cooper; VGF20.
   b. Hubbell; GFR5352L.
   c. Pass & Seymour; 2095.
   d. Leviton; 7590.

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

1. **Products**: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cooper; CWL520R.
   b. Hubbell; HBL2310.
   c. Leviton; 2310.
   d. Pass & Seymour; L520-R.

2.6 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. **Products**: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   1) Single Pole:
   2) Cooper; AH1221.
   3) Hubbell; HBL1221.
   4) Leviton; 1221-2.
   5) Pass & Seymour; CSB20AC1.
   6) Two Pole:
7) Cooper; AH1222.
8) Hubbell; HBL1222.
9) Leviton; 1222-2.
10) Pass & Seymour; CSB20AC2.

11) Three Way:
12) Cooper; AH1223.
13) Hubbell; HBL1223.
14) Leviton; 1223-2.
15) Pass & Seymour; CSB20AC3.

2.7 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces, satin-finished, Type 302 stainless steel 0.04-inch-1-mm-thick.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, thermoplastic with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtailed.

4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
   1. Replace devices that have been in temporary use during construction and that were installed before finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtailed that are not less than 6 inches (152 mm) in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
   6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
   7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtailed for device connections.
   8. Tighten unused terminal screws on the device.
   9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
   1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.
3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726
SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.


4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

5. Coordination charts and tables and related data.

6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition operations and maintenance items required by MDT, include the following:

1. Ambient temperature adjustment information.

2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse
4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Cooper Bussmann, Inc.
   2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:
   1. Motor Branch Circuits: Class RK1, time delay.
   2. Other Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install permanent labels indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Interior lighting fixtures, lamps, and ballasts.
   2. Emergency lighting units.
   3. Exit signs.
   4. Lighting fixture supports.
   5. Retrofit kits for fluorescent lighting fixtures.
B. Related Sections:
   1. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS
A. BF: Ballast factor.
B. CCT: Correlated color temperature.
C. CRI: Color-rendering index.
D. HID: High-intensity discharge.
E. LER: Luminaire efficacy rating.
F. Lumen: Measured output of lamp and luminaire, or both.
G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
   a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
   b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:
   1. Lamps and ballasts, installed.
   2. Cords and plugs.
   3. Pendant support system.

D. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS
A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
B. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
C. Field quality-control reports.
D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE
A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
C. Comply with NFPA 70.

1.8 COORDINATION
A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.9 WARRANTY
A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS
A. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
B. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.125 inch (3.175 mm) <insert dimension> minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:
   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
   d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
   e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
   f. CCT and CRI for all luminaires.

H. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
   a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
4. **Charger**: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

**B. External Type**: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.

1. **Emergency Connection**: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. **Nightlight Connection**: Operate one fluorescent lamp in a remote fixture continuously.
3. **Battery**: Sealed, maintenance-free, nickel-cadmium type.
4. **Charger**: Fully automatic, solid-state, constant-current type.
5. **Housing**: NEMA 250, Type 1 enclosure.
6. **Test Push Button**: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. **LED Indicator Light**: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. **Remote Test**: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. **Integral Self-Test**: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

### 2.6 EMERGENCY LIGHTING UNITS

**A. General Requirements for Emergency Lighting Units**: Self-contained units complying with UL 924.

1. **Battery**: Sealed, maintenance-free, lead-acid type.
2. **Charger**: Fully automatic, solid-state type with sealed transfer relay.
3. **Operation**: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. **Test Push Button**: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. **LED Indicator Light**: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. **Wire Guard**: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. **Integral Time-Delay Relay**: Holds unit on for fixed interval of 15 <Insert period> minutes when power is restored after an outage.
8. **Remote Test**: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. **Integral Self-Test**: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
2.7 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 <Insert value> K, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 <Insert value> K, and average rated life of 20,000 hours unless otherwise indicated.

C. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3000 <Insert value> K, and average rated life of 20,000 hours unless otherwise indicated.

D. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 <Insert value> K, and average rated life of 20,000 hours unless otherwise indicated.

E. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, unless otherwise indicated.

   1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
   2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
   3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
   4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
   5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
   6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
   7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.8 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

B. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:
   1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
   2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

3.2 IDENTIFICATION

A. Install permanent type labels with panel and circuit numbers on concealed junction and outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.
3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 <Insert number> months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two <Insert number> visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100
SECTION 282300 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.

1.3 DEFINITIONS
A. AGC: Automatic gain control.
B. BNC: Bayonet Neill-Concelman - type of connector.
C. B/W: Black and white.
D. CCD: Charge-coupled device.
E. FTP: File transfer protocol.
F. IP: Internet protocol.
G. LAN: Local area network.
H. MPEG: Moving picture experts group.
I. NTSC: National Television System Committee.
J. PC: Personal computer.
K. PTZ: Pan-tilt-zoom.
L. RAID: Redundant array of independent disks.
M. TCP: Transmission control protocol - connects hosts on the Internet.
N. UPS: Uninterruptible power supply.
O. WAN: Wide area network.
1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
   3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
   4. UPS: Sizing calculations.
   5. Wiring Diagrams: For power, signal, and control wiring.

Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NECA 1.

C. Comply with NFPA 70.

D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.
1.7 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of [36 to 122 deg F (2 to 50 deg C)] dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
3. Interior, Uncontrolled Environment: System components installed in non air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 3R enclosures.
4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h). Use NEMA 250, Type 3R enclosures.
5. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence and shall be provided with dome protection.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Video-signal format shall comply with NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.

B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.

C. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.
2.2 STANDARD CAMERAS

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

A. Basis-of-Design Product: Subject to compliance with requirements, provide HD Camera by Avigilon Corporation, or comparable product, upon approval by MDT, of one of the following:

1. AXCESS International Inc.
3. CBC (AMERICA) Corp.
4. COP-USA.
5. Crest Electronics, Inc.
6. Elbex Ltd.; Elbex America Inc.
7. ELMO.
8. EverFocus Electronics Corporation.
9. GENWAC; a brand of Watec Cameras.
10. GE Security, Inc.
11. Hitachi, Ltd.
13. Hunt Electronics USA, Inc.
14. Ikegami Electronics (USA) Inc.
15. JVC Americas Corp.; JVC Professional products.
16. Merit Li-Lin (USA) Corp.
17. Panasonic Corporation of North America; Panasonic Security Systems.
18. Pelco.
22. SANYO North America Corporation.
23. Telpix Electronics, Inc.
24. Toshiba Corporation; Surveillance products.
25. Trinus Systems Inc.
26. Tyco International Limited; Sensormatic products.
27. VELTEK.
28. Vicon Industries, Inc.
29. Videology Imaging Solutions, Inc.
30. Visiontech.
31. Watec America Corporation.

B. B/W Camera:

1. Comply with UL 639.
2. Pickup Device: CCD interline transfer, 252,000 512(H) by 492(V) pixels.
3. Horizontal Resolution: 380 lines.
4. Signal-to-Noise Ratio: Not less than 46 dB.
5. With AGC, manually selectable on or off.
6. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 1.0 lux at f/1.4 with camera AGC off.
7. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
8. Manually selectable modes for backlight compensation or normal lighting.
9. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
10. Motion Detector: Built-in digital.

C. Color Camera:

1. Comply with UL 639.
2. Pickup Device: CCD interline transfer, 380,000 771(H) by 492(V) pixels.
3. Horizontal Resolution: 480 lines.
5. With AGC, manually selectable on or off.
6. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 1.0 lux, with camera AGC off.
7. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
8. Manually selectable modes for backlight compensation or normal lighting.
9. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
11. Motion Detector: Built-in digital.

2.3 REINFORCED DOME CAMERAS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Avigilon Corporation, or comparable product, upon approval by MDT, of the following:

1. Extreme CCTV Surveillance Systems.

C. Camera: Designed for high-abuse locations, with a weathertight semirecessed or surface mounting, impact-resistance polycarbonate dome, and heavy-gage, 6061 T6 aluminum body.

1. Suitable for exterior environment, rated for continuous operation in ambient temperatures of minus 40 to plus 122 deg F (minus 40 to plus 50 deg C) dry bulb and up to 85 percent relative humidity.
2. Pickup Device: CCD interline transfer, 290,000 510(H) by 492(V) pixels.
3. Horizontal Resolution: 350 lines.
4. Signal-to-Noise Ratio: Not less than 46 dB.
5. With AGC and automatic backlight compensation.
6. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 6 lux at f/2.0.
7. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.

2.4 LENSES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Avigilon Corporation, or comparable product, upon approval by MDT, of the following:

2. CBC (AMERICA) Corp.
3. COP-USA.
4. Crest Electronics, Inc.
5. Elbex Ltd.; Elbex America Inc.
6. GENWAC; a brand of Watec Cameras.
7. GE Security, Inc.
8. Hitachi, Ltd.
10. Hunt Electronics USA, Inc.
11. International Space Optics; Rainbow CCTV products.
13. Pelco.
15. SANYO North America Corporation.
16. Tamron USA, Inc.; Industrial Optics Division.
17. Telpix Electronics, Inc.
18. Tyco International Limited; Sensormatic products.
19. VELTEK.
20. Vicon Industries, Inc.
21. Videology Imaging Solutions, Inc.
22. Watec America Corporation.

C. Description: Optical-quality coated lens, designed specifically for video-surveillance applications and matched to specified camera. Provide color-corrected lenses with color cameras.

1. Auto-Iris Lens: Electrically controlled iris with circuit set to maintain a constant video level in varying lighting conditions.
2. Fixed Lens: With calibrated focus ring.
3. Zoom Lens: Motorized, remote-controlled unit, rated as "quiet operating." Features include the following:

   a. Electrical Leads: Filtered to minimize video signal interference.
   b. Motor Speed: Variable.
c. Lens shall be available with preset positioning capability to recall the position of specific scenes.

2.5 POWER SUPPLIES

A. Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, and of type as recommended by manufacturer of camera and lens.

1. Enclosure: NEMA 250, Type 3.

2.6 CAMERA-SUPPORTING EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Avigilon Corporation, or comparable product, upon approval by MDT, of the following:

2. CBC (AMERICA) Corp.
3. COP-USA.
4. Crest Electronics, Inc.
5. Elbex Ltd.; Elbex America Inc.
6. ELMO.
7. EverFocus Electronics Corporation.
8. GENWAC; a brand of Watec Cameras.
9. GE Security, Inc.
11. Ikegami Electronics (USA) Inc.
12. Merit Li-Lin (USA) Corp.
16. SANYO North America Corporation.
17. Telpix Electronics, Inc.
18. Tyco International Limited; Sensormatic products.
19. VELTEK.
20. Vicon Industries, Inc.
22. Video Mount Products.
23. Visiontech.

C. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

D. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.
E. Protective Housings for Fixed and Movable Cameras: Steel enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.

1. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display.
2. Camera Viewing Window: Polycarbonate window, aligned with camera lens.
4. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.
5. Built-in, thermostat-activated heater units. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.
6. Sun shield shall not interfere with normal airflow around the housing.
7. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.
8. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.
9. Enclosure Rating: NEMA Type 3R.

2.7 DIGITAL VIDEO RECORDERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Avigilon Corporation, or comparable product, upon approval by MDT, of the following:

1. AXCESS International Inc.
3. CBC (AMERICA) Corp.
4. COP-USA.
5. Crest Electronics, Inc.
6. Dedicated Microcomputers Limited; Dedicated Micros USA.
7. Elbex Ltd.; Elbex America Inc.
8. EverFocus Electronics Corporation.
9. GE Security, Inc.
10. Hitachi, Ltd.
12. Ikegami Electronics (USA) Inc.
13. JVC Americas Corp.; JVC Professional products.
15. Pelco.
17. SANYO North America Corporation.
18. Tyco International Limited; Sensormatic products.
19. VELTEK.
20. Vicon Industries, Inc.
C. Description: Digital, time-lapse type, full-frame and motion recorder, with removable hard drive.

1. Recording Time: 400 hours minimum.
2. Resolution: 720 by 480 lines, minimum.
3. Programming shall be from trackball and push buttons on face of the recorder, settings shall be displayed on any video monitor connected to the recorder. Programming shall include the following:
   a. Motion analysis graph.
   b. Password protection.
   c. Alarm and timer controls.
   d. Continuous recording option.
   e. Time-lapse operating modes.
   f. Search video by time, event, or motion.
4. Programming: SmartMedia card for software updating, image archiving, and image transfer to a PC.
7. Time and Date Generator: Records time (hr:min:sec) and date legend of each frame.
8. Audio Recording: 70 to 7000 Hz. Phono and microphone input; phono output.
9. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E, or freestanding desktop.

2.8 DIGITAL SWITCHERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Avigilon Corporation, or comparable product, upon approval by MDT, of the following:

1. AXCESS International Inc.
3. CBC (AMERICA) Corp.
4. Communications Specialties, Inc.
5. Convision Systems GmbH.
6. COP-USA.
7. Crest Electronics, Inc.
8. Dedicated Microcomputers Limited; Dedicated Micros USA.
9. Elbex Ltd.; Elbex America Inc.
10. EverFocus Electronics Corporation.
11. GE Security, Inc.
13. Hunt Electronics USA, Inc.
14. Ikegami Electronics (USA) Inc.
15. JVC Americas Corp.; JVC Professional products.
16. Merit Li-Lin (USA) Corp.
17. Panasonic Corporation of North America; Panasonic Security Systems.
18. Pelco.
20. SANYO North America Corporation.
21. Telpix Electronics, Inc.
22. Toshiba Corporation; Surveillance products.
23. Trinus Systems Inc.
24. Tyco International Limited; Sensormatic products.
25. VELTEK.
26. Vicon Industries, Inc.

C. Quad Switch: For displaying images from four cameras on a single monitor. Provide color switcher if one or more cameras or monitors are in color.

1. Controls: Unit-mounted front panel.
2. Resolution: 720 by 480 lines.
3. Modes: Auto, manual, and alarm. In manual mode, each channel can also be viewed in single display mode. In the event of an alarm, alarming channel shall automatically switch to full screen. If several alarms are activated, channels in alarm shall be in auto-switching mode.
4. Channel Loss Alarm: Audible buzzer; occurrence details shall be recorded.
5. Time: Indicate date and time.
6. Timing of Auto-Switcher: 1 to 30 seconds, selectable.
7. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E, or freestanding desktop.

D. Manual Switch Bank: Low-loss, high-isolation, multiple-video switch to allow manual switching of multiple quad switches and cameras to a single output. Switches shall be illuminated.

E. Sequential Switchers: Automatically sequence outputs of multiple cameras to single monitor and videotape recorder.

1. Switching Time Interval: Continuously adjustable, 5 to 20 seconds minimum, with manual override.
2. Skip-Sequential-Hold Switch: One for each camera, with LED to indicate active camera.
3. Camera Identification Legend: Either on-screen message or label at skip-sequential switch.
4. Alarm Switching: In the event of an alarm, alarming channel shall automatically switch the monitor to full screen.
5. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E.

F. PTZ Controls: Arranged for multiple-camera control, with switches to select camera to be controlled.

1. Pan-and-Tilt Control: Joystick type.
2. Zoom Control: Momentary-contact, "in-out" push button.
3. Automatic-Scan Control: A push button for each camera with pan capability that places camera in automatic-scanning mode.
2.9 IP VIDEO SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Avigilon Corporation, or comparable product, upon approval by MDT, of the following:

1. AXCESS International Inc.
3. CBC (AMERICA) Corp.
4. COP-USA.
5. Crest Electronics, Inc.
6. Dedicated Microcomputers Limited; Dedicated Micros USA.
7. Elbex Ltd.; Elbex America Inc.
8. EverFocus Electronics Corporation.
9. GE Security, Inc.
10. Hitachi, Ltd.
12. Ikegami Electronics (USA) Inc.
13. JVC Americas Corp.; JVC Professional products.
15. Pelco.
17. SANYO North America Corporation.
18. Tyco International Limited; Sensormatic products.
19. VELTEK.
20. Vicon Industries, Inc.

