



SOLICITATION NUMBER

PROJECT NO. 561-19-152

SPECIFICATIONS

FOR: Site Improvements and Catch Basin Restoration

AT: VA Medical Center
385 Tremont Avenue
East Orange, NJ

ISSUE DATE: 10/4/2019

BID OPENING DATE:

Contracting Officer (90C)
VA Medical Center
East Orange, NJ

**DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS**

**TABLE OF CONTENTS
Section 00 01 10**

| SECTION NO. | DIVISION AND SECTION TITLES | DATE |
|--------------------|--|-------------|
| | DIVISION 00 - SPECIAL SECTIONS | |
| | | |
| 00 01 15 | List of Drawing Sheets | 07-15 |
| | | |
| | DIVISION 01 - GENERAL REQUIREMENTS | |
| | | |
| 01 00 00 | General Requirements | 05-17 |
| 01 35 26 | Safety Requirements | 02-17 |
| 01 42 19 | Reference Standards | 09-19 |
| 01 45 00 | Quality Control | 03-19 |
| 01 45 29 | Testing Laboratory Services | 11-18 |
| 01 57 19 | Temporary Environmental Controls | 01-11 |
| 01 74 19 | Construction Waste Management | 09-13 |
| | | |
| | DIVISION 02 - EXISTING CONDITIONS | |
| | | |
| 02 21 13 | Site Surveys | 08-16 |
| 02 41 00 | Demolition | 08-17 |
| | | |
| | DIVISION 03 - CONCRETE | |
| | | |
| 03 30 00 | Cast-in-Place Concrete | 07-19 |
| | | |
| | DIVISION 04 - MASONRY | |
| | | |
| 04 01 00 | Maintenance of Masonry | 02-16 |
| 04 05 13 | Masonry Mortaring | 10-17 |
| 04 05 16 | Masonry Grouting | 02-16 |
| 04 20 00 | Unit Masonry | 08-17 |
| 04 72 00 | Cast Stone Masonry | 02-15 |
| | | |
| | DIVISION 05 - METALS | |
| | | |
| 05 50 00 | Metal Fabrications | 08-18 |
| | | |
| | DIVISION 06 - WOOD, PLASTICS AND COMPOSITES | |
| | | |
| 06 10 00 | Rough Carpentry | 10-17 |
| 06 20 00 | Finish Carpentry | 08-16 |
| | | |
| | DIVISION 07 - THERMAL AND MOISTURE PROTECTION | |
| | | |
| 07 92 00 | Joint Sealants | 10-17 |
| | | |
| | DIVISION 08 - OPENINGS | |

| SECTION NO. | DIVISION AND SECTION TITLES | DATE |
|-------------|--|-------|
| | | |
| | DIVISION 09 - FINISHES | |
| | | |
| | DIVISION 10 - SPECIALTIES | |
| | | |
| | DIVISION 11 - EQUIPMENT | |
| | | |
| | DIVISION 12 - FURNISHINGS | |
| | | |
| | DIVISION 13 - SPECIAL CONSTRUCTION | |
| | | |
| | DIVISION 14- CONVEYING EQUIPMENT | |
| | | |
| | DIVISION 21- FIRE SUPPRESSION | |
| | | |
| | DIVISION 22 - PLUMBING | |
| | | |
| | DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) | |
| | | |
| | DIVISION 25 - INTEGRATED AUTOMATION | |
| | | |
| | DIVISION 26 - ELECTRICAL | |
| | | |
| | DIVISION 27 - COMMUNICATIONS | |
| | | |
| | DIVISION 31 - EARTHWORK | |
| | | |
| 31 20 00 | Earthwork | 07-16 |
| | | |
| | DIVISION 32 - EXTERIOR IMPROVEMENTS | |
| | | |
| 32 05 23 | Cement and Concrete for Exterior Improvements | 08-16 |
| 32 12 16 | Asphalt Paving | 09-15 |
| 32 17 23 | Pavement Markings | 08-16 |
| 32 31 13 | Chain Link Fences and Gates | 06-18 |
| 32 90 00 | Planting | 08-16 |
| | | |
| | DIVISION 33 - UTILITIES | |
| | | |
| 33 40 00 | Storm Sewer Utilities | 12-17 |
| | | |
| | DIVISION 34 - TRANSPORTATION | |
| | | |
| | DIVISION 48 - Electrical Power Generation | |
| | | |

Site Repairs and Catch Basin Restoration
VANJHCS, East Orange Campus
Construction Documents

Project No. 561-19-152
East Orange, NJ 07018
October 2, 2019

SECTION 00 01 15
LIST OF DRAWING SHEETS

The drawings listed below accompanying this specification form a part of
the contract.

| <u>Drawing No.</u> | <u>Title</u> |
|--------------------|---------------|
| 1 | SITE PLANNING |

- - - END - - -

SECTION 01 00 00
GENERAL REQUIREMENTS

TABLE OF CONTENTS

| | |
|---|----|
| 1.1 SAFETY REQUIREMENTS..... | 1 |
| 1.2 GENERAL INTENTION..... | 1 |
| 1.3 STATEMENT OF BID ITEM(S) | 2 |
| 1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR..... | 3 |
| 1.5 CONSTRUCTION SECURITY REQUIREMENTS..... | 3 |
| 1.6 OPERATIONS AND STORAGE AREAS..... | 5 |
| 1.7 ALTERATIONS..... | 8 |
| 1.8 DISPOSAL AND RETENTION..... | 10 |
| 1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS..... | 10 |
| 1.10 RESTORATION..... | 11 |
| 1.11 PHYSICAL DATA..... | 12 |
| 1.12 PROFESSIONAL SURVEYING SERVICES..... | 12 |
| 1.13 LAYOUT OF WORK..... | 12 |
| 1.14 AS-BUILT DRAWINGS..... | 12 |
| 1.15 WARRANTY MANAGEMENT..... | 12 |
| 1.16 USE OF ROADWAYS..... | 12 |
| 1.17 RESIDENT ENGINEER'S FIELD OFFICE..... | 13 |
| 1.18 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT..... | 13 |
| 1.19 TEMPORARY USE OF EXISTING ELEVATORS..... | 13 |
| 1.20 TEMPORARY USE OF NEW ELEVATORS..... | 13 |
| 1.21 TEMPORARY TOILETS..... | 13 |
| 1.22 AVAILABILITY AND USE OF UTILITY SERVICES..... | 13 |
| 1.23 NEW TELEPHONE EQUIPMENT..... | 15 |
| 1.24 TESTS..... | 15 |
| 1.25 INSTRUCTIONS..... | 15 |
| 1.26 GOVERNMENT-FURNISHED PROPERTY..... | 15 |

| | |
|--|----|
| 1.27 RELOCATED // EQUIPMENT // ITEMS // | 15 |
| 1.28 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT..... | 15 |
| 1.29 CONSTRUCTION SIGN..... | 15 |
| 1.30 SAFETY SIGN..... | 15 |
| 1.31 PHOTOGRAPHIC DOCUMENTATION..... | 15 |
| 1.32 FINAL ELEVATION Digital Images..... | 15 |
| 1.33 HISTORIC PRESERVATION..... | 15 |
| 1.34 VA TRIRIGA CPMS..... | 15 |

SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 SAFETY REQUIREMENTS

Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.

1.2 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Site Repairs and Catch Basin Restoration as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the Resident Engineer in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the Resident Engineer.
- E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- F. Prior to commencing work, general contractor shall provide proof that an OSHA designated "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
 - 1. All employees of general contractor or subcontractors shall have the 30-hour OSHA Construction Safety course and other relevant competency training, as determined by RE/COR acting as the Construction Safety Officer with input from the facility Construction Safety Committee.

2. Submit training records of all such employees for approval before the start of work.

H. VHA Directive 7715, Safety and Health during Construction, dated April 6, 2017 in its entirety is made a part of this section

1.3 STATEMENT OF BID ITEM(S)

A. ITEM I, Base Bid: GENERAL CONSTRUCTION: Site Repairs and Catch Basin Restoration: Contractor shall provide all tools, resources, materials, temporary fencing, signage, permits, supervision, etc. for the all work related to general construction, alterations, roads, walks, grading, drainage, catch basin restoration, chain link fence, stone pillars, timber guard rail, 3-rail split fence, caulking, masonry repointing and certain other items.

The period of performance for Base Bid Item I will be 120 calendar days from Notice To Proceed (NTP)

B. DEDUCT ALTERNATE NO.1: Base bid with a deduct of the work involved in the areas indicated on the plans and specifications as "Deduct Alternate Item #20 Delivery gate at McKay Ave"

The period of performance for Bid Deduct Alternate # 1 is 3 calendar days.

Deduct Alternate NO.1 shall be stated as a per square feet lump sum amount.

C. DEDUCT ALTERNATE NO.2: Base bid with a deduct of the work involved in the areas indicated on the plans and specifications as "Deduct Alternate Item #20 Delivery gate at McKay Ave" and "Deduct Alternate Item #22 Concrete Sidewalk"

The period of performance for Bid Deduct Alternate # 2 is 8 calendar days.

Deduct Alternate NO.2 shall be stated as a per square feet lump sum amount.

D. DEDUCT ALTERNATE NO.3: Base bid with a deduct of the work involved in the areas indicated on the plans and specifications as "Deduct Alternate Item #20 Delivery gate at McKay Ave" and "Deduct Alternate

Item #22 Concrete Sidewalk" and "Deduct Alternate Item #50 Split 3-Rail Fence".

The period of performance for Bid Deduct Alternate # 3 is 20 calendar days.

Deduct Alternate NO.3 shall be stated as a per square feet and linear feet lump sum amount.

1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. Drawings and contract documents may be obtained from the website where the solicitation is posted. Additional copies will be at Contractor's expense.

1.5 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. Before starting work the General Contractor shall give one week's notice to the Contracting Officer so that security escort arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the

event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Guards:

1. The Contractor shall provide the guards and VA police with communication devices as directed.

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the Contracting Officers Representative (COR) for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".