C. Description:

1. System shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
2. System shall have seamless integration of all video surveillance and control functions.
3. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
4. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-2/MPEG-4 video. Unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discreet sensor inputs, and control system outputs.
5. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
6. Camera system units shall be ruggedly built and designed for extreme adverse environments, complying with NEMA Type environmental standards.
7. Encoder/decoder combinations shall place video, audio, and data network stream that can be managed from multiple workstations on the user's LAN or WAN.
8. All system interconnect cables, workstation PCs, PTZ joysticks, and network intermediate devices shall be provided for full performance of specified system.
2.10 CONTROL STATIONS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Avigilon Corporation, or comparable product, upon approval by MDT, of the following:

1. AXCESS International Inc.
3. CBC (AMERICA) Corp.
4. COP-USA.
5. Crest Electronics, Inc.
6. Elbex Ltd.; Elbex America Inc.
7. GE Security, Inc.
12. SANYO North America Corporation.
13. Tyco International Limited; Sensormatic products.
14. VELTEK.
15. Vicon Industries, Inc.

C. Description: Heavy-duty, freestanding, modular, metal furniture units arranged to house electronic equipment. Coordinate component arrangement and wiring with components and wiring of other systems.

D. Equipment Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E.

E. Normal System Power Supply: 120 V, 60 Hz, through a locked disconnect device and an isolation transformer in central-station control unit. Central-station control unit shall supply power to all components connected to it unless otherwise indicated.

F. Power Continuity for Control Station: Batteries in power supplies of central-station control units and individual system components shall maintain continuous system operation during outages of both normal and backup ac system supply.

1. Batteries: Rechargeable, valve-regulated, recombinant, sealed, lead-acid type with nominal 10-year life expectancy. Capacity adequate to operate portions of system served including audible trouble signal devices for up to four hours and audible and visual alarm devices under alarm conditions for an additional 10 minutes.

2. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Charger shall recharge fully discharged battery within 24 hours.

G. Annunciation: Indicate change in system condition and switching of system or component to backup power.
2.11 SIGNAL TRANSMISSION COMPONENTS

A. Cable: Coaxial cable elements have 75-ohm nominal impedance.

B. Video Surveillance Coaxial Cable Connectors: BNC type, 75 ohms.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP network before device installation.

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

3.2 WIRING

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

B. Wiring Method: Install cables in raceways unless otherwise indicated.

1. Except raceways are not required in accessible indoor ceiling spaces and attics.
2. Except raceways are not required in hollow gypsum board partitions.
3. Conceal raceways and wiring except in unfinished spaces.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

E. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.3 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Install cameras and infrared illuminators level and plumb.

B. Install cameras with 84-inch- (2134-mm-) minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.
C. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.

D. Install power supplies and other auxiliary components at control stations unless otherwise indicated.

E. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.

F. Avoid ground loops by making ground connections only at the control station.
   1. For 12- and 24-V dc cameras, connect the coaxial cable shields only at the monitor end.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:
   1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
   2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
      a. Prepare equipment list described in "Informational Submittals" Article.
      b. Verify operation of auto-iris lenses.
      c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
      d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet (17 to 23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
      e. Set and name all preset positions; consult Owner's personnel.
      f. Set sensitivity of motion detection.
      g. Connect and verify responses to alarms.
      h. Verify operation of control-station equipment.
3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

E. Video surveillance system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:

1. Check cable connections.
2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
3. Adjust all preset positions; consult Owner's personnel.
4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
5. Provide a written report of adjustments and recommendations.

3.6 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION 282300
SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Earthwork for buildings as indicated on Drawings and specified in this section.

B. Related Sections:
   1. 31 23 35 - Excavating, Backfilling, and Compaction for Utilities.
   2. 31 31 00 - Soil Treatment.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   2. D422-63(90) Test Method for Particle-Size Analysis of Soils.
   6. D2487-93 Classification of Soils for Engineering Purposes (Unified Soil Classification System).

B. Miami-Dade County Public Works Manual (M-DCPW).

C. Florida Statute, Chapter 556, Underground Facility Damage Prevention and Safety.

1.03 QUALITY ASSURANCE

A. Trench Safety Act:
   1. Comply with the Trench Safety Act, sections 553.60 through 553.64 Florida Statutes.
   2. Where projects include trenching which exceeds a depth of 5 feet comply with the trench safety standard as required by sections 553.63 and 553.64 Florida Statute.
1.04 DEFINITIONS

A. "Satisfactory Fill Materials" include materials classified in ASTM D2487 as GW, GP, SW and SP properly worked by Contractor to obtain optimum moisture and compaction.

   1. For Buildings:
      a. Within 2 feet of the surface of indicated grade, limit rock size to 2 inches.
      b. Below 2 feet of the surface of indicated grade limit rock size to 6 inches.

B. "Unsatisfactory Materials" include materials other than "Satisfactory Fill Materials". Materials of any classification determined by testing laboratory as too wet or too soft for providing a stable foundation for structure, paving, and walks will be classified as "unsatisfactory".

C. Degree of Compaction: Required compaction is expressed as a percentage of maximum density obtained by test procedures of ASTM D1557.

D. Building Area: The area bounded by lines not less than 4 feet beyond the outside line of the building perimeter footings.

   1. Increase the 4 foot dimension by 1 foot for each foot of excavation depth required exceeding 4 feet.

1.05 SUBMITTALS

A. Submit the following before starting work:

   1. Compaction Machinery Specifications.
   2. Compaction Tests.
   3. Soil Classification Tests using ASTM classification for subgrade materials and USDA classifications for topsoil materials.
   4. Stabilized Subgrade Composition and Density.
   5. Testing Laboratory.

1.06 SITE CONDITIONS

A. Determine location and nature of work, character of equipment, and facilities needed for performance of work, general, and local conditions prevailing at site, and other matters affecting work under this contract according to Instructions to Bidders and General Conditions.

B. Subsurface data, including soil borings, ground water elevations, or conditions, if shown on the drawings or attached to these specifications, are presented only as information available indicating conditions found and limited to exact locations and shall not be interpreted as an indication of conditions that may actually develop during construction.
1. Make deductions of subsurface conditions that may affect methods or cost of construction and agree that no claim for damages or other compensation shall be made, except as are provided for in the agreement, should conditions be found during construction different from those as calculated or anticipated by the Contractor.

2. Neither Miami-Dade Transit nor the Engineer will be held responsible for variations found to exist between the subsurface data referred to above and actual field conditions that may develop during construction.

C. Where existing grades, utility lines, or substructures are shown on drawings, Contractor, Miami-Dade Transit, and the Engineer assume no responsibility for correctness of existing conditions indicated.

1. Contractor shall locate indicated existing utility lines or substructures that may be affected by this Project, and shall be responsible for any damage or injury they may sustain as a result from working on or near these existing utilities or substructures not specified to be removed or demolished.

D. Bench Marks and Monuments:

1. Maintain existing bench marks, monuments, and other reference points, and if disturbed or destroyed, replace as directed by the Engineer.

1.07 JOB CONDITIONS

A. Condition of Premises: Accept site as found and excavate, fill, compact, and backfill site as indicated on drawings and specified in this section.

B. Protection:

1. Adjacent Structures and Property:

a. Take precautions to guard against movement, settlement, injury, or loss to existing structures or to equipment and furnishings housed therein arising directly or indirectly in connection with this contract according to Instructions to Bidders and General Conditions.

b. Provide and place bracing or shoring as necessary or proper according to Instructions to Bidders and General Conditions.

c. Be responsible for the safety and support of such structures and facilities and be liable for any movement or settlement, damage, or injury caused by or resulting therefrom.

1) If, at any time, the safety of any adjacent structures or facilities appears to be in doubt, cease operations and take immediate precautions to support such structures and facilities and notify the Engineer at once.

2) Resume operations only after permission has been granted by the Engineer.
2. Adjacent Sidewalks and Streets:

a. Take precautions to guard against movement, settlement, or collapse of any sidewalks, curbs, or street passages on adjoining sites and be liable for any such movement, settlement, or collapse according to Instructions to Bidders and General Conditions.
   1) Repair such damage promptly when so ordered at no cost to the Board.
   2) Install necessary shoring, including sheet piling as may be required, to protect banks, adjacent paving, structures, and utilities during excavations.
   3) Be responsible for any damage to existing structures, equipment, and furnishings due directly or indirectly to construction operations. Except where removal is needed by site grading or location of new buildings, use every possible precaution to prevent injuries to landscaping, drives, curbs, and walks on or next to site of the work and replace, at no expense to the Board, any of the above destroyed.

3. Existing Landscaping, Drives, Curbs, and Walks: Except where removal is required by site grading or location of new buildings, take every possible precaution to prevent injuries or loss to individual trees, groups of trees, and other existing landscaping, drives, curbs and walks on or next to the site of the work according to Instructions to Bidders and General Conditions, and replace any such damaged or destroyed at no cost to the Miami-Dade Transit.

PART 2 EXECUTION

2.01 INSPECTION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

2.02 GENERAL

A. Public Safety: Accomplish work in a manner providing for the safety of the public and workers and the protection of property.

B. Construction: Do not close, obstruct, or store material or equipment in streets, sidewalks, alleys, or passageways without a permit according to local ordinances, regulations, codes, and the Board's approval.

C. Interference: Conduct operations with minimum interference with roads and other facilities.

D. Removal:

1. Unless otherwise noted or specified to be relocated or stored, materials removed become property of Contractor and shall be removed completely away from site.
2. Do not store or allow debris to accumulate on site.
3. If Contractor fails to remove excess debris promptly, Miami-Dade Transit reserves the right to remove the debris at Contractor's expense.

E. Temporary Structures: Remove temporary structures when no longer required.

F. Repair:

1. Clean up, repair, or replace, at no cost to the Board, property damage arising in connection with this Contract.
2. Patch and repair work shall match existing and be performed in a neat and professional manner by workers skilled in the trade involved.
3. This applies to damage to the newly graded areas within the building area limits and damage to adjacent properties by eroded materials.

G. Erosion Repair:

1. Take every precaution and temporary measure to prevent damage from erosion of freshly graded areas.
   a. Repair and reestablish grades to required elevations and slopes where settlement or washing occurs before acceptance of work at no cost to Miami-Dade Transit.
   b. This applies to damage to the newly graded areas within the building area limits and damage to adjacent properties by eroded materials.

2.03 LOCATIONS AND ELEVATIONS

A. Be responsible for surveys, measurements, and layouts required for proper execution of the work.

1. Lay out lines and grades from existing survey control system and as shown on drawings.

B. Locate by stake and mark locations and elevations of following:

   1. Elevations of existing earth cut and fill.
   2. Final grades for landscape contours.
   3. Other items as required to execute work as specified.

2.04 CLEARING AND GRUBBING

A. Within limits of areas designated for building area, grading and site construction work, remove trees, brush, stumps, wood debris, and other deleterious materials not required to remain as part of finished work.

B. Remove grass, plants, vegetation, and organic material from same area.
C. Burning of materials is not allowed on the site.

D. Remove accumulated material daily or as necessary to prevent fire hazard condition.

2.05 STRIPPING

A. Strip turf, organic material, surface litter, rubble, and overburden for entire depth of root system of grass or other vegetation within areas indicated on Site Plan.

B. Stockpile topsoil on site where directed.

C. For building area, remove muck or organic material above the limestone layer. Clean potholes, larger than 6 inches in any horizontal direction, in rock filled with muck or organic material.

2.06 EXCAVATION

A. Begin excavation after stripping, clearing, and grubbing has been completed.

B. Excavate to grades required to accommodate the proposed construction.

C. Dewater as specified.

D. Excavations for structures shall conform to dimensions and elevations indicated for each building.
   1. Extend excavations a sufficient distance from walls and footings to allow for placing and removal of forms and installation of services, except where the concrete for walls and footing is authorized to be deposited directly against excavation surfaces.
   2. Excavation below general machine excavation for footings and foundations shall be hand worked.
   3. Bottoms of footings shall be on level planes.

E. Excavate in such a manner that quick and efficient drainage of storm water will occur.

F. Remove "unsatisfactory materials" encountered from the building areas.

G. Classify excavated materials and stockpile separately suitable soils for use as backfill materials. If sufficient quantities of excavated materials meeting requirements for backfill are not available on site, provide materials meeting these requirements.

H. Stockpile excavated material suitable for use as fill and backfill where directed by the Engineer.

2.07 FILLING, BACKFILLING, AND COMPACTION

A. Compaction:
1. Compact existing earth surfaces (exclude rock) after excavation, backfilling, and compaction of said areas to levels required with "Suitable Backfill Materials".

   a. Compact with equipment suited for soil compaction.
   b. Moisten or aerate material, as necessary, to provide moisture content to facilitate obtaining specified compaction with equipment being used.
   c. Compact each layer to not less than percentage of maximum density specified below, determined according to ASTM D1557, Method D.
   d. Insure compaction of previously prepared fill areas has been maintained before placing new layers.

<table>
<thead>
<tr>
<th>Location</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Under structures and building slabs, except footings, each layer.</td>
<td>95</td>
</tr>
<tr>
<td>2) Under footings, top 1 foot in cut, each layer of fill.</td>
<td>95</td>
</tr>
<tr>
<td>3) Under pavements and sidewalk areas, top 12 inches, each layer.</td>
<td>95</td>
</tr>
<tr>
<td>4) Under pavements and sidewalk areas, below 12 inches, each layer.</td>
<td>90</td>
</tr>
</tbody>
</table>

B. Filling and Backfilling:

1. Materials: "Satisfactory Fill Materials" shall be used in fills and backfills.
2. Place "Satisfactory Fill Material" in horizontal layers not exceeding 12 inches in loose depth.

   a. Compact as specified in this section.
   b. Do not place materials on muddy surfaces.

C. Reconditioning of Subgrade:

1. Where approved compacted subgrades are disturbed by the Contractor's subsequent operations or adverse weather, scarify and compact the subgrade as specified to required density before further construction occurs.
2. Use power driven hand tampers for recompaction over underground utilities

D. Backfilling:

1. Do not begin backfilling until:

   a. Construction below finished grade has been accepted.
   b. Underground utilities systems have been inspected, tested, and accepted.
c. Forms have been removed.
d. Excavation cleaned of trash and debris.

2. Bring backfill to indicated finished grades.
3. Backfill materials and compaction shall be as specified.
4. Do not place backfill in wet areas.
5. Do not operate heavy equipment for spreading and compacting backfill closer to foundation or retaining walls than a distance equal to height of backfill above top of footing.
6. Compact the area remaining by power-driven hand tampers suitable for material being compacted.
7. Place backfill carefully around pipes to avoid damage to the pipes.

E. Protection: Settlement or washing occurring in backfilled areas before acceptance of work shall be repaired and grades reestablished to required elevation and slope.

2.08 DISPOSAL OF EXCESS EXCAVATED MATERIALS

A. Excess "Satisfactory Fill Materials" and "Unsatisfactory Materials" shall become the property of the Contractor.

1. Remove from site.

2.09 LASER GRADING

A. Provide gradients and elevations as shown in Construction Documents with current industry standard laser grading procedures using laser automated graders and laser automated dozers to ensure specified tolerances.