7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
 - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
 - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

F. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. A limited number of (2 to 5) permits shall be issued for General Contractor and its employees for parking in designated areas only.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting

Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(FAR 52.236-10)

- D. Working space and space available for storing materials shall be as determined by the COR.
- E. Workers are subject to rules of Medical Center applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.
 - 1. Do not store materials and equipment in other than assigned areas.
- G. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.
 - 1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR.
 - 2. Contractor shall submit a request to interrupt any such services to COR, in writing, 7 days in advance of proposed interruption. Request

shall state reason, date, exact time of, and approximate duration of such interruption.

3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
 4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
 5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
 6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- H. Phasing: The Medical Center must maintain its operation 24 hours a day 7 days a week. Therefore, any interruption in service must be scheduled and coordinated with the COR to ensure that no lapses in operation occur. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks.

To ensure such executions, Contractor shall furnish the COR with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to ensure accomplishment of this work in successive phases mutually agreeable to Medical Center and Contractor.

- I. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.
- J. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance therefore:
1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
 2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.
- K. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- L. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR, of areas in which alterations occur and areas which are anticipated routes of access, and furnish a report,

signed by both, to the Contracting Officer. This report shall list by buildings and spaces:

1. Shall note any discrepancies between drawings and existing conditions at site.
 2. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur, and which have been agreed upon by Contractor and COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings and spaces involved. They shall furnish a report on conditions then existing compared with conditions of same as noted in first condition survey report:
1. Re-survey report shall also list any damage caused by Contractor to such buildings and surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workers in executing work of this contract.
- D. Protection: Provide the following protective measures:
1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
 2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.

3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 DISPOSAL AND RETENTION

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
 1. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.

1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workers, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(FAR 52.236-9)

- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:
- Designating areas for equipment maintenance and repair;
 - Providing waste receptacles at convenient locations and provide regular collection of wastes;
 - Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
 - Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
 - Providing adequately maintained sanitary facilities.//

1.10 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be

defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workers to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.11 PHYSICAL DATA - RESERVED

1.12 PROFESSIONAL SURVEYING SERVICES - RESERVED

1.13 LAYOUT OF WORK - RESERVED

1.14 AS-BUILT DRAWINGS

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To ensure compliance, as-built drawings shall be made available for the COR review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings in the electronic version (scanned PDF) to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.

D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.15 WARRANTY MANAGEMENT - RESERVED

1.16 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed and restoration performed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.

1.17 RESIDENT ENGINEER'S FIELD OFFICE - RESERVED

1.18 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT - RESERVED

1.19 TEMPORARY USE OF EXISTING ELEVATORS - RESERVED

1.20 TEMPORARY USE OF NEW ELEVATORS - RESERVED

1.21 TEMPORARY TOILETS

A. Provide where directed, (for use of all Contractor's workers) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COR, provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

1.22 AVAILABILITY AND USE OF UTILITY SERVICES

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.

B. The Contractor, at Contractor's expense and in a workmanlike manner, in compliance with code and as satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and

distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia and repair restore the infrastructure as required.

- C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
 - 1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- E. Water (for Construction and Testing): Furnish temporary water service.
 - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection as per code. Water is available at no cost to the Contractor.
 - 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR discretion) of use of water from Medical Center's system.

1.23 NEW TELEPHONE EQUIPMENT - RESERVED

1.24 TESTS - RESERVED

1.25 INSTRUCTIONS - RESERVED

1.26 GOVERNMENT-FURNISHED PROPERTY - RESERVED

1.27 RELOCATED // EQUIPMENT // ITEMS // - RESERVED

1.28 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT - RESERVED

1.29 CONSTRUCTION SIGN

- A. Contractor shall provide signage for each phased work area and where directed by the COR. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed. Signage shall read:

CONSTRUCTION AREA - OR - AREA UNDER CONSTRUCTION

PLEASE USE ALTERNATE PATH

Provide directional arrows(s) to indicate proposed alternate route. Signage shall be securely fastened to construction fence. Signs shall be at each end of the work area and along the sides at a minimum of 40'-0" OC.

- B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.
- C. Maintain sign and remove it when directed by the Resident Engineer COR.

1.30 SAFETY SIGN - RESERVED

1.31 PHOTOGRAPHIC DOCUMENTATION - RESERVED

1.32 FINAL ELEVATION DIGITAL IMAGES - RESERVED

1.33 HISTORIC PRESERVATION

Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible

Site Repairs and Catch Basin Restoration
VANJHCS, East Orange Campus
Construction Documents

Project No. 561-19-152
East Orange, NJ 07018
October 2, 2019

archeological, historical and/or cultural resources, the Contractor shall immediately notify the COR verbally, and then with a written follow up.

1.34 VA TRIRIGA CPMS - RESERVED

- - - E N D - - -

SECTION 01 35 26
SAFETY REQUIREMENTS

TABLE OF CONTENTS

| | | |
|------|--|----|
| 1.1 | APPLICABLE PUBLICATIONS | 3 |
| 1.2 | DEFINITIONS | 4 |
| 1.3 | REGULATORY REQUIREMENTS | 6 |
| 1.4 | ACCIDENT PREVENTION PLAN (APP) | 6 |
| 1.5 | ACTIVITY HAZARD ANALYSES (AHAs) | 11 |
| 1.6 | PRECONSTRUCTION CONFERENCE | 13 |
| 1.7 | "SITE SAFETY AND HEALTH OFFICER" (SSHO) and "COMPETENT PERSON" (CP) | 14 |
| 1.8 | TRAINING | 14 |
| 1.9 | INSPECTIONS | 16 |
| 1.10 | ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS | 16 |
| 1.11 | PERSONAL PROTECTIVE EQUIPMENT (PPE) | 17 |
| 1.12 | INFECTION CONTROL | 18 |
| 1.13 | TUBERCULOSIS SCREENING | 26 |
| 1.14 | FIRE SAFETY | 27 |
| 1.15 | ELECTRICAL | 29 |
| 1.16 | FALL PROTECTION | 29 |
| 1.17 | SCAFFOLDS AND OTHER WORK PLATFORMS | 30 |
| 1.18 | EXCAVATION AND TRENCHES | 31 |
| 1.19 | CRANES | 33 |
| 1.20 | CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT) | 33 |
| 1.21 | CONFINED SPACE ENTRY | 33 |
| 1.22 | WELDING AND CUTTING | 34 |
| 1.23 | LADDERS | 34 |
| 1.24 | FLOOR & WALL OPENINGS | 34 |

Site Repairs and Catch Basin Restoration
VANJHCS, East Orange Campus
Construction Documents

Project No. 561-19-152
East Orange, NJ 07018
October 2, 2019

SECTION 01 35 26
SAFETY REQUIREMENTS

1.1 APPLICABLE PUBLICATIONS:

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. American Society of Safety Engineers (ASSE):

A10.1-2011.....Pre-Project & Pre-Task Safety and Health
Planning

A10.34-2012.....Protection of the Public on or Adjacent to
Construction Sites

A10.38-2013.....Basic Elements of an Employer's Program to
Provide a Safe and Healthful Work Environment
American National Standard Construction and
Demolition Operations

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

E84-2013.....Surface Burning Characteristics of Building
Materials

D. The Facilities Guidelines Institute (FGI):

FGI Guidelines-2010Guidelines for Design and Construction of
Healthcare Facilities

E. National Fire Protection Association (NFPA):

10-2013.....Standard for Portable Fire Extinguishers

30-2012.....Flammable and Combustible Liquids Code

51B-2014.....Standard for Fire Prevention During Welding,
Cutting and Other Hot Work

70-2014.....National Electrical Code

70B-2013.....Recommended Practice for Electrical Equipment
Maintenance

70E-2015Standard for Electrical Safety in the Workplace

99-2012.....Health Care Facilities Code

241-2013.....Standard for Safeguarding Construction,
Alteration, and Demolition Operations

F. The Joint Commission (TJC)

TJC ManualComprehensive Accreditation and Certification
Manual

G. U.S. Nuclear Regulatory Commission

10 CFR 20Standards for Protection Against Radiation

H. U.S. Occupational Safety and Health Administration (OSHA):

29 CFR 1904Reporting and Recording Injuries & Illnesses

29 CFR 1910Safety and Health Regulations for General
Industry

29 CFR 1926Safety and Health Regulations for Construction
Industry

CPL 2-0.124.....Multi-Employer Citation Policy

I. VHA Directive 2005-007

1.2 DEFINITIONS:

A. Critical Lift. A lift with the hoisted load exceeding 75% of the crane's maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where other adverse environmental conditions exist; and any lift which the crane operator believes is critical.

B. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

C. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

D. High Visibility Accident. Any mishap which may generate publicity or high visibility.

E. Accident/Incident Criticality Categories:

No impact - near miss incidents that should be investigated but are not required to be reported to the VA;

Minor incident/impact - incidents that require first aid or result in minor equipment damage (less than \$5000). These incidents must be investigated but are not required to be reported to the VA;

Moderate incident/impact - Any work-related injury or illness that results in:

1. Days away from work (any time lost after day of injury/illness onset);
2. Restricted work;
3. Transfer to another job;
4. Medical treatment beyond first aid;
5. Loss of consciousness;
6. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,
7. any incident that leads to major equipment damage (greater than \$5000).

These incidents must be investigated and are required to be reported to the VA;

Major incident/impact - Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to major property

damage (greater than \$20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported to the VA as soon as practical, but not later than 2 hours after the incident.

- E. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by physician or registered personnel.

1.3 REGULATORY REQUIREMENTS:

- A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority.

1.4 ACCIDENT PREVENTION PLAN (APP) :

- A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.
- B. The APP shall be prepared as follows:

1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
2. Address both the Prime Contractors and the subcontractors work operations.
3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
4. Address all the elements/sub-elements and in order as follows:
 - a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:
 - 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
 - 2) Plan approver (company/corporate officers authorized to obligate the company);
 - 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
 - b. **BACKGROUND INFORMATION.** List the following:
 - 1) Contractor;
 - 2) Contract number;
 - 3) Project name;
 - 4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
 - c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing

commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.

d. RESPONSIBILITIES AND LINES OF AUTHORITIES. Provide the following:

- 1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;
- 2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
- 3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.;
- 4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
- 5) Requirements for pre-task Activity Hazard Analysis (AHAs);
- 6) Lines of authority;
- 7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

e. SUBCONTRACTORS AND SUPPLIERS. If applicable, provide procedures for coordinating SOH activities with other employers on the job site:

- 1) Identification of subcontractors and suppliers (if known);
- 2) Safety responsibilities of subcontractors and suppliers.

f. TRAINING.

- 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.

- 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc....) and any requirements for periodic retraining/recertification are required.
- 3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
- 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

g. SAFETY AND HEALTH INSPECTIONS.

- 1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.
- 2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

h. ACCIDENT/INCIDENT INVESTIGATION & REPORTING. The Contractor shall conduct mishap investigations of all Moderate and Major as well as all High Visibility Incidents. The APP shall include accident/incident investigation procedure and identify person(s) responsible to provide the following to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority:

- 1) Exposure data (man-hours worked);
- 2) Accident investigation reports;
- 3) Project site injury and illness logs.

i. PLANS (PROGRAMS, PROCEDURES) REQUIRED. Based on a risk assessment of contracted activities and on mandatory OSHA compliance

programs, the Contractor shall address all applicable occupational, patient, and public safety risks in site-specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following:

- 1) Emergency response;
- 2) Contingency for severe weather;
- 3) Fire Prevention;
- 4) Medical Support;
- 5) Posting of emergency telephone numbers;
- 6) Prevention of alcohol and drug abuse;
- 7) Site sanitation (housekeeping, drinking water, toilets);
- 8) Night operations and lighting;
- 9) Hazard communication program;
- 10) Welding/Cutting "Hot" work;
- 11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
- 12) General Electrical Safety;
- 13) Hazardous energy control (Machine LOTO);
- 14) Site-Specific Fall Protection & Prevention;
- 15) Excavation/trenching;
- 16) Asbestos abatement;
- 17) Lead abatement;
- 18) Crane Critical lift;
- 19) Respiratory protection;
- 20) Health hazard control program;
- 21) Radiation Safety Program;
- 22) Abrasive blasting;

- 23) Heat/Cold Stress Monitoring;
- 24) Crystalline Silica Monitoring (Assessment);
- 25) Demolition plan (to include engineering survey);
- 26) Formwork and shoring erection and removal;
- 27) Pre-Cast Concrete;
- 28) Public (Mandatory compliance with ANSI/ASSE A10.34-2012).

- C. Submit the APP to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.
- D. Once accepted by the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer in accordance with FAR Clause 52.236-13, *Accident Prevention*, until the matter has been rectified.
- E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the project superintendent, project overall designated OSHA Competent Person, and Facility Safety Officer, Contracting Officer Representative or Government Designated Authority. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public and the environment.

1.5 ACTIVITY HAZARD ANALYSES (AHAS) :

- A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity

involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)

- B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.
- C. Work shall not begin until the AHA for the work activity has been accepted by the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
 - 1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.
 - 2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
 - a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
 - b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.

3. Submit AHAs to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.
4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority.

1.6 PRECONSTRUCTION CONFERENCE:

- A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.
- B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

1.7 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP) :

- A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b) (2) that will be identified as a CP to administer their individual safety programs.
- B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.
- E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

1.8 TRAINING:

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for

the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.

- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the Resident Engineer that individuals have undergone contractor's safety briefing.

- G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.9 INSPECTIONS:

- A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of the their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions Facility Safety Officer, Contracting Officer Representative or Government Designated Authority.

1.10 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:

- A. The prime contractor shall establish and maintain an accident reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damage (both government and contractor) that occur on site. Notify the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority as soon as practical, but no more than four hours after any accident meeting the definition of a Moderate or Major incident, High Visibility Incidents, , or any weight handling and hoisting equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority determine whether a government investigation will be conducted.
- B. Conduct an accident investigation for all Minor, Moderate and Major incidents as defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162 (or equivalent) , and provide the report to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority

within 5 calendar days of the accident. The Facility Safety Officer, Contracting Officer Representative or Government Designated Authority will provide copies of any required or special forms.

- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority.
- D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority as requested.

1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE) :

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
 - 1. Hard Hats - unless written authorization is given by the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.
 - 2. Safety glasses - unless written authorization is given by the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority in circumstances of no eye hazards, appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.

3. Appropriate Safety Shoes - based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority in circumstances of no foot hazards.
4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

1.12 INFECTION CONTROL

- A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. Exterior construction activities causing disturbance of soil or creates dust in some other manner must be controlled.
- B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The required infection control precautions with each class are as follows:
 1. Class I requirements:
 - a. During Construction Work:
 - 1) Notify the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority

- 2) Execute work by methods to minimize raising dust from construction operations.

b. Upon Completion:

- 1) Clean work area upon completion of task
- 2) Notify the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority

2. Class II requirements:

a. During Construction Work:

- 1) Notify the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority
- 2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
- 3) Water mist work surfaces to control dust while cutting.
- 4) Seal unused doors with duct tape.
- 5) Block off and seal air vents.
- 6) Remove or isolate HVAC system in areas where work is being performed.

b. Upon Completion:

- 1) Wipe work surfaces with cleaner/disinfectant.
- 2) Contain construction waste before transport in tightly covered containers.
- 3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
- 4) Upon completion, restore HVAC system where work was performed
- 5) Notify the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority

3. Class III requirements:

a. During Construction Work:

- 1) Obtain permit from the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority
- 2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.
- 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
- 5) Contain construction waste before transport in tightly covered containers.
- 6) Cover transport receptacles or carts. Tape covering unless solid lid.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority and thoroughly cleaned by the VA Environmental Services Department.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Vacuum work area with HEPA filtered vacuums.
- 4) Wet mop area with cleaner/disinfectant.
- 5) Upon completion, restore HVAC system where work was performed.

- 6) Return permit to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority.

4. Class IV requirements:

a. During Construction Work:

- 1) Obtain permit from the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority
- 2) Isolate HVAC system in area where work is being done to prevent contamination of duct system.
- 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
- 5) Seal holes, pipes, conduits, and punctures.
- 6) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.
- 7) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the Facility Safety Officer, Contracting

Officer Representative or Government Designated Authority with thorough cleaning by the VA Environmental Services Dept.

- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Contain construction waste before transport in tightly covered containers.
- 4) Cover transport receptacles or carts. Tape covering unless solid lid.
- 5) Vacuum work area with HEPA filtered vacuums.
- 6) Wet mop area with cleaner/disinfectant.
- 7) Upon completion, restore HVAC system where work was performed.
- 8) Return permit Facility Safety Officer, Contracting Officer Representative or Government Designated Authority

C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:

1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
 - a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the COR and Medical Center) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping
 - b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
 - c. Class III & IV - Seal all penetrations in existing barrier airtight

- d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris
 - e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
 - f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.
- D. Products and Materials:
- 1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
 - 2. Barrier Doors: Self Closing Two-hour fire-rated solid core wood in steel frame, painted
 - 3. Dust proof two-hour fire-rated drywall
 - 4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
 - 5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
 - 6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
 - 7. Disinfectant: Hospital-approved disinfectant or equivalent product
 - 8. Portable Ceiling Access Module
- E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

- F. A dust control program will be establish and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to Facility Safety Officer, Contracting Officer Representative or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- G. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.
- H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
 2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
 3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
 4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
 5. The contractor shall not haul debris through patient-care areas without prior approval of the Resident Engineer and the Medical

Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

I. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

J. Exterior Construction

1. Contractor shall verify that dust will not be introduced into the medical center through intake vents, or building openings. HEPA filtration on intake vents is required where dust may be introduced.
2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary
3. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.13 TUBERCULOSIS SCREENING

- A. Contractor shall provide written certification that all contract employees assigned to the work site have had a pre-placement tuberculin screening within 90 days prior to assignment to the worksite and been found have negative TB screening reactions. Contractors shall be required to show documentation of negative TB screening reactions for any additional workers who are added after the 90-day requirement before they will be allowed to work on the work site. NOTE: This can be the Center for Disease Control (CDC) and Prevention and two-step skin testing or a Food and Drug Administration (FDA)-approved blood test.
1. Contract employees manifesting positive screening reactions to the tuberculin shall be examined according to current CDC guidelines prior to working on VHA property.
 2. Subsequently, if the employee is found without evidence of active (infectious) pulmonary TB, a statement documenting examination by a physician shall be on file with the employer (construction contractor), noting that the employee with a positive tuberculin screening test is without evidence of active (infectious) pulmonary TB.
 3. If the employee is found with evidence of active (infectious) pulmonary TB, the employee shall require treatment with a subsequent statement to the fact on file with the employer before being allowed to return to work on VHA property.

SPEC WRITER NOTE: Coordinate editing with facility Safety Manager/Officer at VA medical facilities. Edit subparagraphs C, E, G, H, M, P and Q carefully as they directly relate to interim life safety measures required in or adjacent to construction affecting occupied buildings by the Joint Commission on Accreditation of Healthcare Organizations. At other sites, edit for project and delete // and facility Safety // Manager // Officer// provisions.

1.14 FIRE SAFETY

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Facility Safety Officer, Contracting Officer Representative or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.
- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Temporary Construction Partitions:
 - 1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, $\frac{3}{4}$ hour fire/smoke rated doors with self-closing devices.
 - 2. Install two-hour fire-rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
 - 3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-

penetration firestop materials in accordance with Section 07 84 00,
FIRESTOPPING.

- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Facility Safety Officer, Contracting Officer Representative or Government Designated Authority.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Facility Safety Officer, Contracting Officer Representative or Government Designated Authority.
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- J. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather protected.
- K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Facility Safety Officer, Contracting Officer Representative or Government Designated Authority. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident Engineer.

- M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Facility Safety Officer, Contracting Officer Representative or Government Designated Authority.
- N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Facility Safety Officer, Contracting Officer Representative or Government Designated Authority at least 2 days in advance.
- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Facility Safety Officer, Contracting Officer Representative or Government Designated Authority.
- P. Smoking: Smoking is prohibited at the entire VA property.
- Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- R. If required, submit documentation to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.15 ELECTRICAL - RESERVED

1.16 FALL PROTECTION

- A. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.
 - 1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
 - 2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
 - 3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f))

for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.