2.010 DEWATERING

A. Dewater excavations for inspection and for construction. Concrete or fill shall not be placed in water and concrete less than 8 hours of age shall not be subjected to ground water pressure.

1. Keep excavations free of water while backfilling or construction takes place.
2. Dispose of water resulting from dewatering operations according to city, county, state, and federal regulations.
3. Conduct operations to insure storm water runoff sediment is not discharged to the adjacent lakes, waterways, sewers, streets, and adjacent properties.

2.011 TESTING

A. Miami-Dade Transit will provide services of a Testing Laboratory to perform specified tests, inspections, instrumentation and inspection of work.
1. Notify, through the Engineer, Miami-Dade Transit contracted Testing Laboratory to perform specified tests at Miami-Dade Transits’ expense.

B. Tests of Materials:

1. Soil Classification:
   
a. One test from each type of material encountered or proposed to be used.

2. Laboratory Tests for Moisture-Content and Density According to ASTM D1557:
   
a. One test for each material encountered or proposed to be used.

3. Field Tests for Moisture-Content and Density:
   
a. According to ASTM D1556 or ASTM D2922, one test per layer of fill per 10,000 square feet of area, plus one test per 10,000 square feet of subgrade in cut.

C. Fill and topsoil mixture may be inspected at any stage of operation to determine compaction characteristics, densities and freedom from organic and plastic materials.

D. Notification:

1. Give sufficient notification of placing of orders for fill and topsoil with supplier to allow full inspection including testing for compaction characteristics at source of supply.
2. Obtain approval from the Engineer before placing topsoil mixture at project site, without exception.

END OF SECTION
SECTION 311000
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Protecting existing trees and vegetation to remain.
   2. Removing trees and other vegetation.
   3. Clearing and grubbing.
   4. Topsoil stripping.
   5. Removing above-grade site improvements.
   6. Disconnecting, capping or sealing, and abandoning site utilities in place.
   7. Disconnecting, capping or sealing, and removing site utilities.

1.2 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.3 MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.4 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings according to Division 1 Section "Contract Closeout."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.
1.5 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by Owner before award of Contract.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Notify utility locator service for area where Project is located before site clearing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 312000 “Earth Moving”.

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
C. Locate and clearly flag trees and vegetation to remain or to be relocated.

D. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Owner will arrange to shut off indicated utilities when requested by Contractor.
   2. Arrange to shut off indicated utilities with utility companies.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.3 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
   4. Use only hand methods for grubbing within drip line of remaining trees.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding 8-inch loose depth, and compact each layer to a density equal to adjacent original ground.

3.4 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within drip line of remaining trees.
3. Dispose of excess topsoil as specified for waste material disposal.
4. Stockpile surplus topsoil and allow for resspreading deeper topsoil.

3.5 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.6 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

- END OF SECTION -
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the protection and trimming of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Certification: From a qualified arborist that trees indicated to remain have been protected during construction according to recognized standards and that the trees were promptly and properly treated and repaired when damaged.

D. Maintenance Recommendations: From a qualified arborist for care and protection of trees affected by construction during and after completing the Work.

1.3 QUALITY ASSURANCE

A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site on a full-time basis during execution of the Work.

B. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located.

C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated.

D. Preinstallation Conference: Conduct conference at Project site.
1. Before starting tree protection and trimming, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities. Review tree protection and trimming procedures and responsibilities. Notify participants at least three working days before convening conference. Record discussions and agreements and furnish a copy to each participant.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D 5268. Provide topsoil that is free of stones larger than 1 inch in any dimension and free of other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches or more; do not obtain from bogs or marshes.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

D. Chain Link Fence: Metallic-coated steel chain link fence fabric, 0.120-inch diameter wire size; 48 inches high, minimum; line posts, 1.9 inches in diameter; terminal and corner posts, 2-3/8 inches in diameter; top rail, 1-5/8 inches in diameter; bottom tension wire, 0.177 inch in diameter; with tie wires, hog ring ties, and other accessories for a complete fence system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing located as indicated or outside the drip line of trees to protect remaining vegetation from construction damage.

1. Install chain link fence according to ASTM F 567 and manufacturer's written instructions.

B. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
C. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.

D. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

1. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches back from new construction.

2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

D. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond drip line of trees. Maintain existing grades within drip line of trees.

B. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by qualified arborist, unless otherwise indicated.
1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

C. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

D. Moderate Fill: Where existing grade is more than 6 inches, but less than 12 inches, below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:

1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches below elevation of grade.
2. Place filter fabric with edges overlapping 6 inches minimum.
3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune remaining trees affected by temporary and new construction.

B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.

C. Pruning Standards: Prune trees according to ANSI A300 as follows:

1. Type of Pruning: Crown cleaning.
2. Type of Pruning: Crown thinning.
3. Type of Pruning: Crown raising.
4. Type of Pruning: Crown reduction.
5. Type of Pruning: Vista pruning.
6. Type of Pruning: Crown restoration.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Chip branches removed from trees. Spread chips where indicated or as directed by Architect.

3.5 TREE REPAIR AND REPLACEMENT
A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.

B. Remove and replace dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern.
   1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in Division 2 Section "Trees and Shrubs."
   2. Provide new trees of 6-inch caliper size and of a species selected by Architect when trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced.

C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

A. Burning is not permitted.

B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

- END OF SECTION -
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preparing subgrades for slabs-on-grade walks pavements turf and grasses and plants.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for concrete slabs-on-grade.
   4. Subbase course for concrete walks and pavements.
   5. Subbase course and base course for asphalt paving.
   6. Subsurface drainage backfill for walls and trenches.
   7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
   8. Excavating well hole to accommodate elevator-cylinder assembly.

1.2 DEFINITIONS

A. Backfill: Soil material or controlled low-strength 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.

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.

G. Fill: Soil materials used to raise existing grades.
H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. 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.

K. 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.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
   2. Controlled low-strength material, including design mixture.
   3. Warning tapes.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487.
   2. Laboratory compaction curve according to ASTM D 698.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
B. Preexcavation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures are in place.

E. Do not commence earth moving operations until plant-protection measures are in place.

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487; 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 in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487; 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.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of [washed ]crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate.
K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting low-density, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
5. Water: ASTM C 94/C 94M.
2.4 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils 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 deep; colored as follows:

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

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 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

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.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
   a. 24 inches outside of concrete forms other than at footings.
   b. 12 inches outside of concrete forms at footings.
   c. 6 inches outside of minimum required dimensions of concrete cast against grade.
   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   e. 6 inches beneath bottom of concrete slabs-on-grade.
   f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

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.
2. Pile Foundations: Stop excavations 6 to 12 inches 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. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand 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. Cut and protect roots according to requirements in Section 311316 "Selective Tree and Shrub Trimming."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

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 higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

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. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. 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."

3.8 EXCAVATION FOR ELEVATOR CYLINDER

A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances.

B. Provide well casing as necessary to retain walls of well hole.

3.9 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.
3.10 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, may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.11 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.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
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 and 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.

3.13 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 of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of [subbase material] free of particles larger than 1 inch in any dimension, to a height of 12 inches 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.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 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:
   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.
   5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.
3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, 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.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches 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.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
1. Under structures, building slabs, steps, and pavements, scarify and recompress top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
2. Under walkways, scarify and recompress top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompress top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.17 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.
1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch thick compacted layers to final subgrade.

3.19 SUBBASE AND BASE COURSES 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:
   1. Place base course material over subbase course under hot-mix asphalt pavement.
   2. Shape subbase course and base course to required crown elevations and cross-slope grades.
   3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
   4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 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. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place drainage course 6 inches or less in compacted thickness in a single layer.
   3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.21 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material and maximum lift thickness comply with requirements.
   3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

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

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.
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 Engineer.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

F. 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.

3.22 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.
   1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

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.

3.23 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.

B. Transport surplus satisfactory soil to designated storage areas outside working area.
1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off site.

- END OF SECTION -
SECTION 31 23 35
EXCAVATING, BACKFILLING, AND COMPACTION FOR UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Related Sections:
   1. 31 00 00 – Earthwork.
   2. Division 26 – Electrical Work.
   3. Division 33 – Utilities.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. D1556-90(96) Test Method for Density of Soil in Place by the Sand-Cone Method.
   2. D1557-91 Test Method for Laboratory Compaction Characteristics of Soil Using
      Modified Effort
   3. D2487-93 Classification of Soils for Engineering Purposes (Unified Soil Classification
      System).

B. Occupational Safety and Health Administration (OSHA): Trench Safety Act.

1.03 DEFINITIONS

A."Satisfactory Fill Materials" include materials classified in ASTM D2487 as GW, GP, SW, and
   SP properly worked by Contractor to obtain optimum moisture and compaction. Maximum
   size of rock limited to 6 inches. Use 2 inch maximum size for the top 2 feet below the finish
   indicated grade.

1.04 SUBMITTALS

A.Submit copies of tests and records performed as specified to A/E for review before starting work.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with OSHA, Trench Safety Act, Standard 29 C.F.R.s.,
   Chapter XVII, Subpart P (para.1926.650 thru 1926.653).
1.06 PROJECT CONDITIONS

A. Excavation, filling and backfilling for utilities complete for underground utility lines and structures as specified and as shown on the drawings.

B. Sidewalks and Streets:
   1. Take precautions to guard against movements, settlement, or collapse of sidewalks or street passages on site or on adjoining property.
   2. Be liable for any such movement, settlement, or collapse.
   3. Repair promptly such damage.
   4. Install shoring, including sheet piling, as may be required during excavation to protect trench banks adjacent paving structure, and utilities.

C. Existing Utilities:
   1. Protect existing utilities from movement, settlement, or other damages according to Instructions to bidders and General Conditions.

D. Trench Safety Act: Provide trench safety systems at all trench excavations where workers may be exposed to moving ground or cave-ins regardless of depth of trench. All trenches more than 5 feet in depth shall comply with OSHA "Trench Safety Act".

PART 2 PRODUCTS

2.01 MATERIALS

A. Trench Backfill Materials: Either satisfactory excavated material or fill materials as specified.

B. Pipe Bedding Material: Bedding material shall be selected or satisfactory backfill material and free of any rocks or stones larger than 2 inches in diameter for cast iron and PVC pipe. Limerock screenings or sand shall be used for copper tubing. (Underground copper lines are 3 inch diameter or less.)

PART 3 EXECUTIONS

3.01 INSPECTION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

3.02 EXCAVATION

A. General:
   1. Perform excavating of every description and of whatever substance encountered to depths indicated or specified.
2. Pile materials suitable for backfilling a sufficient distance from banks of trenches to prevent slides or cave-ins.
4. Remove excavated materials not required nor suitable for backfill from site.
5. Remove water by pumping or other acceptable method and discharge at a safe distance from excavation. Continue dewatering until deemed proper or desirable for the installation of utility lines.
6. Comply with the applicable standards and regulations of Miami-Dade County and the city where building is located.
7. Sheetings and shoring shall be done as is necessary for protection of work and for safety of personnel. Excavating shall be by open cut.

B. Trench Excavations:

1. Make trench of necessary width and depth for proper laying of pipe, with bank as vertical as practical.
2. Coordinate trench excavation to avoid open trenches for prolonged periods.
3. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along their entire length, except portions of pipe sections where it is necessary to excavate for couplings and for proper making of pipe joints or where unsatisfactory materials incapable of properly supporting pipe and utility structures are encountered at bottom of trench.
4. Dig holes and depressions for joints after trench bottom has been graded of length, depth, and width required for properly making the particular type of joint.
5. When unsatisfactory soil, incapable of properly supporting pipe, is encountered at the bottom of the trench, remove such soil to a minimum depth of 12 inches, or 1/4 of the pipe diameter, whichever is greater, below the bottom of pipe and backfill material specified.
6. Over-depths in unstable soil excavation and unauthorized over-depths shall be at the expense of Contractor.

C. Special requirements relating to specific utilities are as follows:

1. Storm Drains and Sanitary Sewers:
   a. Where shown on drawings, make width of trench at and below top of pipe adequate to allow space for workers to place and properly joint pipe.
   b. Clear space between the barrel of the pipe and trench wall shall not exceed 8 inches on either side of the pipe.
   c. Width of the trench above the level may be as wide as necessary for sheeting and bracing and proper performance of the work.
   d. For plastic pipe, where shown on drawings, make depth of trench to allow a minimum of 24 inches of cover over the top of 2-1/2" or less pipe and a minimum of 36 inches of cover over the top of 3 inch or larger pipe from finished grade unless otherwise indicated or required by local utility. Install metallic detection tape.
inches - 6 inches below finish grade. See Section 15047 - Identification.
e. Round the bottom of the trench so at least the bottom quadrant of the pipe shall rest firmly on undisturbed soil or select bedding for as nearly the full length of the barrel as proper joining operations will allow.
f. Trenches for plastic pipe shall be cut to an over-depth of not less than 6 inches and a cushion of rock free soil or coarse sand used for not less than 6 inches bedding and 12 inches backfill over the plastic pipe.
g. Perform this part of the excavation manually a few feet ahead of the pipe laying operation by workers skilled in this type of work.

2. Water Lines, Force Mains, and Gas Lines:

a. Where shown on drawings, make depth of trench to allow a minimum of 24 inches of cover over the top of the pipe from finished grade unless otherwise indicated or required by local utility.
b. For plastic pipe, install metallic detection tape 4 inches - 6 inches below finish grade. See Section 15047 - Identification.
c. Avoid interference of water lines with other utilities, grade water lines to avoid air pockets.
d. Trenches for plastic pipe shall be cut to an over-depth of not less than 6 inches and a cushion of rock free soil or coarse sand used for not less than 6 inches bedding and 12 inches backfill over the plastic pipe.

3. Electrical Conduit or Cables:

a. Trenches for plastic conduits shall be a depth providing not less than 24 inches of cover from finished grade or 12 inches or greater of cover from underside of slabs to accommodate bending radii, unless otherwise indicated. Install warning tape 8 inches below finish grade or underside of slab. See Section 15047 - Identification.
b. Trenches for plastic conduit and cables shall be cut to an over-depth of not less than 3 inches and a cushion of rock free soil or coarse sand used for not less than 3 inches bedding and 3 inches backfill over the plastic conduit and cable.

4. Excavating for Appurtenances:

c. Excavations for structures shall be sufficient to leave at least 12 inches in the clear between their outer surfaces and the embankment or shoring used.
d. Whenever unstable soil is incapable of properly supporting the structure is encountered in the bottom of the excavation, such soil shall be removed and excavation backfilled as specified herein in paragraph "Trench Excavation".
e. Unauthorized over-depths or under-depths in wet or otherwise unstable soil shall be filled with selected backfill material or concrete, as directed, at the expense of the Contractor.
3.03 EXCAVATION OF UNCLASSIFIED MATERIAL

A. Materials encountered during the excavating to the depth and extent specified and indicated on drawings may include rock, concrete, masonry, or other similar materials.

1. No adjustment will be made in the Contract Price because of the presence (or absence) of rock, concrete, masonry, or other similar materials.

3.04 PROTECTION OR REMOVAL OF UTILITY LINES

A. Protection:

1. Protect existing utility lines indicated on drawings (or the locations of which are made known to Contractor before excavating and trenching) specified to remain, including utility lines constructed during trenching operations, from damage during trenching, backfilling, and compacting operations.

   f. If such new or existing utility lines are damaged during trenching, back filling and compacting, operations, repair or replace at no cost to A/E.

2. When utility lines specified to be removed or replaces are encountered within the area of operations, issue notice in ample time for measures to be taken to coordinate necessary interruption of services.