4. Fall protection while using a ladder will be governed by the OSHA requirements.

1.17 SCAFFOLDS AND OTHER WORK PLATFORMS

- A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.
- B. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) as stated in Section 1.16.
- C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.
 1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.
 2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.
 3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
 4. Emergency descent devices shall not be used as working platforms.
- D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:
 1. The Competent Person's name and signature;
 2. Dates of initial and last inspections.
- E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed 20 ft (6 m) in height, positive fall protection shall be used.

1.18 EXCAVATION AND TRENCHES

- A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P. Excavations less than 5 feet in depth require evaluation by the contractor's "Competent Person" (CP) for determination of the necessity of an excavation protective system where kneeling, laying in, or stooping within the excavation is required.
- B. All excavations and trenches 24 inches in depth or greater shall require a written trenching and excavation permit (NOTE - some States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater than 5 feet in depth. Each section of the permit shall be provided to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority prior to proceeding with digging or drilling and prior to proceeding with entering the excavation. After completion of the work and prior to opening a new section of an excavation, the permit shall be closed out and provided to the Facility Safety Officer, Contracting Officer Representative or Government Designated Authority. The permit shall be maintained onsite and the first section of the permit shall include the following:
1. Estimated start time & stop time
 2. Specific location and nature of the work.
 3. Indication of the contractor's "Competent Person" (CP) in excavation safety with qualifications and signature. Formal course in excavation safety is required by the contractor's CP.
 4. Indication of whether soil or concrete removal to an offsite location is necessary.
 5. Indication of whether soil samples are required to determine soil contamination.
 6. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.

7. Indication of review of site drawings for proximity of utilities to digging/drilling.

The second section of the permit for excavations greater than five feet in depth shall include the following:

1. Determination of OSHA classification of soil. Soil samples will be from freshly dug soil with samples taken from different soil type layers as necessary and placed at a safe distance from the excavation by the excavating equipment. A pocket penetrometer will be utilized in determination of the unconfined compression strength of the soil for comparison against OSHA table (Less than 0.5 Tons/FT² - Type C, 0.5 Tons/FT² to 1.5 Tons/FT² - Type B, greater than 1.5 Tons/FT² - Type A without condition to reduce to Type B).
 2. Indication of selected protective system (sloping/benching, shoring, shielding). When soil classification is identified as "Type A" or "Solid Rock", only shoring or shielding or Professional Engineer designed systems can be used for protection. A Sloping/Benching system may only be used when classifying the soil as Type B or Type C. Refer to Appendix B of 29 CFR 1926, Subpart P for further information on protective systems designs.
 3. Indication of the spoil pile being stored at least 2 feet from the edge of the excavation and safe access being provided within 25 feet of the workers.
 4. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist. Internal combustion engine equipment is not allowed in an excavation without providing force air ventilation to lower the concentration to below OSHA PELs, providing sufficient oxygen levels, and atmospheric testing as necessary to ensure safe levels are maintained.
- C. As required by OSHA 29 CFR 1926.651(b)(1), the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

1. The planned dig site will be outlined/marked in white prior to locating the utilities.
 2. Used of the American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.
 3. 811 will be called two business days before digging on all local or State lands and public Right-of Ways.
 4. Digging will not commence until all known utilities are marked.
 5. Utility markings will be maintained
- D. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations approach within 3 to 5 feet of identified underground utilities. Exploratory bar or other detection equipment will be utilized as necessary to further identify the location of underground utilities.
- E. Excavations greater than 20 feet in depth require a Professional Engineer designed excavation protective system.

1.19 CRANES - RESERVED

1.20 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

- A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other VA specific requirements discussed in the section.

1.21 CONFINED SPACE ENTRY

- A. All confined space entry shall comply with 29 CFR 1926, Subpart AA except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].
- B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the Facility Safety

Officer, Contracting Officer Representative or Government Designated Authority.

1.22 WELDING AND CUTTING

As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Facility Safety Officer, Contracting Officer Representative or Government Designated Authority. Obtain permits from Facility Safety Officer, Contracting Officer Representative or Government Designated Authority at least 2 days in advance.

1.23 LADDERS

- A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders
- D. Step Ladders shall not be used in the closed position
- E. Top steps or cap of step ladders shall not be used as a step
- D. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.
 - 1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.
 - 2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.
- G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.24 FLOOR & WALL OPENINGS

- A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.

- B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. Skylights located in floors or roofs are considered floor or roof hole/openings.
- C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toe boards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.
1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
 2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.
 3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
 4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
 5. Workers are prohibited from standing/walking on skylights.

- - - E N D - - -

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street N.W, (sixth floor)
Washington, DC 20001
Telephone Numbers: (202) 632-5249 or (202) 632-5178
Between 9:00 AM - 3:00 PM

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

| | |
|--------|---|
| AA | Aluminum Association Inc. http://www.aluminum.org |
| AABC | Associated Air Balance Council http://www.aabchg.com |
| AAMA | American Architectural Manufacturer's Association http://www.aamanet.org |
| AASHTO | American Association of State Highway and Transportation Officials http://www.aashto.org |
| AATCC | American Association of Textile Chemists and Colorists http://www.aatcc.org |
| ACGIH | American Conference of Governmental Industrial Hygienists http://www.acgih.org |
| ACI | American Concrete Institute http://www.aci-int.net |
| ACPA | American Concrete Pipe Association http://www.concrete-pipe.org |
| ACPPA | American Concrete Pressure Pipe Association http://www.acppa.org |
| ADC | Air Diffusion Council http://flexibleduct.org |
| AGA | American Gas Association http://www.aga.org |
| AGC | Associated General Contractors of America http://www.agc.org |
| AGMA | American Gear Manufacturers Association, Inc. http://www.agma.org |

| | |
|--------|--|
| AH | American Hort https://www.americanhort.org |
| AHAM | Association of Home Appliance Manufacturers http://www.aham.org |
| AIA | American Institute of Architects http://www.aia.org |
| AISC | American Institute of Steel Construction http://www.aisc.org |
| AISI | American Iron and Steel Institute http://www.steel.org |
| AITC | American Institute of Timber Construction https://aitc-glulam.org |
| AMCA | Air Movement and Control Association, Inc. http://www.amca.org |
| ANSI | American National Standards Institute, Inc. http://www.ansi.org |
| APA | The Engineered Wood Association http://www.apawood.org |
| ARI | Air-Conditioning and Refrigeration Institute http://www.ari.org |
| ARPM | Association for Rubber Product Manufacturers https://arpm.com |
| ASABE | American Society of Agricultural and Biological Engineers https://www.asabe.org |
| ASCE | American Society of Civil Engineers http://www.asce.org |
| ASHRAE | American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org |

| | |
|-------|---|
| ASME | American Society of Mechanical Engineers http://www.asme.org |
| ASSE | American Society of Sanitary Engineering International http://www.asse-plumbing.org |
| ASTM | American Society for Testing and Materials International http://www.astm.org |
| AWI | Architectural Woodwork Institute https://www.awinet.org |
| AWS | American Welding Society https://www.aws.org |
| AWWA | American Water Works Association https://www.awwa.org |
| BHMA | Builders Hardware Manufacturers Association https://www.buildershardware.com |
| BIA | The Brick Industry Association http://www.gobrick.com |
| CAGI | Compressed Air and Gas Institute https://www.cagi.org |
| CGA | Compressed Gas Association, Inc. https://www.cganet.com |
| CI | The Chlorine Institute, Inc. https://www.chlorineinstitute.org |
| CISCA | Ceilings and Interior Systems Construction Association https://www.cisca.org |
| CISPI | Cast Iron Soil Pipe Institute https://www.cispi.org |
| CLFMI | Chain Link Fence Manufacturers Institute https://www.chainlinkinfo.org |
| CPA | Composite Panel Association https://www.compositepanel.org |

| | |
|------|---|
| CPMB | Concrete Plant Manufacturers Bureau https://www.cpmc.org |
| CRA | California Redwood Association http://www.calredwood.org |
| CRSI | Concrete Reinforcing Steel Institute https://www.crsi.org |
| CTI | Cooling Technology Institute https://www.cti.org |
| DHA | Decorative Hardwoods Association https://www.decorativehardwood.org |
| DHI | Door and Hardware Institute https://www.dhi.org |
| EGSA | Electrical Generating Systems Association http://www.egsa.org |
| EEI | Edison Electric Institute https://www.eei.org |
| EPA | United States Environmental Protection Agency https://www.epa.gov |
| ETL | ETL Testing Services http://www.intertek.com |
| FAA | Federal Aviation Administration https://www.faa.gov |
| FCC | Federal Communications Commission https://www.fcc.gov |
| FPS | Forest Products Society http://www.forestprod.org |
| GANA | Glass Association of North America http://www.glasswebsite.com |
| FM | Factory Mutual Global Insurance https://www.fmglobal.com |

| | |
|-------|---|
| GA | Gypsum Association https://gypsum.org |
| GSA | General Services Administration https://www.gsa.gov |
| HI | Hydraulic Institute http://www.pumps.org |
| ICC | International Code Council https://shop.iccsafe.org |
| ICEA | Insulated Cable Engineers Association https://www.icea.net |
| ICAC | Institute of Clean Air Companies http://www.icac.com |
| IEEE | Institute of Electrical and Electronics Engineers https://www.ieee.org/ |
| IGMA | Insulating Glass Manufacturers Alliance https://www.igmaonline.org |
| IMSA | International Municipal Signal Association http://www.imsasafety.org |
| MBMA | Metal Building Manufacturers Association https://www.mbma.com |
| MSS | Manufacturers Standardization Society of the Valve and Fittings Industry http://msshq.org |
| NAAMM | National Association of Architectural Metal Manufacturers https://www.naamm.org |
| PHCC | Plumbing-Heating-Cooling Contractors Association https://www.phccweb.org |
| NBS | National Bureau of Standards See - NIST |

NBBI The National Board of Boiler and Pressure Vessel Inspectors
<https://www.nationalboard.org>

NEC National Electric Code
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
<https://www.nema.org>

NFPA National Fire Protection Association
<https://www.nfpa.org>

NHLA National Hardwood Lumber Association
<https://www.nhla.com>

NIH National Institute of Health
<https://www.nih.gov>

NIST National Institute of Standards and Technology
<https://www.nist.gov>

NELMA Northeastern Lumber Manufacturers Association, Inc.
<http://www.nelma.org>

NPA National Particleboard Association
(See CPA, Composite Panel Association)