B. Repair of Damage to Unknown Existing Utility Lines:

1. Existing utility lines not shown on drawings (or the location of which is not known to Contractor in time to avoid damage) damaged during trenching operations shall be repaired by Contractor and an adjustment to the Contract Price will be made according to Instructions to Bidders and General Conditions.

3.05 BACKFILLING

A. General:

1. Coordinate backfilling with testing of utilities. Leave sheeting in place where damage is likely to result from withdrawal.

2. Carefully backfill trenches with satisfactory specified materials.

3. Bring backfill up evenly in 9 inch maximum layers, loose depth, and thoroughly and carefully compact with mechanical or hand tampers until pipe has a minimum cover of one foot. Take care not to damage the pipe.

4. Deposit remainder on the satisfactory backfill material in the trench in one foot layers and compact by mechanical means to percentages as specified.

   g. Trenches and excavation pits improperly backfilled or where settlement occurs
shall be reopened to the depth required for proper compaction, refilled and compacted, with the surface restored to the specified grade and compaction.

5. Keep excavations free of ground and surface water until backfilling operation is complete.

B. Appurtenances:

1. At structures, remove forms and trash before backfilling.

   h. Place satisfactory backfill materials symmetrically on all sides in 9 inch maximum loose depth layers.
   i. Moisten each layer, if necessary, and compact with mechanical or hand tamper, taking care not to injure the structure by excessive tamping.

2. Materials and density shall be as previously specified for trenches depending upon location of the structure.

C. Compaction:

1. Material may be compacted by a hand tamper, a powered hand tamper, a vibrating tamper, or mechanized power tamper provided such compaction percentages meet the required density as specified below.

2. Backfilling and compacting by means of hydraulic methods will not be allowed except as may be approved by A/E.

   j. Compact each layer to not less than the percentage of maximum density specified below, determined according to ASTM D1557, Method D:

<table>
<thead>
<tr>
<th>FILLS AND BACKFILL</th>
<th>COHESIONLESS SOIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under slabs and pavement</td>
<td>95%</td>
</tr>
<tr>
<td>Under walk areas, top 12 inches</td>
<td>95%</td>
</tr>
<tr>
<td>Under walk areas, below top 12 inches</td>
<td>90%</td>
</tr>
<tr>
<td>Under landscape areas</td>
<td>85%</td>
</tr>
<tr>
<td>Under other areas noted on Site Plan</td>
<td>85%</td>
</tr>
</tbody>
</table>
3.06 TESTING

A. Notify, through A/E, the Board contracted Testing Laboratory to perform specified tests at the Board's expense.

B. Tests of Materials shall be as follows:

1. Laboratory Tests for Moisture Content and Density:

   a. According to ASTM D1557, one test for each material encountered or proposed to be used.

2. Field Tests for Moisture Content and density:

   a. According to ASTM D1556, one test per layer per 100 linear feet of ditch.

END OF SECTION
SECTION 31 31 00
SOIL TREATMENT
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Termiticide application to soil under new buildings as indicated on drawings and specified in this section
B. Use of chlordane, heptachlor, aldrin, dieldrin and chlorpyrifos class of chemicals are not allowed.
C. Related Sections:
   1. 31 00 00 - Earthwork.
   2. 03 30 00 - Cast-In-Place Concrete.

1.02 SUBMITTALS

A. Submit the following for review before starting work:
   1. Product data, including manufacturers specifications, chemical analysis, with recommended dilution, application directions, and safety precautions.
   2. Sample copy of applicator's warranty for review.
   3. Applicator's experience evidence with copies of current local and state licenses and current Certified Operator-in-Charge certificate.
B. Miami-Dade County Public Works Manual (M-DCPW).
C. Florida Statute, Chapter 556, Underground Facility Damage Prevention and Safety.

1.03 QUALITY ASSURANCE

A. Work shall be done by a bonded Contractor whose principal business is pest control and termite treatment and can show evidence of at least 5 years of successful operation in this field.
B. Field Samples:
   1. Test samples of the mixture of the concentrate and water will be taken by the Board contracted Testing Laboratory.
   2. If sample solution indicates noncompliance with the manufacturer's application requirements, the Contractor shall pay for the initial test performed by the Board, any subsequent retesting required by the Board, and reapplication of soil treatment solution.
1.04 PROTECTION

A. To avoid surface flow or overspray of toxicant from application site, do not apply soil poisons when soil or fill is excessively wet or after heavy rains.

B. Unless treated areas are to be immediately covered, take precautions to prevent disturbance of treatment by human or animal contact.

C. Comply with applicable laws, codes, ordinances of Federal, State, and local regulatory agencies having jurisdiction over use of soil poisons.

D. Provide warning signs and instruct workers to use protective measures for their safety.

1.05 WARRANTY

A. Upon completion of soil treatment and as a condition of substantial completion, furnish the Board with a written warranty, from the applicator, which shall provide that:
   1. Application was made at concentration, rates, and methods complying with these specifications.
   2. Effectiveness of treatment is warranted for not less than 5 years without additional cost to the Board, by means of a 5-year repair and replacement bond.
   3. Upon evidence of subterranean termite activity, retreat area at no additional charge to the Board. Additional treatment shall be sufficient to prevent termites from attacking building or its contents.
   4. Upon occurrence of damage to building or to its contents within warranty period, retreat soil and replace damage at no cost to the Board.
   5. Warranty bond shall be drawn in favor of the Board, successor, or assigns and shall be non-cancelable by all parties to the contract except the Board.
PART 2 PRODUCTS

2.01 MATERIALS

A. Florida Registered Soil Termiticides:
   2. Talstar, bifenthrin, FMC Corporation.
   5. Tribute, fenvalerate, Aventis Environmental Science.
   6. Termidor, fipronil, Aventis Environmental Science.
   7. Premise, imidacloprid, Bayer Corporation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

3.02 APPLICATION

A. Before mixing concentrate and water as recommended by the manufacturer for specific application and conditions, contact the Board 48 hours in advance.

B. Apply termiticide mixture to the following:
   1. Soil and earth that will be covered by or lie next to buildings.
   2. Masonry foundations.
   3. Areas around pipes and conduits penetrating slabs on fill to provide a lethal barrier to subterranean termites.

C. Apply termiticide mixture after subgrade has been made ready for placement of any floor slab vapor barrier, and as soon as practical before placement of concrete slabs and caps on masonry piers. Piling, pile caps, grade beams, foundation walls, and below grade waterproofing shall have been completed.

D. Apply at least 12 hours before placement of concrete slabs and during normal working hours to be subject to inspection. Notify applicator at least 24 hours before application of termiticide mixtures will be completed.
E. Soil Conditions: Apply termiticide mixtures when moisture content soil is sufficiently low to allow uniform distribution of chemical throughout specified areas.

F. Application Under Slabs on Fill:
1. Apply termiticide mixtures uniformly to all areas beneath concrete slabs-on-grade, including beneath walkways and entrance platforms and beneath sidewalks within 5 feet of buildings.
2. A minimum of 1 gallon of termiticide mixtures shall be uniformly applied to each 10 square feet of area to be treated.
3. Ground areas beneath concrete slabs-on-grade and paving abutting building slabs shall be similarly treated for a distance not less than 3 feet from building.

G. Application Along Foundation Walls, Pipes, and Conduits:
1. Treat critical areas along both sides of exterior and interior foundation walls, columns, and around utility pipes, conduits, ducts, and other similar items extending through soil beneath, and next to new construction, to a depth of 1 foot in a strip 6 inches wide, at a rate of 4 gallons of termiticide mixture to each 10 linear feet.
2. Mix chemical with soil as it is placed against walls and utility lines.
3. Apply at least 1 gallon of termiticide mixture around each pipe.

H. Application to Masonry Foundation Walls: Treat voids of unit masonry foundation walls, top of course occurring at or just above grade level, with additional treatment of not less than 2 gallons of chemical for each 5 linear feet.

I. Retreatment of Disturbed Soil: Retreat soil surfaces disturbed after treatment and before placement of slabs and covering structures.

3.03 CLEAN UP

A. Improper disposal of pesticide, spray mixture, or rinsate is a violation of federal law. Comply with manufacturer’s instructions for disposal of these materials and empty containers. Do not allow supplies of chemicals to remain on site unattended.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt overlay.
5. Asphalt surface treatments.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [Project site].

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

   a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
   b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.
2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:

1. Paving Fabric: 12 by 12 inches minimum.
1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of FDOT for asphalt paving work.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.
B. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS
A. Asphalt Binder: AASHTO M 320.
B. Asphalt Cement: ASTM D 3381.
C. Cutback Prime Coat: ASTM D 2027, medium-curing cutback asphalt.
F. Fog Seal: ASTM D 977 emulsified asphalt.
G. Water: Potable.

2.3 AUXILIARY MATERIALS
A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires 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.
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.
C. Sand: [ASTM D 1073], Grade No. 2 or No. 3.
D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
E. Joint Sealant: ASTM D 6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent or more than 25 percent by weight.
   1. Surface Course Limit: Recycled content no more than 10 percent by weight.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes designed according to procedures in AIMS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types" and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

C. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction]. Limit vehicle speed to 3 mph.
   2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
   3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

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

3.2 COLD MILLING

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.
1. Mill to a depth of 1-1/2 inches.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
7. Keep milled pavement surface free of loose material and dust.
8. Do not allow milled materials to accumulate on-site.

3.3 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 6 inches 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.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. 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.

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.

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.

E. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.
3.4 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
   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.

3.6 PAVING GEOTEXTILE INSTALLATION
A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.
B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.
C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.7 PLACING HOT-MIX ASPHALT
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.
   1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
   2. Place hot-mix asphalt surface course in single lift.
   3. Spread mix at a minimum temperature of 250 deg F.
   4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
   5. 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 wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
   2. Complete a section of asphalt base course before placing asphalt surface course.
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.

3.8 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.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
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 according to AIMS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.9 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.

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:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, 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. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 ASPHALT CURBS

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 mix at a minimum temperature of 250 deg F.

1. Asphalt Mix: 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.

3.11 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.12 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.
B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.13 FIELD QUALITY CONTROL

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

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

   a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.

   b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Replace and compact hot-mix asphalt where core tests were taken.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.
SECTION 321313
CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Driveways.
   2. Roadways.
   3. Parking lots.
   4. Curbs and gutters.
   5. Walks.

1.2 DEFINITIONS

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

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

D. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

E. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

F. Material Test Reports: For each of the following:

1. Aggregates. [Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.]

G. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

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

C. Concrete Testing Service: Owner will engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

   a. Concrete mixture design.
   b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

   a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete paving subcontractor.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

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

2.2 STEEL REINFORCEMENT

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from galvanized steel wire into flat sheets.


E. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
F. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.

G. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

H. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

I. Plain-Steel Wire: ASTM A 82/A 82M, galvanized.

J. Deformed-Steel Wire: ASTM A 496/A 496M.

K. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain.

L. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars zinc coated after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

M. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

N. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

O. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

P. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

Q. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, gray portland cement Type I/II:
   a. Fly Ash: ASTM C 618, Class C.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag, Type IP, portland-pozzolan cement.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source.

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

C. Water: Potable and complying with ASTM C 94/C 94M.


E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

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

C. Water: Potable.
D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

   a. **Axim Italcementi Group, Inc.**; Caltexol CIMFILM.
   b. **BASF Construction Chemicals, LLC**; Confilm.
   c. **ChemMasters**; Spray-Film.
   d. **Conspec by Dayton Superior**; Aquafilm.
   e. **Dayton Superior Corporation**; Sure Film (J-74).
   f. **Edoco by Dayton Superior**; BurkeFilm.
   g. **Euclid Chemical Company (The), an RPM company**; Eucobar.
   h. **Kaufman Products, Inc.**; VaporAid.
   i. **Lambert Corporation**; LAMBCO Skin.
   j. **L&M Construction Chemicals, Inc.**; E-CON.
   k. **Meadows, W. R., Inc.**; EVAPRE.
   l. **Metalcrete Industries**; Waterhold.
   m. **Nox-Crete Products Group; MONOFILM.**
   n. **Sika Corporation, Inc.**; SikaFilm.
   o. **SpecChem, LLC**; Spec Film.
   p. **Symons by Dayton Superior**; Finishing Aid.
   q. **TK Products, Division of Sierra Corporation**; TK-2120 TRI-FILM.
   r. **Unitex**; PRO-FILM.
   s. **Vexcon Chemicals Inc.**; Certi-Vex EnvioAssist.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. **Anti-Hydro International, Inc.**; A-H Curing Compound #2 DR WB.
   b. **ChemMasters; Safe-Cure Clear.**
   c. **Conspec by Dayton Superior; [D.O.T. Resin Cure] [DSSCC Clear Resin Cure].**
   d. **Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).**
   e. **Edoco by Dayton Superior; [DSSCC Clear Resin Cure] [Resin Emulsion Cure V.O.C. (Type I)].**
   f. **Euclid Chemical Company (The), an RPM company; Kurez W VOX.**
   g. **Kaufman Products, Inc.**; Thinfilm 420.
   h. **Lambert Corporation; AQUA KURE - CLEAR.**
   i. **L&M Construction Chemicals, Inc.**; L&M CURE R.
   j. **Meadows, W. R., Inc.**; 1100-CLEAR SERIES.
   k. **Nox-Crete Products Group; Resin Cure E.**
1. SpecChem, LLC; PaveCure Rez.
m. Symons by Dayton Superior; Resi-Chem Clear.

n. Tamms Industries, Inc., Euclid Chemical Company (The); TAMMSCURE WB 30C.
o. TK Products, Division of Sierra Corporation; [TK-2519 WB] [TK-2519 DC WB].

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Anti-Hydro International, Inc.; A-H Curing Compound #2 WP WB.
c. Conspec by Dayton Superior; [D.O.T. Resin Cure White] [DSSCC White Resin Cure].
d. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
e. Edoco by Dayton Superior; Resin Emulsion Cure V.O.C. (Type II).
f. Euclid Chemical Company (The), an RPM company; Kurez VOX White Pigmented.
g. Kaufman Products, Inc.; Thinfilm 450.
h. Lambert Corporation; AQUA KURE - WHITE.
i. L&M Construction Chemicals, Inc.; L&M CURE R-2.
j. Meadows, W. R., Inc.; 1100-WHITE SERIES.
k. SpecChem, LLC; PaveCure Rez White.
l. Symons by Dayton Superior; Resi-Chem White.
m. Vexcon Chemicals Inc.; Certi-Vex Enviocure White 100.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

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

D. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

MDT Project No. CIP010-CT1-TR12
RPQ No. 265910-R
DIVISION 32 – EXTERIOR IMPROVEMENTS
321313 – 7 of 18
1. Types I and II, non-load bearing, Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ChemMasters; Exposee.
b. Conspec by Dayton Superior; Delay S.
c. Dayton Superior Corporation; Sure Etch (J-73).
d. Edoco by Dayton Superior; True Etch Surface Retarder.
e. Euclid Chemical Company (The), an RPM company; Surface Retarder Formula S.
g. Meadows, W. R., Inc.; TOP-STOP.
h. Metalcrete Industries; Surftard.
i. Nox-Crete Products Group; CRETE-NOX TA.
j. Scofield, L. M. Company; LITHOTEX Top Surface Retarder.
k. Sika Corporation, Inc.; Rugasol-S.
l. SpecChem, LLC; Spec Etch.
m. TK Products, Division of Sierra Corporation; TK-6000 Concrete Surface Retarder.

F. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.6 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4 inch in diameter, 10-inch minimum length.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
3. Slump Limit: 4 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
2. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
3. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

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

1. Use high-range, water-reducing and retarding admixture plasticizing and retarding 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.

F. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches 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, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of [1/2 inch according to requirements in Section 312000 "Earth Moving."

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

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.
3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes.[Eliminate grooving-tool marks on concrete surfaces.]

   a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

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

   a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 CONCRETE PROTECTION AND CURING

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

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by [moisture curing] [moisture-retaining-cover curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
3. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.

3.10 WHEEL STOPS

A. Install wheel stops in bed of adhesive applied as recommended by manufacturer.

B. Securely attach wheel stops to paving with not less than two steel dowels located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if 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.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. 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.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

### 3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

- END OF SECTION -
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Expansion and contraction joints within cement concrete pavement.
   2. Joints between cement concrete and asphalt pavement.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Samples: For each type and color of joint sealant required.
C. Product certificates.
D. Compatibility and Adhesion Test Reports: From sealant manufacturer.

1.3 QUALITY ASSURANCE
A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

1. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

2.3 HOT-APPLIED JOINT SEALANTS

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Products:

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.

C. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

D. Install backer materials to support sealants during application and at position required to produce optimum sealant movement capability. Do not leave gaps between ends of backer materials. Do not stretch, twist, puncture, or tear backer materials. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

E. Install sealants at the same time backings are installed to completely fill recesses provided for each joint configuration and to produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

G. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

- END OF SECTION -
PART 1 - GENERAL

1.01 SUMMARY

A. The Work covered by this Section shall include the furnishing of all labor, Equipment and Materials necessary to construct and install all pavement marking, striping and car stops in accordance with the plans and these Specifications.

1.02 QUALITY ASSURANCE

A. Perform all Work in accordance with the requirements of jurisdictional local agencies and applicable FDOT requirements.

1.03 SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For pavement markings.
   1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
   2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Packaging and Labeling: All coatings and traffic marking materials shall be shipped in strong containers plainly marked with the weight in pounds per gallon or kilograms per liter, the volume of coatings and traffic marking materials content in gallons or liters, the color, user information, date of manufacture, LOT, batch and DOT code number. Each batch manufactured shall have a unique number. A true statement of the percentage composition of the pigment, the proportion of pigment to vehicle, and the name and address of the manufacturer, also shall be shown. The label shall warn the user of any special handling or precautions of the material, as recommended by the manufacturer. Any package not so marked will not be accepted for use under these specifications.
B. Storage: Any coatings and traffic marking materials which, although inspected and approved at the point of manufacture, hardens or livers in the containers so that it cannot be readily broken up with a paddle to a smooth, uniform painting consistency, will be rejected. All materials shall have a container storage life of one year from date of manufacture. Any coatings and traffic marking materials not acceptable for proper application will be rejected, even though it conforms to these Specifications in all other respects.

C. Mixing:

All paints except aluminum shall be delivered to the project completely mixed, and ready to be used without additional oil or thinner. Gasoline shall not be used for thinner under any circumstances.
For aluminum paint, the aluminum paste and the varnish shall be packed separately.

D. FDOT Products List:

All coatings and traffic marking materials shall be one of the products listed on the FDOT Qualified Products List (QPL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.

Products may only be used for applications recommended by the manufacturer.

A notation of the number of coats and the thickness of each coat at which the product passes testing may be placed on the QPL. When listed, this will be the minimum criteria for application of the coating.

E. FDOT Certification: The CONTRACTOR shall provide the Engineer a certification conforming to the requirements of FDOT from the manufacturer of the coatings and/or traffic marking materials confirming that the requirements of this Section are met. Each certification shall cover only one batch for coating and/or traffic marking material.

F. Retroreflectivity: Materials for traffic stripes or markings shall meet the Reflectivity requirements specified in the application requirements for that material.

G. Additional Requirements:

Coatings and traffic stripe materials shall be characterized as non-hazardous as defined by Resource Conservation and Recovery Act (RCRA) Subarticle C rules, Table 1 of 40 CFR 261.24 “Toxicity Characteristic”. Traffic stripe materials shall contain no more than 3.0 ppm lead by weight in a cured state when tested by EPA methods 3050 and 6010.
Coatings shall contain less than 450 g/L Volatile Organic Compounds (VOC). Traffic strip materials shall contain less than 150 g/L VOC.

The presence of these compounds shall be tested for compliance by x-ray diffraction, ICP, or other methods capable of this level of detection. The material shall not exude fumes which are toxic or detrimental to persons or property.

2.02 INERT PIGMENTS

A. Only barites, barium sulphate (artificial), silica or magnesium silicate will be considered as suitable fillers. Inerts shall in no case contain organic coloring matter, soap or emulsifying agents. Tinting pigments shall be ground in oil before mixing with paint.

2.03 TWO REACTIVE COMPONENT MATERIALS FOR TRAFFIC STRIPES AND MARKINGS

A. General: Two reactive component materials intended for use under this Specification shall include, but not be limited to, epoxies, polyesters and urethanes. Upon curing, these materials shall produce an adherent, reflective pavement marking capable of resisting deformation by traffic. The manufacturer shall have the option of formulating the material according to his own specifications. However, the criteria outlined in this Specification and FM 5-541 shall apply regardless of the type of formulation used. In a cured condition, all of the products designated in this Specification shall be classified as non-hazardous waste as defined by 40 CFR 261.24 when tested in accordance with EPA Method 1311, Toxicity Characteristics Leaching Procedures (TCLP). The material shall not exude fumes which are toxic or detrimental to persons or property. The material shall be free from all skins, dirt and foreign objects.

B. Composition:

<table>
<thead>
<tr>
<th>Component</th>
<th>Test Method</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>TiO₂, Type II Rutile (white paint only) weight</td>
<td>ASTM D476</td>
<td>minimum 10% by weight</td>
</tr>
<tr>
<td>Lead</td>
<td>EPA 1311 (TCLP)</td>
<td>maximum 0.15 ppm</td>
</tr>
<tr>
<td>Volatile Organic Content, (VOC)</td>
<td>ASTM D3960</td>
<td>maximum 150 g/L</td>
</tr>
</tbody>
</table>

C. Pigment: The yellow pigment used shall not contain lead or any other Resource Recovery and Conservation Act (RCRA) materials.

D. Glass Spheres: Glass spheres shall have an index of refraction of 1.5 or greater. The glass spheres shall meet the requirements of AASHTO M247, Type I.

E. Sharp Silica Sand: Sharp silica sand used for bike lane symbols and longitudinal lines shall meet the following gradation requirements:
Sieve Size | % Passing
--- | ---
20 mils | 100
50 mils | 0 to 10

F. Physical Requirements: The material shall meet the following criteria:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Opacity*</td>
<td>Fed Std 141a</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Method 4121</td>
<td>0.96</td>
<td>--</td>
</tr>
<tr>
<td>Bleed Ratio</td>
<td>Fed Spec TT-P-85D</td>
<td>0.95</td>
<td>--</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Fed Spec TT-P-115D</td>
<td>Pass</td>
<td>--</td>
</tr>
<tr>
<td>Abrasion Resistance</td>
<td>971-12.6.3</td>
<td>Pass</td>
<td>--</td>
</tr>
</tbody>
</table>

*When applied at manufacturer's recommended dry film thickness.

Set To Bear Traffic Time: When applied at the temperatures and thickness specified, the material shall set to bear traffic in not more than two minutes.

Color:

<table>
<thead>
<tr>
<th>Property</th>
<th>White</th>
<th>Yellow</th>
<th>Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD* (Fed Std 141a)</td>
<td>minimum 87%</td>
<td>minimum 43%</td>
<td>--</td>
</tr>
<tr>
<td>Color, Visual Match</td>
<td>Color No. 37875</td>
<td>Color No. 33538</td>
<td>Color No. 37038</td>
</tr>
<tr>
<td>(Fed Std 595a)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*After four hour ambient dry and 24 hour oven dry at 150ºF.

The color of the yellow thermoplastic material shall meet the following criteria:

1. Initial Reflectance: 43% minimum Initial chromaticity of the cured yellow traffic paint shall fall within the area bordered by the following coordinates:

\[
\begin{align*}
X & = 0.455 & 0.510 & 0.472 & 0.530 \\
Y & = 0.444 & 0.485 & 0.400 & 0.456
\end{align*}
\]

The retained color of the yellow chromaticity coordinates, shall fall within the following limits:

<table>
<thead>
<tr>
<th>Chromaticity Coordinates (X, Y)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
</tr>
<tr>
<td>Y</td>
</tr>
</tbody>
</table>
**Chromaticity shall fall in an area bordered by these coordinates of a beaded yellow line (for the life of the Reflectivity performance when measured in accordance with Florida Test Method FM 5-541) when measured with a BYK Gardner Catalog No. 9200 Handy-Color Colorimeter or approved equal by the State Materials Office in accordance with Florida Test Method FM 5-541.

Abrasion Resistance: Test four samples per LOT using a Taber Abrader. The paint shall be applied to specimen plates using a drawdown blade having a clearance of 26 mils 660 μm. Air dry each sample for 30 minutes and bake at 220°F 105°C for 18 hours. Clean with a soft brush and weigh each sample. Abrade samples for 1,000 cycles with 1.1 lb 500 g weights and CS-10 wheels. Clean the samples with a soft brush and weigh again. The average weight loss for the four plates shall not exceed 0.178 oz per plate.

G. Packaging and Labeling: The two reactive component material shall be placed in 55 gal open-end steel drums with a reusable multi-seal sponge gasket. No more than 50 gal of material shall be placed in any drum to allow for expansion during transport and storage. Other containers will be used for applicable products. Each container shall designate the color, generic type (e.g. epoxy), user information, manufacturer’s name and address, batch number and date of manufacture. Each batch manufactured shall have a unique number. The label shall warn the user of hazards associated with handling or using the material.

H. Storage Life: Any material stored for less than one year not meeting these requirements shall be replaced at no cost to the CITY.

2.04 FAST DRY SOLVENT TRAFFIC PAINT

A. General: Fast dry traffic paints intended for use under this Specification shall include products that are single packaged and ready mixed. Upon curing, these materials shall produce an adherent, reflective pavement marking capable of resisting deformation by traffic. The manufacturer shall have the option of formulating the material according to his own specifications. However, the requirements delineated in this Specification and FM 5-541 shall apply regardless of the type of formulation used. The material shall be free from all skins, dirt and foreign objects.

B. Composition:

<table>
<thead>
<tr>
<th>Component</th>
<th>Test Method</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Solids, by weight</td>
<td>ASTM D2369</td>
<td>minimum 75%</td>
</tr>
<tr>
<td>Pigments, by weight</td>
<td>ASTM D3723</td>
<td>minimum 57%</td>
</tr>
<tr>
<td>Vehicle Solids, % on Vehicle*</td>
<td></td>
<td>minimum 40%</td>
</tr>
<tr>
<td>TiO2, Type II Rutile (white paint only)</td>
<td>ASTM D476</td>
<td>minimum 1.5 lb/gal</td>
</tr>
<tr>
<td>Volatile Organic Content, (VOC)</td>
<td>ASTM D3960</td>
<td>maximum 150 g/L</td>
</tr>
</tbody>
</table>
C. Sharp Silica Sand: Sharp silica sand used for bike lane symbols and longitudinal lines shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mils [850 μm]</td>
<td>100</td>
</tr>
<tr>
<td>50 mils [300 μm]</td>
<td>0 to 10</td>
</tr>
</tbody>
</table>

D. Physical Requirements: The material shall meet the following criteria:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM D1475</td>
<td>13.5 ± 0.37 lb/gal</td>
<td>N/A</td>
</tr>
<tr>
<td>Consistency at 170°F [77°C]</td>
<td>ASTM D562</td>
<td>80 KU</td>
<td>100 KU</td>
</tr>
<tr>
<td>Fineness of Grind</td>
<td>ASTM D1210</td>
<td>2 (HS)</td>
<td>3(HS)</td>
</tr>
<tr>
<td>Dry Opacity at 5 mils [127 μm] WFT Method 4121</td>
<td>Fed Std 141a</td>
<td>0.96</td>
<td>-</td>
</tr>
<tr>
<td>Bleed Ratio</td>
<td>Fed Spec TT-P-85D</td>
<td>0.95</td>
<td>--</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Fed Spec TT-P-115D</td>
<td>Pass</td>
<td>--</td>
</tr>
<tr>
<td>Abrasion Resistance</td>
<td>961-10.6.3</td>
<td>Pass</td>
<td>--</td>
</tr>
</tbody>
</table>

Set To Bear Traffic Time: When applied at the temperatures and thickness specified by Section 710, the material shall set to bear traffic in not more than two minutes.

Color:

<table>
<thead>
<tr>
<th>Property</th>
<th>White</th>
<th>Yellow</th>
<th>Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD* (Fed Std 141a)</td>
<td>minimum 87%</td>
<td>minimum 43%</td>
<td>--</td>
</tr>
<tr>
<td>Color, Visual Match (Fed Std 595a)</td>
<td>Color No. 37875</td>
<td>Color No. 33538</td>
<td>Color No. 37038</td>
</tr>
</tbody>
</table>

*After four hour ambient dry and 24 hour oven dry at 150°F.

The color of the yellow thermoplastic material shall meet the following criteria:

2. Initial reflectance: 43% minimum.

Initial chromaticity of the cured yellow traffic paint shall fall within the area bordered by the following coordinates:
The retained color of the yellow chromaticity coordinates, shall fall within the following limits:

Chromaticity Coordinates (X, Y)**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>0.435</td>
<td>0.51</td>
<td>0.449</td>
</tr>
<tr>
<td>Y</td>
<td>0.429</td>
<td>0.485</td>
<td>0.377</td>
</tr>
</tbody>
</table>

**Chromaticity shall fall in an area bordered by these coordinates of a beaded yellow line (for the life of the Reflectivity performance when measured in accordance with Florida Test Method FM 5-541) when measured with a BYK Gardner Catalog No. 9200 Handy-Color Colorimeter or approved equal by the State Materials Office in accordance with Florida Test Method FM 5-541.

Abrasion Resistance: Test four samples per LOT using a Taber Abrader. The paint shall be applied to specimen plates using a drawdown blade having a clearance of 26 mils. Air dry each sample for 30 minutes and bake at 220°F for 18 hours. Clean with a soft brush and weigh each sample. Abrade samples for 1,000 cycles with 1.1 lb weights and CS-10 wheels. Clean the samples with a soft brush and weigh again. The average weight loss for the four plates shall not exceed 0.178 oz [50 mg] per plate.

E. Packaging and Labeling: The traffic paint shall be placed in 55 gal open-end steel drums with a reusable multi-seal sponge gasket. No more than 50 gal [190 liters] of material shall be placed in any drum to allow for expansion during transport and storage.

2.05 GLASS SPHERES (FOR REFLECTIVE PAVEMENT MARKING STRIPING SYSTEMS)

A. General Requirements: Glass spheres shall be of a composition designed to be highly resistant to traffic wear and to the effects of weathering for the production of a reflective surface, creating night visibility of the pavement markings without altering day visibility of the marking. The general requirements of FDOT 971-1 applies to glass spheres.
The glass spheres shall conform to the requirements of AASHTO M 247, Type I with moisture resistant coating or a formulation specified by the traffic striping material manufacture and be one of the gradation, index of refraction and formulations included on the Qualified Products List (QPL).