NSF National Sanitation Foundation
<http://www.nsf.org>

OSHA Occupational Safety and Health Administration
Department of Labor
<https://www.osha.gov>

PCA Portland Cement Association
<https://www.cement.org>

PCI Precast Prestressed Concrete Institute
<https://www.pci.org>

PPI Plastics Pipe Institute
<https://www.plasticpipe.org>

PEI Porcelain Enamel Institute
<http://www.porcelainenamel.com>

| | |
|--------|--|
| PTI | Post-Tensioning Institute http://www.post-tensioning.org |
| RFCI | Resilient Floor Covering Institute https://www.rfci.com |
| RIS | Redwood Inspection Service (See Western Wood Products Association) https://www.wwpa.org |
| SCMA | Southern Cypress Manufacturers Association http://www.cypressinfo.org |
| SDI | Steel Door Institute http://www.steeldoor.org |
| SJI | Steel Joist Institute https://www.steeljoist.org |
| SMACNA | Sheet Metal & Air-Conditioning Contractors' National Association https://www.smacna.org |
| SSPC | The Society for Protective Coatings https://www.sspc.org |
| STI | Steel Tank Institute https://www.steeltank.com |
| SWI | Steel Window Institute https://www.steelwindows.com |
| TCNA | Tile Council of North America https://www.tcnatile.com |
| TEMA | Tubular Exchanger Manufacturers Association http://www.tema.org |
| TPI | Truss Plate Institute https://www.tpinst.org |
| UBC | The Uniform Building Code (See ICC) |

UL Underwriters' Laboratories Incorporated
<https://www.ul.com>

ULC Underwriters' Laboratories of Canada
<https://www.ulc.ca>

WCLB West Coast Lumber Inspection Bureau
<http://www.wclib.org>

WDMA Window and Door Manufacturers Association
<https://www.wdma.com>

WRCLA Western Red Cedar Lumber Association
<https://www.realcedar.com>

WWPA Western Wood Products Association
<http://www.wwpa.org>

- - - E N D - - -

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by the General Contractor.

1.2 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
 - T96-02 (R2006).....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
 - T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
 - T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
 - T191-02 (R2006).....Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method
 - T310-13.....Standard Method of Test for In-place Density and Moisture Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)
- C. American Concrete Institute (ACI):
 - 506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete
- D. American Society for Testing and Materials (ASTM):
 - A370-12.....Standard Test Methods and Definitions for Mechanical Testing of Steel Products

| | |
|----------------------|--|
| A416/A416M-10..... | Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete |
| C31/C31M-10..... | Standard Practice for Making and Curing Concrete Test Specimens in the Field |
| C33/C33M-11a..... | Standard Specification for Concrete Aggregates |
| C39/C39M-12..... | Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens |
| C109/C109M-11b..... | Standard Test Method for Compressive Strength of Hydraulic Cement Mortars |
| C136-06..... | Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates |
| C138/C138M-10b..... | Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete |
| C140-12..... | Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units |
| C143/C143M-10a..... | Standard Test Method for Slump of Hydraulic Cement Concrete |
| C172/C172M-10..... | Standard Practice for Sampling Freshly Mixed Concrete |
| C173/C173M-10b..... | Standard Test Method for Air Content of freshly Mixed Concrete by the Volumetric Method |
| C330/C330M-09..... | Standard Specification for Lightweight Aggregates for Structural Concrete |
| C567/C567M-11..... | Standard Test Method for Density Structural Lightweight Concrete |
| C780-11..... | Standard Test Method for Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry |
| C1019-11..... | Standard Test Method for Sampling and Testing Grout |
| C1064/C1064M-11..... | Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete |
| C1077-11c..... | Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation |
| C1314-11a..... | Standard Test Method for Compressive Strength of Masonry Prisms |

| | |
|------------------------|---|
| D422-63(2007)..... | Standard Test Method for Particle-Size Analysis of Soils |
| D698-07e1..... | Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort |
| D1140-00(2006)..... | Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve |
| D1143/D1143M-07e1..... | Standard Test Methods for Deep Foundations Under Static Axial Compressive Load |
| D1188-07e1..... | Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples |
| D1556-07..... | Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| D1557-09..... | Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft lbf/ft ³ (2,700 KNm/m ³)) |
| D2166-06..... | Standard Test Method for Unconfined Compressive Strength of Cohesive Soil |
| D2167-08)..... | Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method |
| D2216-10..... | Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass |
| D2974-07a..... | Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils |
| D3666-11..... | Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials |
| D3740-11..... | Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction |
| D6938-10..... | Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) |
| E94-04(2010)..... | Standard Guide for Radiographic Examination |

| | |
|------------------------|---|
| E164-08..... | Standard Practice for Contact Ultrasonic Testing of Weldments |
| E329-11c..... | Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection |
| E543-09..... | Standard Specification for Agencies Performing Non-Destructive Testing |
| E605-93 (R2011) | Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material (SFRM) Applied to Structural Members |
| E709-08..... | Standard Guide for Magnetic Particle Examination |
| E1155-96 (R2008) | Determining FF Floor Flatness and FL Floor Levelness Numbers |
| F3125/F3125M-15..... | Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions |

E. American Welding Society (AWS):

| | |
|------------------|-------------------------------|
| D1.D1.1M-10..... | Structural Welding Code-Steel |
|------------------|-------------------------------|

1.3 REQUIREMENTS:

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Resident Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.

- C. Written Reports: Testing laboratory shall submit test reports to Resident Engineer, Contractor, unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to Resident Engineer immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Resident Engineer regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Resident Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 2. Provide part time observation of fill placement and compaction and field density testing in building areas and provide part time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
- B. Testing Compaction:
1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557.
 2. Make field density tests in accordance with the primary testing method following ASTM D6938 and ASHTOT238 wherever possible. Field density tests utilizing ASTM D1556, AASHTO T191, or ASTM D2167 shall be utilized on a case by case basis only if there are problems with

the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR before the tests are conducted.

- a. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
- b. Pavement Subgrade: One test for each 335 m² (400 square yards), but in no case fewer than two tests.
- c. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
- d. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
- C. Fill and Backfill Material Gradation: One test per cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM D422.
- D. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- E. Testing Materials: Test suitability of on-site and off-site borrow as directed by COR.

3.2 FOUNDATION PILES - RESERVED

3.3 FOUNDATION CAISSONS- RESERVED

3.4 LANDSCAPING - RESERVED

3.5 ASPHALT CONCRETE PAVING: REFER TO AND UTILIZE THE NEW JERSEY DOT STANDARD SPECIFICATIONS AND MATERIALS

- A. Asphalt Concrete: **REFER TO AND UTILIZE THE NEW JERSEY STANDARD SPECIFICATIONS AND MATERIALS FOR TESTS**

3.6 SITE WORK CONCRETE:

Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.7 POST-TENSIONING OF CONCRETE - RESERVED

3.8 CONCRETE:

A. Batch Plant Inspection and Materials Testing:

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COR.
2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m³ (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. // After good concrete quality control has been established and maintained as

- determined by COR make three cylinders for each 80 m³ (100 cubic yards) or less of each concrete type, and at least three cylinders from any one day's pour for each concrete type. Label each cylinder with an identification number. COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
 5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m³ (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m³ (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
 6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
 7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
 8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
 9. Verify that specified mixing has been accomplished.
 10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
 - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
 - b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.

11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
 12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
 13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
 14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
 15. Observe preparations for placement of concrete:
 - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
 - b. Inspect preparation of construction, expansion, and isolation joints.
 16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
 17. Observe concrete mixing:
 - a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
 18. Measure concrete flatwork for levelness and flatness as follows:
 - a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the Resident Engineer with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
 19. Other inspections:
 - a. Grouting under base plates.
 - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as

directed by COR. Compile laboratory test reports as follows:

Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded, and strength of spare cylinder shall be used.

2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to COR. In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in MPa (psi).
 - e. Weight of lightweight structural concrete in kg/m³ (pounds per cubic feet).
 - f. Weather conditions during placing.
 - g. Temperature of concrete in each test cylinder when test cylinder was molded.
 - h. Maximum and minimum ambient temperature during placing.
 - i. Ambient temperature when concrete sample in test cylinder was taken.
 - j. Date delivered to laboratory and date tested.

3.9 REINFORCEMENT- RESERVED

3.10 SHOTCRETE- RESERVED

3.11 PRESTRESSED CONCRETE - RESERVED

3.12 ARCHITECTURAL PRECAST CONCRETE - RESERVED

3.13 MASONRY:

A. Mortar Tests:

1. Laboratory compressive strength test:
 - a. Comply with ASTM C780.
 - b. Obtain samples during or immediately after discharge from batch mixer.
 - c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
 - d. Test one sample at 7 days and 2 samples at 28 days.
2. Two tests during first week of operation; one test per week after initial test until masonry completion.

B. Grout Tests:

1. Laboratory compressive strength test:
 - a. Comply with ASTM C1019.
 - b. Test one sample at 7 days and 2 samples at 28 days.
 - c. Perform test for each 230 m² (2500 square feet) of masonry.

C. Masonry Unit Tests:

1. Laboratory Compressive Strength Test:
 - a. Comply with ASTM C140.
 - b. Test 3 samples for each 460 m² (5000 square feet) of wall area.

- D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m² (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.14 STRUCTURAL STEEL - RESERVED

3.15 STEEL DECKING - RESERVED

3.16 SHEAR CONNECTOR STUDS - RESERVED

3.17 SPRAYED-ON FIREPROOFING - RESERVED

3.18 TYPE OF TEST:

Approximate Number of Tests Required

A. Earthwork:

Laboratory Compaction Test, Soils:

// (AASHTO T180) // (AASHTO T99) // (ASTM D1557) // (ASTM D698) //

Field Density, Soils (AASHTO T191, T205, or T310)

Penetration Test, Soils

B. Aggregate Base:

Laboratory Compaction, // (AASHTO T180) // // (ASTM D1557) //

Field Density, // (AASHTO T191) // // (ASTM D1556) //

Aggregate, Base Course Gradation (AASHTO T27)

Wear (AASHTO T96)

Soundness (AASHTO T104)

C. Asphalt Concrete:

Field Density, (AASHTO T230) // ASTM D1188 //

Aggregate, Asphalt Concrete Gradation (AASHTO T27)

Wear (AASHTO T96)

Soundness (AASHTO T104)

D. Concrete:

| | |
|---|-------|
| Making and Curing Concrete Test Cylinders (ASTM C31) | _____ |
| Compressive Strength, Test Cylinders (ASTM C39) | _____ |
| Concrete Slump Test (ASTM C143) | _____ |
| Concrete Air Content Test (ASTM C173) | _____ |
| Unit Weight, Lightweight Concrete (ASTM C567) | _____ |
| Aggregate, Normal Weight: Gradation (ASTM C33) | _____ |
| Deleterious Substances (ASTM C33) | _____ |
| Soundness (ASTM C33) | _____ |
| Abrasion (ASTM C33) | _____ |
| Aggregate, Lightweight Gradation (ASTM C330) | _____ |
| Deleterious Substances (ASTM C330) | _____ |
| Unit Weight (ASTM C330) | _____ |
| Flatness and Levelness Readings (ASTM E1155) (number of days) | _____ |

E. Masonry:

| | |
|---|-------|
| Making and Curing Test Cubes (ASTM C109) | _____ |
| Compressive Strength, Test Cubes (ASTM C109) | _____ |
| Sampling and Testing Mortar, Comp. Strength (ASTM C780) | _____ |
| Sampling and Testing Grout, Comp. Strength (ASTM C1019) | _____ |
| Masonry Unit, Compressive Strength (ASTM C140) | _____ |
| Prism Tests (ASTM C1314) | _____ |

F. Inspection:

Technical Personnel (Man-days) _____ //

SPEC WRITER NOTE: Use the following for
large projects where field testing is
part of technician's service.

G. Technical Personnel: (Minimum _____ months)

1. Technicians to perform tests and inspection listed above. Laboratory will be equipped with concrete cylinder storage facilities, compression machine, cube molds, proctor molds, balances, scales, moisture ovens, slump cones, air meter, and all necessary equipment for compaction control. //

- - - E N D - - -

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
1. Adversely effect human health or welfare,
 2. Unfavorably alter ecological balances of importance to human life,
 3. Effect other species of importance to humankind, or;
 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.

6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
7. Sanitary Wastes:
 - a. Sewage: Domestic sanitary sewage and human and animal waste.
 - b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328.....Definitions

1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Resident Engineer to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Resident Engineer and the Contracting Officer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.

- e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
 - f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
 - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
 - h. Permits, licenses, and the location of the solid waste disposal area.
 - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
 - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
 - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.

- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the Resident Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
 2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
 - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
 3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
 4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
 5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the

- Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
 7. Manage and control spoil areas on and off Government property to limit spoil to areas on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
 9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 11. Handle discarded materials other than those included in the solid waste category as directed by the Resident Engineer.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.

3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of New Jersey, NJAC 7:27 Air Pollution Control and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
 2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
 4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Resident Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m. unless otherwise

permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

| Time Duration of Impact Noise | Sound Level in dB |
|-------------------------------------|-------------------|
| More than 12 minutes in any hour | 70 |
| Less than 30 seconds of any hour | 85 |
| Less than three minutes of any hour | 80 |
| Less than 12 minutes of any hour | 75 |

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
 - a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

| EARTHMOVING | | MATERIALS HANDLING | |
|-----------------------|----|--------------------|----|
| FRONT LOADERS | 75 | CONCRETE MIXERS | 75 |
| BACKHOES | 75 | CONCRETE PUMPS | 75 |
| DOZERS | 75 | CRANES | 75 |
| TRACTORS | 75 | DERRICKS IMPACT | 75 |
| SCAPERS | 80 | PILE DRIVERS | 95 |
| GRADERS | 75 | JACK HAMMERS | 75 |
| TRUCKS | 75 | ROCK DRILLS | 80 |
| PAVERS, STATIONARY | 80 | PNEUMATIC TOOLS | 80 |
| PUMPS | 75 | | |
| GENERATORS | 75 | SAWS | 75 |
| COMPRESSORS | 75 | VIBRATORS | 75 |

- b. Use shields or other physical barriers to restrict noise transmission.
 - c. Provide soundproof housings or enclosures for noise-producing machinery.
 - d. Use efficient silencers on equipment air intakes.

- e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - f. Line hoppers and storage bins with sound deadening material.
 - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the Resident Engineer noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the Resident Engineer. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

- - - E N D - - -

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
 - 1. Waste Management Plan development and implementation.
 - 2. Techniques to minimize waste generation.
 - 3. Sorting and separating of waste materials.
 - 4. Salvage of existing materials and items for reuse or resale.
 - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
 - 1. Soil.
 - 2. Inerts (eg, concrete, masonry and asphalt).
 - 3. Clean dimensional wood and palette wood.
 - 4. Green waste (biodegradable landscaping materials).
 - 5. Engineered wood products (plywood, particle board and I-joists, etc).
 - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
 - 7. Cardboard, paper and packaging.
 - 8. Bitumen roofing materials.
 - 9. Plastics (eg, ABS, PVC).
 - 10. Carpet and/or pad.
 - 11. Gypsum board.
 - 12. Insulation.
 - 13. Paint.
 - 14. Fluorescent lamps.

1.2 RELATED WORK

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
1. Excess or unusable construction materials.
 2. Packaging used for construction products.
 3. Poor planning and/or layout.
 4. Construction error.
 5. Over ordering.
 6. Weather damage.
 7. Contamination.
 8. Mishandling.
 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org/tools/cwm.php> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
 - 1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
 - 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
 - 1. Procedures to be used for debris management.
 - 2. Techniques to be used to minimize waste generation.
 - 3. Analysis of the estimated job site waste to be generated:

- a. List of each material and quantity to be salvaged, reused, recycled.
- b. List of each material and quantity proposed to be taken to a landfill.
4. Detailed description of the Means/Methods to be used for material handling.
 - a. On site: Material separation, storage, protection where applicable.
 - b. Off site: Transportation means and destination. Include list of materials.
 - 1) Description of materials to be site-separated and self-hauled to designated facilities.
 - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
 - c. The names and locations of mixed debris reuse and recycling facilities or sites.
 - d. The names and locations of trash disposal landfill facilities or sites.
 - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.6 APPLICABLE PUBLICATIONS

- A Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC):
LEED Green Building Rating System for New Construction

1.7 RECORDS

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

Site Repairs and Catch Basin Restoration
VANJHCS, East Orange Campus
Construction Documents

Project No. 561-19-152
East Orange, NJ 07018
October 2, 2019

- - - E N D - - -

SECTION 02 21 13
SITE SURVEYS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Researching and collecting documents informing surveys.
2. Performing // boundary survey, // topographic survey, // and // utility survey //.
3. Creating survey drawings.

1.2 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Land Title Association and American Congress on Surveying and Mapping (ALTA-ACSM):
1. Accuracy Standards for ALTA-ACSM Land Title Surveys.
- C. Federal Geographic Data Committee (FGDC):
1. STD-007.03-98 - Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy.
 2. STD-007.04-02 - Geospatial Positioning Accuracy Standards Part 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management.

1.3 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Survey Drawings:
1. Prints: Two sets of black line, full size prints of each drawing.
 2. Electronic Files: Consistent with computer-aided design (CAD) Standards described at www.cfm.va.gov/til/projReq.asp.

1.4 QUALITY ASSURANCE

- A. Land Surveyor: One of the following:
1. Experienced professional land surveyor licensed in state in which project is located.
 2. Experienced professional civil engineer licensed in state in which project is located and authorized to practice land surveying as civil engineer.

1.5 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 ACCESSORIES

- A. Monuments: Iron pin, with driven 16 mm (5/8 inch) diameter, minimum 600 mm (24 inches) long to prevent displacement.
- B. Stakes: Hardwood.
- C. Flagging: Plastic, roll form, highly visible, solid color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Research public and VA facility records for deeds, maps, monuments, plats, surveys, title certificates or abstracts, rights-of-way, easements, section line, other boundary line locations, and other documents pertaining to project site.
- B. Research public and VA facility utility records for aerial, surface, and subgrade structures and utility service lines and easements.

3.2 PREPARATION

- A. Coordinate with Contracting Officer's Representative for site access.
- B. Coordinate with adjacent property owners when access to adjoining properties is required.
 - 1. Notify Contracting Officer's Representative when access is denied.

3.3 SURVEYS

- A. Perform survey on ground according to // Accuracy Standards for ALTA-ACSM Land Title Surveys // and // FGDC STD-007.3 and FGDC STD-007.4 //.
- B. Boundary Survey:
 - 1. Locate permanent monuments within and along survey boundary.
 - 2. Set permanent monument at property corners when monument is not found.
 - 3. Temporarily mark monument locations with stake and flagging.
 - 4. Reconcile differences between legal description and survey.
- C. Topographic Survey:

1. Vertical Control: National Geodetic Survey or existing VA Medical Center benchmark.
 2. Establish minimum three permanent benchmarks // plus one permanent benchmark for each 1.6 hectares (4 acres) within survey boundary //.
 3. Determine project site contours at maximum // 300 mm (1 foot) // interval.
 4. Determine spot elevations at specified locations.
- D. Utility Survey:
1. Locate piped utilities and utility structures. Identify service type, sizes, depths, and pressures.
 2. Locate fire hydrants.
 3. Locate wired utilities and utility structures. Identify service type, rated capacities, and elevations above and below grade.
 4. Identify each utility authority including contact person and phone number.
- E. Locate permanent structures within survey boundary by perpendicular dimension to property lines.
1. Determine structure plan dimensions, heights, and vertical offsets.
 2. Determine projections and overhangs beyond structure perimeter at grade.
 3. Determine number of stories and primary building materials.
- F. Locate rights-of-way and easements within and adjacent to survey boundary by perpendicular dimension to property line.
1. Locate project site access from rights-of-way by dimension from survey monument. Determine site access width.