B. Specific Properties: The glass spheres shall have an adhesion coating that will promote adhesion and proper embedment in the binder for optimum retroreflective performance. The general requirements of AASHTO M247 Part 2 and the following physical requirements apply:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gradation</td>
<td>ASTM D1214</td>
<td>AASHTO M247, Type 1</td>
</tr>
<tr>
<td>Roundness</td>
<td>ASTM D1155</td>
<td>Min: 70% true spheres by weight per sieve size</td>
</tr>
<tr>
<td>Refractive Index</td>
<td>Becke Line Method</td>
<td>(25+/-5 C) 1.5 minimum</td>
</tr>
</tbody>
</table>

C. Surface Application Spheres:

Rate of Application: The glass spheres shall be applied at the rate of 6 lb [0.7 kg] of glass spheres per gallon [liter] of pigmented binder.

Sampling: A random 50 lb sample of glass spheres shall be obtained for each 50,000 lb shipped. Upon arrival, the quantity of material will be reduced in a sample splitter to a size of approximately 1 quart [1 liter] by the ENGINEER, or one 50 lb unopened bag.

Containers: The spheres shall be furnished in new 50 lb moistureproof bags. All containers shall meet ICC requirements for strength and type and be marked in accordance with AASHTO 247 Part 5.

2.06 THERMOPLASTIC MATERIALS FOR TRAFFIC STRIPES

A. General: Upon cooling to normal pavement temperature, these materials shall produce an adherent, reflective pavement marking capable of resisting deformation by traffic. The manufacturer shall have the option of formulating the material according to his own specifications. However, the requirements delineated in this Specification, Section 711, and FM 5-541 shall apply regardless of the type of formulation used. The pigment, glass spheres, and filler shall be well dispersed in the resin. The material shall be free from all skins, dirt and foreign objects.
B. Composition:

<table>
<thead>
<tr>
<th>Component</th>
<th>Test Method</th>
<th>White</th>
<th>Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binder</td>
<td>ASTM D476</td>
<td>18.0% minimum</td>
<td>18.0% minimum</td>
</tr>
<tr>
<td>TiO₂, Type II Ductile</td>
<td></td>
<td>10.0% minimum</td>
<td>--</td>
</tr>
<tr>
<td>Glass Spheres</td>
<td>AASHTO T250</td>
<td>40.0% minimum</td>
<td>40.0% minimum</td>
</tr>
<tr>
<td>Yellow Pigment</td>
<td></td>
<td>--</td>
<td>% minimum per</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>manufacturer</td>
</tr>
<tr>
<td>Calcium Carbonate and Inert Filler (-200 mesh sieve)</td>
<td></td>
<td>32.0% maximum</td>
<td>39.5% maximum</td>
</tr>
</tbody>
</table>

Percentages are by weight.

C. Glass Spheres: Glass spheres shall meet the requirements of ARTICLE 2.06.

D. Sharp Silica Sand: Sharp silica sand used for transverse lines, bike lane symbols and longitudinal lines shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 [850 μm]</td>
<td>100</td>
</tr>
<tr>
<td>50 [300 μm]</td>
<td>0 to 10</td>
</tr>
</tbody>
</table>

E. Physical Requirements: Laboratory samples shall be prepared in accordance with ASTM D4960 and shall meet the following criteria:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Absorption</td>
<td>ASTM D570</td>
<td>--</td>
<td>0.5%</td>
</tr>
<tr>
<td>Softening Point</td>
<td>ASTM D36</td>
<td>195°F</td>
<td>--</td>
</tr>
<tr>
<td>Low Temperature Stress Resistance</td>
<td>AASHTO T250</td>
<td>Pass</td>
<td>--</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>Water displacement</td>
<td>1.9</td>
<td>2.3</td>
</tr>
<tr>
<td>Indentation Resistance</td>
<td>ASTM D2240*</td>
<td>Shore Durometer, A2</td>
<td>40</td>
</tr>
<tr>
<td>Impact Resistance</td>
<td>ASTM D256, Method A</td>
<td>1.0 N·m</td>
<td>--</td>
</tr>
<tr>
<td>Flash Point</td>
<td>ASTM D92</td>
<td>475°F</td>
<td>--</td>
</tr>
</tbody>
</table>

*The durometer and panel shall be at 110°F [45°C] with a 4.4 lb [2.0 kg] load applied. Instrument measurement shall be taken after 15 seconds.
Set To Bear Traffic Time: When applied at the temperatures and thickness specified by Section 711, the thermoplastic shall set to bear traffic in not more than two minutes.

Color: The white thermoplastic material shall be pure white and free from any tint. Using a Hunter tristimulus colorimeter or approved equivalent in accordance with ASTM D4960, the material shall not show deviations from magnesium oxide color standard greater than the following:

<table>
<thead>
<tr>
<th>Scale Definition</th>
<th>Magnesium Oxide Standard</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD</td>
<td>100.0%</td>
<td>75.0% minimum</td>
</tr>
<tr>
<td>Reflectance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Red-Green</td>
<td>0</td>
<td>-5 to +5</td>
</tr>
<tr>
<td>b. Yellow-Blue</td>
<td>0</td>
<td>-10 to +10</td>
</tr>
</tbody>
</table>

The color of the yellow thermoplastic material shall meet the following criteria:

Initial reflectance: 43% minimum.

Initial chromaticity shall fall within the area bordered by the following coordinates:

\[
\begin{array}{cccc}
X & 0.455 & 0.510 & 0.472 & 0.530 \\
Y & 0.444 & 0.485 & 0.400 & 0.456 \\
\end{array}
\]

The retained color of the yellow chromaticity coordinates, shall fall within the following limits:

\[
\begin{array}{cccc}
X & 0.435 & 0.51 & 0.449 & 0.53 \\
Y & 0.429 & 0.485 & 0.377 & 0.456 \\
\end{array}
\]

**Chromaticity shall fall in an area bordered by these coordinates of a beaded yellow line (for the life of the reflectivity performance when measured in accordance with Florida Test Method FM 5-541) when measured with a BYK Gardner Catalog No. 9200 Handy-Color Colorimeter or approved equal by the State Materials Office in accordance with Florida Test Method FM 5-541.

F. Packing and Labeling: The thermoplastic material shall be packaged in suitable biodegradable or thermodegradable containers which will not adhere to the product during shipment and storage. The container of thermoplastic material shall weigh approximately 50 lb [23 kg]. The label shall warn the user that the material shall be heated in the range as recommended by the manufacturer.
2.07 PREFORMED MATERIALS FOR PAVEMENT STRIPES AND MARKINGS

A. General: The preformed materials for pavement stripes and markings shall consist of white or yellow weather-resistant reflective film as specified herein. The pigment, glass spheres, and filler shall be well dispersed in the resin. However, the requirements delineated in this specification and FM 5-541 shall apply. The material shall be free from all skins, dirt and foreign objects.

B. Composition: The preformed pavement stripes and markings shall consist of high quality plastic materials, pigments, and glass spheres uniformly distributed throughout their cross-sectional area, with a reflective layer of spheres embedded in the top surface.

C. Skid Resistance: The surface of the stripes and markings shall provide a minimum skid resistance value of 35 BPN (British Pendulum Number) when tested according to ASTM E303.

D. Color: The white preformed materials shall be pure white and free from any tint. Using a Hunter tristimulus colorimeter or approved equivalent in accordance with ASTM D4960, the material shall not show deviations from magnesium oxide color standard greater than the following:

<table>
<thead>
<tr>
<th>Scale Definition</th>
<th>Magnesium Oxide Standard</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD</td>
<td>100.0%</td>
<td>75.0% minimum</td>
</tr>
<tr>
<td>Reflectance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Red-Green</td>
<td>0</td>
<td>-5 to +5</td>
</tr>
<tr>
<td>b. Yellow-Blue</td>
<td>0</td>
<td>-10 to +10</td>
</tr>
</tbody>
</table>

The color of the yellow preformed material shall meet the following criteria:

Initial reflectance: 43% minimum.

Initial chromaticity shall fall within the area bordered by the following coordinates:

| X   | 0.455 | 0.510 | 0.472 | 0.530 |
| Y   | 0.444 | 0.485 | 0.400 | 0.456 |

The retained color of the yellow chromaticity coordinates, shall fall within the following limits:

Chromaticity Coordinates (X, Y)**
**Chromaticity shall fall in an area bordered by these coordinates of a beaded yellow line (for the life of the reflectivity performance when measured in accordance with Florida Test Method FM 5-541) when measured with a BYK Gardner Catalog No. 9200 Handy-Color Colorimeter or approved equal by the State Materials Office in accordance with Florida Test Method FM 5-541.

**

E. Thickness: The preformed materials shall range in thickness from 20 to 90 mils. The Qualified Products List will list the specified thickness of each approved product.

F. Durability and Wear Resistance: When properly applied, the preformed material shall provide neat, durable stripes and markings. The preformed materials shall provide a cushioned resilient substrate that reduces sphere crushing and loss. The film shall be weather resistant and, through normal wear, shall show no significant tearing, rollback or other signs of poor adhesion.

G. Conformability and Resealing: The stripes and markings shall be capable of conforming to pavement contours, breaks and faults under traffic at pavement temperatures recommended by the manufacturer. The film shall be capable of use for patching worn areas of the same types of film in accordance with the manufacturer’s recommendations.

H. Tensile Strength: The stripes and markings shall have a minimum tensile strength of 40 psi when tested according to ASTM D638. A rectangular test specimen 6 by 1 by 0.05 minimum thickness shall be tested at a temperature range of 40 to 80°F using a jaw speed of 0.25 inch/min.

I. Elongation: The stripes and markings shall have a minimum elongation of 25% when tested in accordance with ASTM D638.

J. Plastic Pull Test: The stripes and markings shall support a dead weight of 4 lb. for not less than five minutes at a temperature range of 70 to 80°F. Rectangular test specimen size shall be 6 by 1 by 0.05 inch minimum thickness.

K. Pigmentation: The pigment shall be selected and blended to provide a material which is white or yellow conforming to standard highway colors through the expected life of the stripes and markings.

L. Glass Spheres:

The glass spheres shall meet the requirements of ARTICLE 2.06.

The stripes and markings shall have glass retention qualities such that, when at room temperature a 2 by 6 inches specimen is bent over a 0.5 inch [13 mm] diameter mandrel
axis, a microscopic examination of the area on the mandrel shall show no more than 10% of the spheres with entrapment by the material of less than 40%.

The bead adhesion shall be such that spheres are not easily removed when the film surface is scratched firmly with a thumbnail.

2.08 FAST DRY TRAFFIC PAINT - WATER BORNE

A. General: Fast dry traffic paints intended for use under this Specification shall include water reducible products that are single packaged and ready mixed. Upon curing, these materials shall produce an adherent, reflective pavement marking capable of resisting deformation by traffic. The material shall have the capability of being cleaned and flushed from the striping machines using regular tap water and any required rust inhibitors. The manufacturer shall have the option of formulating the material according to his own specifications. However, the requirements delineated in this Specification and FM 5-541 shall apply regardless of the type of formulation used. The material shall be free from all skins, dirt and foreign objects.

B. Composition:

<table>
<thead>
<tr>
<th>Component</th>
<th>Test Method</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Solids, by weight</td>
<td>ASTM D2369</td>
<td>minimum 75%</td>
</tr>
<tr>
<td>Pigments, by weight</td>
<td>ASTM D3723</td>
<td>minimum 57%</td>
</tr>
<tr>
<td>Vehicle Solids % on Vehicle*</td>
<td></td>
<td>minimum 40%</td>
</tr>
<tr>
<td>TiO2, Type II Rutile (white paint only) [0.18 kg/L]</td>
<td>ASTM D476</td>
<td>minimum 1.5 lb/gal</td>
</tr>
<tr>
<td>Volatile Organic Content, (VOC)</td>
<td>ASTM D3960**</td>
<td>maximum 150 g/L</td>
</tr>
</tbody>
</table>

* % total solids - % pigment
100 - % pigment

** excluding water

C. Glass Spheres: The glass spheres shall meet the requirements of ARTICLE 2.06.

D. Sharp Silica Sand: Sharp silica sand used for bike lane symbols and longitudinal lines shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 [850 μm]</td>
<td>100</td>
</tr>
<tr>
<td>50 [300 μm]</td>
<td>0 to 10</td>
</tr>
</tbody>
</table>

E. Physical Requirements: The material shall meet the following criteria:
<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM D1475</td>
<td>13.5 ± 1.4 lb/gal</td>
<td>--</td>
</tr>
<tr>
<td>Consistency at 77°F [25°C]</td>
<td>ASTM D562</td>
<td>80 KU</td>
<td>100 KU</td>
</tr>
<tr>
<td>Fineness of Grind</td>
<td>ASTM D1210</td>
<td>2(HS)</td>
<td>3(HS)</td>
</tr>
<tr>
<td>Dry Opacity at 5 mils [127 μm]</td>
<td>Fed Std 141a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method 4121</td>
<td>0.96</td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>Bleed Ratio</td>
<td>Fed Spec TT-P-85D</td>
<td>0.95</td>
<td>--</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Fed Spec TT-P-115D</td>
<td>Pass</td>
<td>--</td>
</tr>
<tr>
<td>Abrasion Resistance</td>
<td>961-10.6.3</td>
<td>Pass</td>
<td>--</td>
</tr>
</tbody>
</table>

Set To Bear Traffic Time: When applied at the temperatures and thickness specified by Section 710, the material shall set to bear traffic in not more than two minutes.

Color:

<table>
<thead>
<tr>
<th>Property</th>
<th>White</th>
<th>Yellow</th>
<th>Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD* (Fed Std 141a) Color, Visual Match (Fed Std 595a)</td>
<td>minimum 87%</td>
<td>minimum 43%</td>
<td>--</td>
</tr>
<tr>
<td>Color No. 37875</td>
<td>Color No. 33538</td>
<td>Color No. 37038</td>
<td></td>
</tr>
</tbody>
</table>

*After four hour ambient dry and 24 hour oven dry at 150°F.

The color of the yellow traffic paint shall meet the following criteria:

Initial reflectance: 43% minimum.

Initial chromaticity of the cured yellow traffic paint shall fall within the area bordered by the following coordinates:

\[
\begin{array}{cccc}
X & 0.455 & 0.510 & 0.472 & 0.530 \\
Y & 0.444 & 0.485 & 0.400 & 0.456 \\
\end{array}
\]

The retained color of the yellow chromaticity coordinates, shall fall within the following limits:

\[
\begin{array}{cccc}
\text{Chromaticity Coordinates (X, Y)**} & \\
X & 0.435 & 0.51 & 0.449 & 0.53 \\
Y & 0.429 & 0.485 & 0.377 & 0.456 \\
\end{array}
\]

**Chromaticity shall fall in an area bordered by these coordinates of a beaded yellow line (for the life of the reflectivity performance when measured in
accordance with Florida Test Method FM5-541) when measured with a BYK Gardner Catalog No. 9200 Handy-Color Colorimeter or approved equal by the State Materials Office in accordance with Florida Test Method FM 5-541.

Abrasion Resistance: Test four samples per LOT using a Taber Abrader. The paint shall be applied to specimen plates using a drawdown blade having a clearance of 26 mils. Air dry each sample for 30 minutes and bake at 220°F for 18 hours. Clean with a soft brush and weigh each sample. Abrade samples for 1,000 cycles with 500 g weights and CS-10 wheels. Clean the samples with a soft brush and weigh again. The average weight loss for the four plates shall not exceed 50 mg per plate.

F. Packaging and Labeling: The traffic paint shall be placed in 55 gal open-end steel drums with a reusable multi-seal sponge gasket. No more than 50 gal of material shall be placed in any drum to allow for expansion during transport and storage.