3.4 SURVEY DRAWING REQUIREMENTS

- A. Consult Contracting Officer's Representative to confirm required survey scale and drawing size.
1. Drawing Size: Maximum 760 by 1070 mm (30 by 42 inches).
 2. Boundary Survey Scale: Maximum 1 to 35 (1 inch equals 30 feet).
 3. Enlarged Detail Areas: Scale as required to present dimensional data and survey information clearly. Maintain orientation aligned with smaller scale view.
 4. Plan Orientation: North at top of drawing sheet.
- B. Drawing Notations:
1. Land Surveyor: Name, address, telephone number, signature, seal, and registration number.

2. Survey Dates: Date survey was initially completed and subsequent revision dates.
3. Certification: Certify each drawing adjacent to land surveyor's seal:
 - a. "I hereby certify that all information indicated on this drawing was obtained or verified by actual measurements in the field and that every effort has been made to provide complete and accurate information."
 - b. Title, number, and total number of drawings on each drawing.
 - c. Scale in metric and imperial measurement.
 - d. Graphic scale in metric and imperial measurement.
 - e. Graphic symbol and abbreviation legends.
 - f. North arrow for plan view drawings.
 - g. Benchmark locations.
 - h. Horizontal and vertical control datum.
 - i. Adjacent property owner names.
 - j. Zoning classifications.
 - k. Building street numbers.
4. Evidence of Possession: Indicate character and location of evidence of possession affecting project site. Notation absence signifies no observable evidence of possession.
- C. Vicinity Map: Indicate project site and nearby roadways and intersections.
- D. Record Documents Forming Survey Basis: Indicate titles, source, and recording data of documents relied upon to complete survey.
- E. Legal Description: Recorded title boundaries.
- F. Land Area: Report in // sq. m (sf) // hectares (acres) // as defined by the boundaries of the legal description of the surveyed premises, including legal description of the land.
 1. Accuracy: // 0.1 sq. m (1 sq. ft.) // 0.005 hectares (0.001 acres) //.
- G. Boundary Lines: Show point of beginning, length and bearing for straight lines, and angle, radius, point of curvature, point of tangency, and length of curved lines.
 1. Include bearing basis and data necessary to mathematically close survey.

2. When recorded and measured bearings, angles, and distances differ, indicate both recorded and measured data.
 - a. Indicate when recorded description does not mathematically close survey.
3. Indicate found and installed monuments establishing basis of survey.
4. Contiguity, Gores, and Overlaps: Identify discrepancies within and along survey boundary.
- H. Lots and Parcels: Indicate entire lots and parcels included within and intersected by survey boundary.
- I. Roadways: Indicate names and widths of rights-of-way and roadways within and abutting survey boundary.
 1. Indicate changes in rights-of-way lines either completed or proposed.
 2. Indicate accesses to roadways.
 3. Indicate abandoned roadways.
 4. Indicated unopened dedicated roadways.
- J. Setbacks: Indicate recorded setback and building restriction lines.
- K. Structures and Site Improvements: Indicate buildings, walls, fences, signs, and other visible improvements.
 1. Indicate each building dimensioned to property lines and other structures.
 2. Indicate exterior dimensions of buildings at ground level. Show area of building footprint and gross floor area of entire building.
 3. Indicate maximum measured height of buildings above grade, point of measurement, and number of stories.
 4. Indicate spot elevations at building entrances, first floor, service docks, corners, steps, ramps, and grade slabs.
 5. Indicate structures and site improvements within 1500 mm (5 feet) of survey boundary.
 6. Indicate encroachments on project site, adjoining property, easements, rights-of-way, and setback lines from fire escapes, bay windows, windows and doors opening out, flue pipes, stoops, eaves, cornices, areaways, stoops, other building projections, and site improvements.
 7. Identify setback, height, and floor space area restrictions set by applicable zoning and building codes and recorded subdivision maps. Indicate if no restrictions exist.

L. Easements:

1. Indicate easements evidenced by recorded documents.
 - a. Indicate when easements cannot be located.
2. Indicate observable easements created by roadways, rights-of-ways, water courses, drains, telephone, telegraph, electric and other wiring, water, sewer, oil, gas, and other pipelines within project site and on adjoining properties when potentially affecting project site.
3. Indicate observable surface improvements of underground easements.

M. Pavements // and Railroad Tracks //:

1. Indicate location, alignment, and dimensions for vehicular and pedestrian pavements // and railroad tracks //.
2. Indicate pavement encroachments from adjacent properties onto project site and onto adjacent properties from project site.
 - a. Dimension encroachments from survey boundary.
3. Indicate roadway // and railroad tracks // centerlines with true bearings and lengths by 15 m (50 feet) stationing.
 - a. Describe curves by designating points of curvature and tangency. Include curve data and location of radius and vertex points.
 - b. Indicate elevations at station points along roadway centerlines, roadway edges, and top and bottom of curbs.
 - c. // Indicate elevations at station points along railway tracks. //
4. Indicate parking areas, parking striping, and total parking spaces.
 - a. Identify accessible, // fuel efficient, // and // electric vehicle // parking spaces.
5. Indicate curb cuts, driveways, and other accesses to public ways.

N. Indicate cemetery and burial ground boundaries.

O. Waterways:

1. Indicate boundaries of ponds, lakes, springs, and rivers bordering on or running through project site. Note date of measurement and that boundary is subject to change due to natural causes.
2. Indicate flood plain location and elevation.
3. Indicate watershed extent affecting project site.

P. Indicate topographic contours.

Q. Flood Zone: Indicate applicable flood zone from Federal Flood Insurance Rate Maps, by scaled map location and graphic plotting.

R. Public and Private Utilities:

1. Indicate information source and operating authority for each utility.
2. Indicate utilities existing on or serving project site.
3. Indicate fire hydrants on project site and within 150 m (500 feet) of survey boundary.
4. Indicate manholes, catch basins, inlets, vaults, and other surface indications of subgrade services.
5. Indicate depths or invert elevations, sizes, materials, and pressures of utility pipes.
6. Indicate wires and cables serving, crossing, and adjacent to project site.
7. Indicate exterior lighting, traffic control facilities, security, and communications systems.
8. Indicate utility poles on project site and within 3 m (10 feet) of survey boundary.
9. Indicate dimensions of cross-wires or overhangs affecting project site.

S. Observable Evidence:

1. Indicate in-progress and recently completed earth moving work, building construction, and building additions.
2. Indicate in-progress and recently completed pavement construction and repairs.
3. Indicate areas used as solid waste dump, sump, and sanitary landfill.

T. Trees:

1. Indicate individual trees with minimum 150 mm (6 inches) diameter measured at 400 mm (48 inches) above grade.
2. Indicate wooded area perimeter outline and description of predominant vegetation.

- - - E N D - - -

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:

- A. Testing agency for the trial concrete mix design retained and reimbursed by the Contractor and approved by COR. For all other testing, refer to Section 01 45 29 Testing Laboratory Services.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology. Accompany request for approval of testing agency with a copy of Report of Latest Inspection of Laboratory Facilities by CCRL.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES:

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).
- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:

1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

1.5 REGULATORY REQUIREMENTS:

- A. ACI SP-66 - ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 301 - Standard Specifications for Structural Concrete.

1.6 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
 1. Reinforcing Steel.
 2. Cement.
- D. Manufacturer's Certificates:
 1. Abrasive aggregate.
 2. Lightweight aggregate for structural concrete.
 3. Air-entraining admixture.
 4. Chemical admixtures, including chloride ion content.
 5. Waterproof paper for curing concrete.
 6. Liquid membrane-forming compounds for curing concrete.
 7. Non-shrinking grout.
 8. Liquid hardener.
 9. Waterstops.
 10. Expansion joint filler.
 11. Adhesive binder.
- E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement fly ash ratio curves, concrete mix ingredients, and admixtures.

- G. Shoring and Reshoring Sequence: Submit for approval a shoring and reshoring sequence for flat slab/flat plate portions, prepared by a registered Professional Engineer. As a minimum, include timing of form stripping, reshoring, number of floors to be re-shored and timing of re-shore removal to serve as an initial outline of procedures subject to modification as construction progresses. Submit revisions to sequence, whether initiated by COR (see FORMWORK) or Contractor.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement and fly ash in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

1.8 PRE-CONCRETE CONFERENCE:

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
1. Submittals.
 2. Coordination of work.
 3. Availability of material.
 4. Concrete mix design including admixtures.
 5. Methods of placing, finishing, and curing.
 6. Finish criteria required to obtain required flatness and levelness.
 7. Timing of floor finish measurements.
 8. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; COR; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.

- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

1.9 MOCK-UP:

- A. In addition to the other specified samples and tests, construct a mock-up using the materials, reinforcing, forming system and construction methods proposed for use in exposed architectural concrete.
- B. Construct the mock-up with at least a 2.5 m by 2.5 m (8 feet by 8 feet) exposed surface and suitable foundations. Include the following where applicable: Control joints, reglets, recesses or other typical architectural details.
- C. Before casting the mock-up, submit full detailed Shop Drawings of the mock-up formwork for review by the Architect. Perform all necessary preliminary tests to ensure that concrete used for the mock-up will exactly match the approved sample in color and texture.
- D. Perform the surface treatment proposed for use on one or more areas not less than 300 mm by 300 mm (1 foot by 1 foot) on the back side of the mock-up to establish the texture of finish required by the Architect. Repeat as required until a sample satisfactory to the Architect has been obtained.
- E. Treat the finished front surface of the mock-up to produce a uniform appearance similar in every respect to the approved sample area.
- F. The completed mock-up shall be inspected by the Architect. Failure of the mock-up to match the approved sample will require the construction of further mock-ups until approval is obtained. Remove rejected mock-ups immediately.
- G. Maintain the approved mock-ups in good condition at the job site until all architectural concrete surfaces have been completed and approved by the Architect. Remove the mock-up from the site after completion of the above.