2.09 RAISED RETRO-REFLECTIVE PAVEMENT MARKERS
A. Composition: The marker shall consist of materials conforming to ASTM D4280.
   a) 
B. Physical Requirements:

   The physical size of the RPM shall conform to the requirements of ASTM D4280. Laboratory and field samples for RPMs and bituminous adhesives shall meet the requirements of ASTM D4280 and include the following requirements:
   The minimum area of each reflective face shall be 2.5 in².
   The minimum base size shall be 12 in².

   Designation of Marker Type, Color and Classification: The marker description shall be in order of type, color and reflective surface condition in accordance with ASTM D4280 and the following chart.

<table>
<thead>
<tr>
<th>RPM Class</th>
<th>Description</th>
<th>Expected Normal Service</th>
<th>ASTM Surface Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Temporary marker</td>
<td>Up to six months</td>
<td>none</td>
</tr>
<tr>
<td>B</td>
<td>Permanent marker</td>
<td>Long life</td>
<td>H, hard abrasion resistant lens</td>
</tr>
<tr>
<td>D</td>
<td>Work zone marker</td>
<td>Per project requirement</td>
<td>none</td>
</tr>
<tr>
<td>E</td>
<td>Temporary work zone</td>
<td>Up to five days</td>
<td>none</td>
</tr>
</tbody>
</table>

   C. Performance Requirements: The RPM shall meet the performance requirements specified in ASTM D4280, Section 6.2, for luminous intensity, flexural strength, compressive strength, resistance to cracking, and thermal cycling, as modified herein. Test Method FM 5-566 will be used to evaluate marker performance.
Class A Markers: Meet the coefficient of luminous intensity requirements of ASTM D4280. Abrasion treatment is not required for Class A Markers.

Class B (Abrasion Resistant) Markers: Meet the coefficient of luminous intensity requirements of ASTM D4280 after abrasion. Each marker shall be marked as abrasion resistant by the manufacturer.

In-service Minimum Reflective Intensity: The Class B reflective pavement marker shall retain a minimum coefficient of luminous intensity for 12 months of not less than 25% of the values shown in Table 1 of ASTM D4280, and a minimum luminous intensity of 0.2 cd/ft² at the end of two years.

D. Packaging and Labeling: Shipment shall be made in containers which are acceptable to common carriers and packaged in such a manner as to ensure delivery is in perfect condition. Each package shall be clearly marked as to the name of the manufacturer, type, color, quantity enclosed and date of manufacture. Show the designation of the marker in accordance with ASTM D4280.

2.10 BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS

A. General: Bituminous adhesive as recommended by the marker manufacturer shall be used for bonding the markers to the pavement.

B. Specific Requirements for Bituminous Adhesives: The bituminous adhesive shall meet the properties of adhesives per ASTM D4280 Section A1, including filler-free and filler alone properties.

C. Performance Requirements: The performance of the adhesive shall be determined in accordance with the test methods listed in ASTM D4280.

PART 3 - EXECUTION

3.01 EQUIPMENT

A. Use equipment that will produce continuously uniform dimensions of traffic stripes and markings of varying widths and meet the following requirements:

   Capable of traveling at a uniform, predetermined rate of speed, both uphill and downhill, in order to produce a uniform application of paint and capable of following straight lines and making normal curves in true arcs.

   Capable of applying glass spheres to the surface of the completed stripe by an automatic sphere dispenser attached to the striping machine such that the glass spheres
are dispensed closely behind the installed line. Use a glass spheres dispenser equipped with an automatic cut-off control synchronized with the cut-off of the traffic paint and applies the glass spheres in a manner such that the spheres appear uniform on the entire traffic stripes and markings surface with, 50 to 60% embedment.

Capable of spraying the paint to the required thickness and width without thinning of the paint. Equip the paint tank with a mechanical agitator and nozzles equipped with cut-off valves which will apply broken or skip lines automatically. Provide each nozzle with suitable line guides, either metallic shrouds or air blasts.

3.02 APPLICATION

A. General:

Mix the paint thoroughly prior to pouring into the painting machine. Apply paint to the pavement by spray or other means approved by the Engineer. Conduct field testing in accordance with FM 5-541. Remove and replace traffic stripes and markings not meeting the requirements of this Section at no additional cost to the Owner.

Ensure that existing pavement markings are removed, such that scars or traces of removed markings will not conflict with new stripes and markings by a method approved by the Engineer.

Prior to applying pavement stripes and markings, remove any material that would adversely affect the bond of the pavement stripes and markings by a method approved by the Engineer.
Establish tack points at appropriate intervals for use in aligning stripes, and set a stringline from such points to achieve accuracy.

Apply traffic stripes or markings only to dry surfaces, and when the ambient air and surface temperature is at least 40°F and rising. Follow the manufacturer’s recommendations for application temperature. Do not apply pavement markings when winds are sufficient to cause spray dust.

Apply traffic stripes or markings, having well defined edges, over existing pavement markings such that not more than 2 inches on either end and not more than 1 inch [25 mm] on either side is visible.

Apply all final traffic stripes and markings prior to opening the road to traffic.

Reapply all final traffic stripes and markings a minimum of 14 days after first application but prior to final acceptance of the project.

B. Corrections for Deficiencies to Applied Traffic Stripes and Markings: Remove and reapply a 1.0 mile [1.0 kilometer] LOT centered around any deficiency, at no additional cost to the Owner.

C. Rate of Paint Application: Meet the following minimum rate of application:

   6 inch solid traffic stripe: 25 gal/mi.

   6 inch skip traffic stripe: 6.2 gal/gm.

   Any other width stripe: A direct proportion of the above.

D. Required Film Thickness: Apply paint to attain a minimum wet film thickness of 15 mils.

E. Application of Spheres: Apply glass spheres immediately and uniformly following the paint application, at a rate of not less than 6 lb/gal of paint.

F. Retroreflectivity: Apply white and yellow pavement markings that will attain an initial retroreflectance of not less than 300 cd/ft² and not less than 250 cd/ft², respectively. Ensure that the intermittent and final retroreflectance of white and yellow pavement markings are not less than 150 cd/ft². This does not apply to transverse lines, bike lane symbols and longitudinal lines adjacent to or in a proposed bike lane.
G. Color:

Use white striping and marking material that is pure white, free from any tint and showing no deviations from magnesium oxide color standard greater than the following:

<table>
<thead>
<tr>
<th>Scale Definition</th>
<th>Magnesium Oxide Standard</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD</td>
<td>100</td>
<td>75% minimum</td>
</tr>
</tbody>
</table>

Reflectance

a. Red-Green       0  -5 to +5
b. Yellow-Blue     0  -10 to +10

Use yellow striping and marking material which visually matches Federal Test Standard Number 595-color 33538, and meet the following criteria for chromaticity coordinates (X, Y):

\[
\begin{array}{cccc}
X & 0.455 & 0.510 & 0.472 & 0.530 \\
Y & 0.444 & 0.485 & 0.400 & 0.456 \\
\end{array}
\]

3.03 TOLERANCES IN DIMENSIONS AND IN ALIGNMENT

A. Dimensions:

Longitudinal Lines: Apply painted skip segments of 10 foot, with a 30 foot unpainted gap between segments. Apply painted segments with no more than ±12 inches variance, so that over-tolerance and under-tolerance lengths will approximately balance. Apply longitudinal lines at least 2 inches from construction joints of portland cement concrete pavement.

Transverse Markings, Gore Markings, Arrows, and Messages: Apply paint in multiple passes when the marking cannot be completed in one pass, with an overall line width allowable tolerance of ±1 inch.

Contrast Lines: Use black paint to provide contrast on concrete or light asphalt pavement, when specified by the Engineer. Apply black paint in 10 foot segments following each longitudinal skip line.

B. Alignment: Apply painted stripes that will not deviate more than 1 inch from the stringline on tangents and curves one degree or less. Apply painted stripes that will not deviate more than 2 inches from the stringline on curves greater than one degree. Apply painted edge stripes uniformly, not less than 2 inches or more than 4 inches from the edge of pavement, without noticeable breaks or deviations in alignment or width.
C. Correction Rates: Make corrections of variations in width at a maximum rate of 10 feet for each 0.5 inch of correction. Make corrections of variations in alignment at a maximum rate of 25 feet for each 1 inch of correction, to return to the stringline.

D. Alignment of Stripes: Remove and replace at no additional cost to the Owner traffic stripes that deviates more than 1 inch in any 40 feet from the stringline.

3.04 CONTRACTOR’S RESPONSIBILITY FOR NOTIFICATION

A. Notify the Engineer prior to the placement of the materials. Furnish the Engineer with the manufacturer’s name and LOT numbers of the materials and glass spheres to be used. Ensure that the approved LOT numbers appear on the materials and glass spheres packages. Submit a certified test report to the Engineer indicating that the materials meet all requirements specified.

3.05 PROTECTION OF NEWLY PAINTED STRIPES

A. Do not allow traffic onto newly applied traffic stripes and markings until they are sufficiently dry to permit vehicles to cross them without damage. Remove and replace any portion of the traffic stripes and markings damaged by passing traffic or from any other cause, at no additional cost to the Owner.

- END OF SECTION -
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. A complete underground domestic/fire water supply system, with all necessary accessories indicated on drawings or specified in this section.
2. System shall start from an existing water main located either inside or outside the property line, having sufficient capacity, and extended to within 5 feet from the new building services or as indicated in the drawings and connection to lines furnished under other sections of specifications.
3. The system's installation include, but are not limited to:

   a. Furnishing and installing the water meters.
   b. Tapping to the existing lines as shown on the drawings and the services extension to the point of use.
   c. Meter and tapping.
   d. Reduced pressure backflow preventers for domestic water, full sized, aboveground, complete with concrete pad and fencing.
   e. Piping, pipe coatings, valves, backflow preventers, valve boxes, meter box or vault, and any other item or accessory required for a complete water supply system installation from the point of connection to the point of use shall be either provided by the Contractor directly, or paid for by the Contractor.
   f. Site restoration inside and outside the property line including road restoration.

1.02 REFERENCES

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

1. A53-96 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. D1785-96a Specification PVC Plastic Pipe, Schedules 40, 80, and 120.

B. American National Standards Institute (ANSI):
2. A21.6 Cast-iron Pipe Centrifugally Cast in Metal Molds, for Water or Other Liquids.
3. A21.8 Cast-iron Pipe Centrifugally Cast in Sand-lined Molds, for Water or Other Liquids.
5. A21.51 Ductile-iron Pipe, Centrifugally Cast in Metal Molds or Sand-lined Molds, for Water or Other Liquids.
6. B16.22 Wrought Copper and Bronze Solder Joint Pressure Fittings for Piping under 3 Inches in Diameter.

C. American Water Works Association (AWWA):
1. B300 Hypochlorites.
2. B301 Liquid Chlorine.
4. C500 Gate Valves - 3" through 48" for Water and Other Liquids.
5. C601 Disinfecting Water Mains.
7. C900 Polyvinyl Chloride Pressure Pipe.

1.03 SUBMITTALS

A. Submit manufacturer's literature on the following items before starting work.

1. Pipe and fittings, complete with gaskets and lubricants.
2. Valves.
4. Chemical solvents.
5. Sterilizing chemicals.
6. Test reports and certificates.

B. Certification: Submit certification that solder used for copper tubing joints is lead free and complies with specifications.

1.04 QUALITY ASSURANCE

A. Provide manufacturer's certificate of compliance or certified analysis with each shipment of materials used.
PART 2  PART PRODUCTS

2.01  MATERIALS

A. Cast Iron Pipe:
   1. ANSI S21.6 or A21.8, cement mortar lined, working pressure minimum 150 psi.
   2. Standard thickness cement mortar lining shall comply with ANSI A21.4.
   3. For all water and fire mains inside the property line, for sizes 3 inches and above.

B. Ductile Iron Pipe:
   1. ANSI A21.51, cement mortar lined, working pressure minimum 150 psi.
   2. Standard thickness cement mortar lining shall comply with ANSI A21.4.
   3. For all water and fire mains inside and outside the property line, for sizes 3 inches and above. Pipe also allowed where required by Miami-Dade County Public Works Manual for use in backflow preventer installations.

C. Polyvinyl Chloride Pipe:
   1. AWWA C-900, DR 18, 150 psi minimum working pressure.
   2. For all water and fire mains inside and outside the property line, for sizes 4 inches and above.

D. Polyvinyl Chloride Pipe:
   1. ASTM D2241, SDR 26, 160 psi minimum working pressure.
   2. For non-fireline use inside the property line, sized 3 inches and above.

E. PVC Pipe:
   1. ASTM D1785, Schedules 40, and 80.
   2. For sizes below 3 inches.

F. Copper Tubing:
   1. ASTM B88, Type "K" or "L".
   2. For sizes below 3 inches.

G. Galvanized Steel Pipe:
   1. ASTM A120.
2. For sizes below 3 inches.

H. Joints:

1. ASTM D3139, PVC push-on joints.
   a. For 3 inches diameter and above:

2. Schedule 40 PVC piping below 3 inches diameter:
   a. Solvent welded according to manufacturer's written recommendations.
   b. Do not thread schedule 40 pipe.

3. Copper Water Tubing Joints:
   a. Sweat solder joints using tin-antimony solder and flux according to manufacturer's recommendations without using lead compounds.

4. Cast Iron and Ductile Iron Pipe:

5. Galvanized Steel Pipe:
   a. AWWA C800.
   b. Joints shall be threaded.

6. Dissimilar Metal Joints: Consist of a sandwich-type flange insulating gasket of the dielectric type, insulating washers, and insulating sleeves for flange bolts (for installation between non-threaded ferrous and non-ferrous metallic pipe).
   a. Make gaskets full faced with outside diameter equal to the flange outside diameter.
   b. Provide full length bolt insulating sleeves.
   c. Make units of a shape to prevent metal-to-metal contact between dissimilar metallic piping elements.

I. Fittings and Special Items:

1. For PVC Piping:
a. Fittings: ASTM D2466 and D3139.
b. Solvent welding: Comply with manufacturers written recommendations.

2. For Copper Tubing:
   a. Sweat solder type red bronze or wrought copper complying with ANSI B16.22.
   b. Solder: 95-5 tin-antimony solder. Solder containing lead is not acceptable.

3. For Cast Iron and Ductile Iron Pipe:
   a. Suitable for 150 psi pressure rating.
   b. Pipe, fittings, and special items shall have standard thickness cement mortar lining complying with ANSI A21.4.

4. For Galvanized Steel Piping less than 3 inches.
   a. Steel fittings shall be galvanized malleable iron.
   c. Dresser-type fittings shall not be used.

J. Gate Valves Not in Fire Service.
   1. Design gate valves for a WOG working pressure of 150 psi minimum.
      a. Connect valves as required for the piping in which they are installed.
      b. Valves smaller than 3 inches shall be rising stem.
      c. Provide a clear water-way equal to the full nominal diameter of the valve. Valve shall open by turning counter clockwise.
   2. Valves Smaller Than 3 Inches:
      a. Nibco Scott T-143.
      b. Crane 431-UB.
      c. Milwaukee 1150.
      d. Accepted equivalent.
   3. Valves 3 Inches and Larger:
      a. Iron body, bronze mounted, AWWA C500.
      b. Crane 461/462, Nibco Scott F-619, Milwaukee F-2882 or accepted
K. Domestic Water Reduced Pressure Backflow Preventer.

1. Reduced Pressure Backflow Preventer: Full pipe sized and designed for a pressure drop not to exceed 13 psig at full flow, provided adequate water pressure may be maintained at the most remote water closet fixture while flushing plus a 5 psig safety margin.

2. At Enhanced Hurricane Protection Areas (EHPAs) mount at a height complying with State Requirements for Educational Facilities (SREF) - 1999 flooding requirements. At other areas install according to Miami-Dade Water and Sewer Department (M-DWS) Standard Details WS 4.18 latest edition.

3. 2 Inches and Smaller:
   a. Watts Model FAE-909S, with bronze strainer and flanged adapter ends.
   b. Provide drain line with Watts Model 909 AG Series air gap, as directed.

4. 3 Inches and Larger:
   a. Watts Model 909-S-QT-FDA, or accepted equivalent with FDA approved epoxy coated strainer and quarter turn FDA epoxy coated ball valve shut-offs.
   b. Provide drain line with Watts Model 909 AG Series air gap as directed. Provide intermediate support as required.

5. Provide fenced enclosure complete with top cover and lockable access door, either on side or top of fence, as required.

L. Valve Boxes:

1. Cast Iron:
   a. Traffic type for use at all asphalted locations. Valve box shall be extension type with slide-type adjustment and flared base. Minimum metal thickness 3/16". Provide concrete minimum 8 inches deep and 8 inches around base of valve box.
   b. Cover shall have the work "Water".
   c. Provide ductile iron riser pipe of sufficient diameter to surround valve's bolted bonnet and sufficient length to enter 6 inches into valve box proper.
   d. Cast iron valve boxes may be used at non-traffic locations when approved by A/E.

2. Pre-Cast Concrete:
   a. Shall be used in non-asphalted areas, have the word "Water" embossed or
permanently affixed on the cover.

b. Valve boxes shall be Brooks Products Inc. 36, 37, 38 or 66 series having either cover or lid weighting not less than 16 pounds. Size of valve box shall be adjusted to the size of the valve.

c. Provide extensions as required so depth of box reaches bottom of valve.

3. Precast Polymer Concrete:

a. Quazite by Strongwell, Lenoir City, TN or accepted equivalent.

b. The word "Water" shall be permanently embossed on the cover.

c. Provide standard colors as selected by A/E.

d. Not to used where exposed to vehicular traffic.

M. Meters and Vaults: Water meters and vaults shall comply with the utility company having jurisdiction in the area.

N. Thrust Blocks, Tie Rods, and Socket Clamps:

1. Provide concrete for thrust blocks according to Section 03300 Cast-in Place Concrete. Provide thrust blocks for all push-on type joint water piping, at each pipe junction, dead ends, and change in direction.

2. Provide tie rods and socket clamps underground near each building entrance and elsewhere as required to prevent piping from joint disassembly or blow-out.

3. Transitions to aboveground piping shall be done sufficiently underground to minimize requirements for aboveground tie rods and socket clamps.

O. Miscellaneous Items:

1. Disinfection:

a. Chlorinating materials complying with the following:

1) Chlorine, Liquid: AWWA B301.

2) Hypochlorite, Calcium, and Sodium: AWWA B300.

P. Piping Materials:

1. Domestic Water Piping:

a. Exterior Aboveground: Copper Type "L", except at aboveground backflow preventers where steel piping shall be used according to M-DWS and Public Works Manuals.

b. Exterior Underground: PVC, cast iron, ductile iron, "K" or "L" copper tubing.

2. Transition of underground to aboveground material shall be at the valve box
designated for the building. Aboveground PVC piping is not allowed.

PART 3  PARTEXCUTION

3.01 INSPECTION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

3.02 INSTALLATION

A. Install main according to the requirements of authorities having jurisdiction and AWWA Standard C600.

3.03 HANDLING

A. Handle pipe and accessories to insure delivery to the trench in sound, undamaged condition.

1. Take care not to injure pipe coating.
2. Repair damaged coating or lining, if any, of any pipe or fitting in a satisfactory manner at no cost to the Design Builder or the Owner.
3. Do not place pipe or materials of any kind inside a pipe or fitting after coating has been applied.
4. Carry pipe into position. Do not drag it.
5. Pinch bars or tongs for aligning or turning pipe may be used only on bare ends of pipe.
6. Clean interior of pipe and accessories of foreign matter before lowering into trench.
7. Keep pipe clean during laying operations by plugging or other accepted method.
8. Inspect pipe for defects before installation.
9. Replace material found defective before or after laying with sound material without cost to the Design Builder or the Owner.
10. Store rubber gaskets not immediately installed in a cool, dark place.

3.04 PIPE CUTTING

A. Cut pipe in a neat and professional manner without damage to the pipe.

1. Cut with an accepted type of mechanical cutter unless otherwise recommended by manufacturer and authorized by A/E.

   a. Use a wheel cutter when practical.
3.05 LOCATING

A. Outside property Line:
   1. Do not lay pipe closer horizontally than 10 feet from the edge of a sewer line except where bottom of water pipe will be at least 18 inches above the top of the sewer pipe.
   2. For further requirements comply with Miami-Dade Water and Sewer Authority Department Standard Detail WS 4.61.

B. Inside property Line:
   1. Do not lay pipe closer horizontally than 5 feet from the edge of a sewer line except where bottom of water pipe will be a least 12 inches above the top of the sewer pipe.
   3. Where water lines do not meet the above conditions, encase sewer line in concrete, minimum 4 inches thick, for a distance of at least 5'-1" each side of the crossing, or sewer lines shall be made of cast iron pipe with no joint located within 5'-1" horizontally of crossing. The water line may also be sleeved, with the edges of the sleeve being caulked, for a distance of 5'-1" horizontally from the edge of the sewer line.
   4. Water lines shall cross above sewage force mains a minimum of 2 feet above force main.

C. Do not lay water lines in same trench with sewer, gas, or fuel lines or electrical conduit.

D. Maintain a minimum vertical separation of 12 inches between pipes where non-ferrous metallic pipe (copper) crosses any ferrous piping material.

3.06 PLACING AND LAYING

A. Carefully lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other authorized equipment.
   1. Do not drop or dump any water line materials into trench.
   2. Avoid abrasion to pipe coating.
   3. Lay pipe, except where necessary to make connections with other lines, with bells facing direction of laying.
   4. Rest full length of each section of pipe solidly upon pipe bed, with recesses excavated to accommodate bells, coupling and joints.
   5. Take up pipe that has had grade or joint disturbed after laying.
   6. Do not lay pipe in water or when trench conditions are unsuitable for the work.
   7. Securely close open end of pipe, fittings and valves when work is not in progress.
8. Keep water out of trench until jointing work is complete.
9. Repair damage to existing piping, or to new piping coating or lining in a satisfactory manner without cost to the Design Builder or the Owner.
10. Valve, plug, or cap and anchor pipe ends left for future connections.
11. Place a metallic location tape above all plastic lines, Seton 37220 or 37222 as required.
12. Provide clean sand minimum 6 inches all around plastic lines.

3.07 JOINTING

A. Cast Iron Pipe: Install push-on type joints according to AWWA C600.
B. Galvanized Steel Pipe: screw joints shall be made tight with a stiff mixture of graphite and oil, inert filler and oil, or with an acceptable graphite compound, applied with a brush to the male threads only. Compounds shall not contain lead.
C. Copper Tubing: Sweat solder fittings using solder and flux. Connections made with solder containing lead are not allowed. Joints with lead shall be disassembled, solder remaining removed, and reconnected using the specified solder, at no additional cost to the Design Builder or the Owner.
D. Insulating Joints: Install according manufacturer's requirements.
E. Connections between different type of pipe and accessories shall be made with transition fittings accepted by A/E.

3.08 SETTING OF VALVES AND BOXES

A. Install where shown or specified, and set plumb at finished grade.
B. Valve boxes shall be centered on the valves.
   1. Boxes shall be installed over each outside gate valve unless otherwise shown.
   2. Where feasible, valves shall be located outside the area of roads and parking.
   3. Earth fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet.

3.09 METER, BACKFLOW PREVENTER, AND VAULTS

A. Install according to local utility company standards, as specified, and as indicated on drawings.
3.010  THRUST BLOCKS

A. Plugs, caps, tees, and bends deflecting 22.5 degrees or more, either vertically or horizontally, on water lines 6 lines in diameter or larger, shall be provided with thrust blocking, or metal tie rods and clamps, or lugs.

B. Thrust blocking shall be concrete of a mix not leaner than 1 cement: 2-1/2 sand: 5 gravel and having a compressive strength of not less than 2,500 psi after 28 days.

C. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored.

D. Unless otherwise indicated the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth.

E. The sides of thrust blocks not subject to thrust may be poured against forms.

F. The area of bearing shall be as shown.

G. Blocking shall be placed so that the fitting joints will be accessible for repair.

H. Steel rods and clamps shall be protected by galvanizing or by coating with coal tar enamel coating.

3.011  HYDROSTATIC PRESSURE TEST

A. Test:

1. After pipe is laid, joints completed, and trench partially backfilled, leaving joints exposed for examination, subject newly laid water piping or any valved section of water piping to a one hour, 150 psi hydrostatic pressure test, unless otherwise specified.
2. Open and close each valve several times during test.
3. Carefully examine exposed pipe, joints, fittings and valves during the partially open trench test.
4. Replace or remake joints showing visible leakage as necessary.
5. Remove and replace cracked or defective pipe, joints, fittings, or valves discovered after this pressure test with sound material.
6. Repeat test until results are satisfactory.
7. Replace, repair and retest as required at no cost to the owner.
8. Test shall be according to and accepted by the local utility company.
9. Test shall be also accepted by the A/E.

B. Time for Making Test:
1. Except joint material setting or where concrete reaction backing requires a 5-day delay, pipelines or couplings may be subjected to hydrostatic pressure, inspected and tested for leakage any time after partial completion of backfill.

2. Cement mortar lined pipe may be filled with water as recommended by manufacturer before being subjected to pressure test.

C. Concurrent Hydrostatic Test and Disinfection:

1. Despite sequence of tests employed, results of pressure tests and disinfection shall be satisfactory as specified.
   a. Replace, repair, or retest as required.

2. Pressure test and disinfection may be conducted separately or hydrostatic tests and disinfection may be conducted concurrently, using water tested for disinfection to accomplish hydrostatic test.

3. If water is lost when treated for disinfection and air is admitted to piping unit being tested, or if any repair procedure results in contamination of piping unit, repeat disinfection procedures until satisfactory results are obtained.

3.012 DISINFECTION

A. Before acceptance of potable water operation, disinfect each unit of completed water piping as prescribed by AWWA C601.

3.013 CLEANUP

A. Upon completion of installation of water lines and appurtenances, remove debris and surplus materials resulting from work.

- END OF SECTION -
SECTION 334000

STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.01 SUMMARY

1.02 REFERENCES

A. The American Society for testing and Materials (ASTM):

1. A53-96 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

B. The American Association of the State Highway Transportation Officials (AASHTO).

C. Florida Department of Transportation (FDOT), latest edition, Standard Specifications for Road and Bridge Construction.

1. Delete the basis of payment and other pay measurement requirements from FDOT specifications.
2. Payment for work specified in this section will be included as part of lump sum bid for entire project according to Construction Documents.

D. Miami-Dade County Department of Environmental Regulations.

E. Miami-Dade County Health Department.

1.03 SUBMITTALS

A. Submit properly identified shop drawings and manufacturer's catalog cuts, technical data, and certificates on the following for review before starting work.

1. Precast concrete structures.
2. Frames and grates.
3. Pipe.
4. Test reports.

B. Include manufacturer's certificates of compliance or certified analysis according to applicable standards with each shipment of material.

1.04 QUALITY ASSURANCE

A. Work shall be performed according to plans and specifications in a neat and accurate manner.

1.05 STORAGE

A. Keep materials, structures, equipment, and appurtenances stored on the site clean and free of foreign materials.

B. Replace damaged items at no cost to the Board.

1.06 PROJECT CONDITIONS

A. Comply with Standards and Regulations of Florida State and Miami-Dade County Health Departments and Department of Environmental Regulations.

PART 2 PRODUCTS

2.01 MATERIALS

A. High Density Polyethylene Storm Drainage Pipe:

1. Advance Drainage Systems, Inc.
2. Hancor, Inc.
B. Corrugated Metal Pipes:

1. Helically corrugated aluminum alloy round pipe shall comply with AASHTO M196. 16 gage thickness unless otherwise indicated on the drawings.

2. Helical corrugated aluminum-alloy pipe perforated shall comply with AASHTO M196. 16 gage thickness unless otherwise indicated on the drawings.
   
a. Perforated pipe shall have perforations of 1/4" to 3/8" diameter holes at + 2-3/4" o.c., with a minimum of 114 holes per linear foot.

3. Helically corrugated steel pipe shall comply with AASHTO M36. Pipe shall be fully bituminous coated according to the requirements of AASHTO M190, for Type A. Thickness: 16 gage unless otherwise indicated on the drawings.

4. Joint: Locking bands with a rubber or neoprene gasket for a flexible watertight joint. Locking band shall comply with AASHTO M36 and gasket shall comply with ASTM C443.

C. PVC Sewer Pipe and Fittings: ASTM D3034 for SDR 35.

1. Joints: Bell spigot type, elastomeric gasket joints.


E. Black Steel Pipe: Comply with ASTM A53 for schedule 40 Pipe and Fittings.

F. Catch Basins and Storm Manholes: Cast-in-place concrete or precast concrete, with cast iron frames and hinged grates as indicated on drawings and specified in Section 425 of FDOT Specification.

G. Ballast Rock: Ballast rock shall be obtained from fresh water local sources. When subjected to ASTM C131 tests, the loss shall not exceed 40 percent. Ballast rock designated as 2 inches shall fall within the 3/4" to 2-1/2" range.

PART 3 EXECUTION

3.01 INSPECTION

A. Do not proceed with the work of this section until conditions detrimental to the proper
and timely completion of the work have been corrected in an acceptable manner.

3.02 INSTALLATION

A. Excavation and Backfilling for Trenches and Manholes: As specified in Section 312000 – Earthmoving.

B. Placing Pipe:

1. Carefully examine each pipe before laying. Do not use defective or damaged pipe.
2. Lay pipelines to grades and alignment indicated.
3. Provide proper facilities for lowering sections of pipe into trenches.
4. Inspect pipe in place before backfilling and remove and replace those damaged during placement at no cost to the Owner.
5. Storm Sewer Pipe:

   a. Shape bottom of trench by hand to give uniform circumferential support to lower one fourth of each pipe.
   b. Where applicable, lay pipe upgrade with tongue or spigot ends pointing in direction of flow.
   c. Lay each pipe true to line and grade indicated on drawings and in such a manner to form a close concentric joint with adjoining pipe and to prevent sudden offsets of flow line.
   d. Keep interior of storm sewer free of dirt and superfluous materials as work progresses.
   e. Keep a suitable swab or drag in pipe where cleaning after laying is difficult due to small pipe size and pull forward past each joint immediately after each jointing has been completed.
   f. If maximum width of trench at top of pipe as specified is exceeded, install either concrete cradling, pipe encasement or other bedding as may be required to support added load of backfill.
   g. Keep trenches for sections of sewer free from water until pipe-jointing material has set and trench backfilled.
   h. Do not lay pipe when condition of trench or weather is unsuitable for such work.
   i. Keep open ends of pipes and fittings securely closed at times when work is not in progress.
   j. If pipe cannot be adequately supported on undisturbed earth or tamped backfill, encase pipe in concrete or support it on a concrete cradle.
C. Concrete Structure:

1. Leveling courses at structures for manholes and catch basins shall be 3 to 12 inches and according to DCPW SD4.5.

D. Catch Basins and Manholes: Frames and Inlet Grates or Solid Covers: Set the cast iron frames and grates in a bed or mortar and carefully adjust to elevations shown on the drawings.

END OF SECTION