1.10 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
 117-10.....Specifications for Tolerances for Concrete
 Construction and Materials and Commentary

- 211.1-91 (R2009)Standard Practice for Selecting Proportions for
Normal, Heavyweight, and Mass Concrete
- 211.2-98 (R2004)Standard Practice for Selecting Proportions for
Structural Lightweight Concrete
- 214R-11.....Guide to Evaluation of Strength Test Results of
Concrete
- 301-10.....Standard Practice for Structural Concrete
- 304R-00 (R2009)Guide for Measuring, Mixing, Transporting, and
Placing Concrete
- 305.1-06.....Specification for Hot Weather Concreting
- 306.1-90 (R2002)Standard Specification for Cold Weather
Concreting
- 308.1-11.....Specification for Curing Concrete
- 309R-05.....Guide for Consolidation of Concrete
- 318-11.....Building Code Requirements for Structural
Concrete and Commentary
- 347-04.....Guide to Formwork for Concrete
- SP-66-04.....ACI Detailing Manual
- C. American National Standards Institute and American Hardboard
Association (ANSI/AHA):
- A135.4-2004.....Basic Hardboard
- D. American Society for Testing and Materials (ASTM):
- A82/A82M-07.....Standard Specification for Steel Wire, Plain,
for Concrete Reinforcement
- A185/185M-07.....Standard Specification for Steel Welded Wire
Reinforcement, Plain, for Concrete
- A615/A615M-09.....Standard Specification for Deformed and Plain
Carbon Steel Bars for Concrete Reinforcement
- A653/A653M-11.....Standard Specification for Steel Sheet, Zinc
Coated (Galvanized) or Zinc Iron Alloy Coated
(Galvannealed) by the Hot Dip Process
- A706/A706M-09.....Standard Specification for Low Alloy Steel
Deformed and Plain Bars for Concrete
Reinforcement
- A767/A767M-09.....Standard Specification for Zinc Coated
(Galvanized) Steel Bars for Concrete
Reinforcement

A775/A775M-07.....Standard Specification for Epoxy Coated
 Reinforcing Steel Bars
 A820-11.....Standard Specification for Steel Fibers for
 Fiber Reinforced Concrete
 A996/A996M-09.....Standard Specification for Rail Steel and Axle
 Steel Deformed Bars for Concrete Reinforcement
 C31/C31M-10.....Standard Practice for Making and Curing
 Concrete Test Specimens in the field
 C33/C33M-11A.....Standard Specification for Concrete Aggregates
 C39/C39M-12.....Standard Test Method for Compressive Strength
 of Cylindrical Concrete Specimens
 C94/C94M-12.....Standard Specification for Ready Mixed Concrete
 C143/C143M-10.....Standard Test Method for Slump of Hydraulic
 Cement Concrete
 C150-11.....Standard Specification for Portland Cement
 C171-07.....Standard Specification for Sheet Materials for
 Curing Concrete
 C172-10.....Standard Practice for Sampling Freshly Mixed
 Concrete
 C173-10.....Standard Test Method for Air Content of Freshly
 Mixed Concrete by the Volumetric Method
 C192/C192M-07.....Standard Practice for Making and Curing
 Concrete Test Specimens in the Laboratory
 C231-10.....Standard Test Method for Air Content of Freshly
 Mixed Concrete by the Pressure Method
 C260-10.....Standard Specification for Air Entraining
 Admixtures for Concrete
 C309-11.....Standard Specification for Liquid Membrane
 Forming Compounds for Curing Concrete
 C330-09.....Standard Specification for Lightweight
 Aggregates for Structural Concrete
 C494/C494M-11.....Standard Specification for Chemical Admixtures
 for Concrete
 C618-12.....Standard Specification for Coal Fly Ash and Raw
 or Calcined Natural Pozzolan for Use in
 Concrete
 C666/C666M-03 (R2008)Standard Test Method for Resistance of Concrete
 to Rapid Freezing and Thawing

- C881/C881M-10.....Standard Specification for Epoxy Resin Base
Bonding Systems for Concrete
- C1107/1107M-11.....Standard Specification for Packaged Dry,
Hydraulic-Cement Grout (Non-shrink)
- C1315-11.....Standard Specification for Liquid Membrane
Forming Compounds Having Special Properties for
Curing and Sealing Concrete
- D6-95 (R2011).....Standard Test Method for Loss on Heating of Oil
and Asphaltic Compounds
- D297-93 (R2006).....Standard Methods for Rubber Products Chemical
Analysis
- D412-06AE2.....Standard Test Methods for Vulcanized Rubber and
Thermoplastic Elastomers - Tension
- D1751-04 (R2008).....Standard Specification for Preformed Expansion
Joint Filler for Concrete Paving and Structural
Construction (Non-extruding and Resilient
Bituminous Types)
- D4263-83 (2012).....Standard Test Method for Indicating Moisture in
Concrete by the Plastic Sheet Method.
- E1155-96 (R2008).....Standard Test Method for Determining F_F Floor
Flatness and F_L Floor Levelness Numbers
- F1249-13.....Standard Test Method for Water Vapor
Transmission Rate Through Plastic Film and
Sheeting Using a Modulated Infrared Sensor
- F1869-11.....Standard Test Method for Measuring Moisture
Vapor Emission Rate of Concrete Subfloor Using
Anhydrous Calcium Chloride.
- E. American Welding Society (AWS):
- D1.4/D1.4M-11.....Structural Welding Code - Reinforcing Steel
- F. Concrete Reinforcing Steel Institute (CRSI):
- Handbook 2008
- G. National Cooperative Highway Research Program (NCHRP):
- Report On.....Concrete Sealers for the Protection of Bridge
Structures
- H. U. S. Department of Commerce Product Standard (PS):
- PS 1.....Construction and Industrial Plywood

PS 20.....American Softwood Lumber

I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:

CRD C513.....Rubber Waterstops

CRD C572.....Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS:

2.1 FORMS:

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.
- D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.
- F. Form Lining:
 - 1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
 - 2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
 - 3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.
- G. Concrete products shall comply with following standards for biobased materials:

| Material Type | Percent by Weight |
|-----------------------------|------------------------------|
| Concrete Penetrating Liquid | 79 percent biobased material |
| Concrete form Release Agent | 87 percent biobased material |
| Concrete Sealer | 11 percent biobased material |

The minimum-content standards are based on the weight (not the volume) of the material.

- H. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS:

- A. Portland Cement: ASTM C150 Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33.
1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
 2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
 3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- D. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.
- E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 µm (No. 100) sieve.
- F. Mixing Water: Fresh, clean, and potable.
- G. Admixtures:
1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.

3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
5. Air Entraining Admixture: ASTM C260.
6. Microsilica: Use only with prior review and acceptance of the Resident Engineer. Use only in conjunction with high range water reducer.
7. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.
8. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
9. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- H. Vapor Barrier: ASTM F1249, //0.25 mm (10 mil) WVT 0.012 ft./hr.//0.38 mm (15 mil) WVT 0.007 ft./hr. //.
- I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- J. Welded Wire Fabric: ASTM A185.
- K. Reinforcing Bars to be Welded: ASTM A706.
- L. Galvanized Reinforcing Bars: ASTM A767.
- M. Epoxy Coated Reinforcing Bars: ASTM A775.
- N. Cold Drawn Steel Wire: ASTM A82.
- O. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- P. Expansion Joint Filler: ASTM D1751.
- Q. Sheet Materials for Curing Concrete: ASTM C171.
- R. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and shall meet the requirements of ASTM C1315. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- S. Abrasive Aggregate: Aluminum oxide grains or emery grits.

T. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous silicate solution concrete surface.

1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34% solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.

2. MVE 15-Year Warranty:

- a. When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.

U. Non-Shrink Grout:

1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

V. Adhesive Binder: ASTM C881.

W. Waterstops:

1. Polyvinyl Chloride Waterstop: CRD C572.
2. Rubber Waterstops: CRD C513.
3. Bentonite Waterstop: Flexible strip of bentonite 25 mm x 20 mm (1 inch by 3/4 inch), weighing 8.7 kg/m (5.85 lbs. per foot) composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).

4. Non-Metallic Hydrophilic: Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in in 70 deg water shall be 3 to 1 minimum.
- X. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).
- Y. Fibers:
 1. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m³ (1.5 lb. per cubic yard). Product shall have a UL rating.
 2. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m³ (30 lb. per cubic yard).
- Z. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
- AA. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.
- BB. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to produce a concrete of a color and finish which exactly matches the designated sample panel.

2.3 CONCRETE MIXES:

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
 1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
 2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, fly ash, admixtures, weight of fine and coarse aggregate per m³ (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement-fly ash ratio, and consistency of each cylinder in

- terms of slump. Include dry unit weight of lightweight structural concrete.
3. Prepare a curve showing relationship between water-cement-fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
 4. If the field experience method is used, submit complete standard deviation analysis.
- B. Fly Ash Testing: Submit certificate verifying conformance with ASTM 618 initially with mix design and for each truck load of fly ash delivered from source. Submit test results performed within 6 months of submittal date. Notify Resident Engineer immediately when change in source is anticipated.
1. Testing Laboratory used for fly ash certification/testing shall participate in the Cement and Concrete Reference Laboratory (CCRL) program. Submit most recent CCRL inspection report.
- C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Resident Engineer or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Resident Engineer may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.
- D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with 20% replacement by weight in all structural work. Increase this replacement to 40% for mass concrete, and reduce it to 10% for drilled piers and caissons. Fly ash shall not be used in high-early mix design.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

| Concrete Strength | | Non-Air-Entrained | Air-Entrained | |
|----------------------------------|---|-------------------------|---|-------------------------|
| Min. 28 Day Comp. Str. MPa (psi) | Min. Cement kg/m ³ (lbs/c. yd) | Max. Water Cement Ratio | Min. Cement kg/m ³ (lbs/c. yd) | Max. Water Cement Ratio |
| 35 (5000) ^{1,3} | 375 (630) | 0.45 | 385 (650) | 0.40 |
| 30 (4000) ^{1,3} | 325 (550) | 0.55 | 340 (570) | 0.50 |
| 25 (3000) ^{1,3} | 280 (470) | 0.65 | 290 (490) | 0.55 |
| 25 (3000) ^{1,2} | 300 (500) | * | 310 (520) | * |

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'_c . For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'_c .
 2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
 3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
 4. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.
- E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, MM (INCHES) *

| Type of Construction | Normal Weight Concrete | Lightweight Structural Concrete |
|--|------------------------|---------------------------------|
| Reinforced Footings and Substructure Walls | 75mm (3 inches) | 75 mm (3 inches) |
| Slabs, Beams, Reinforced Walls, and Building Columns | 100 mm (4 inches) | 100 mm (4 inches) |

- F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall

arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75 mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

- G. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

**TABLE III - TOTAL AIR CONTENT
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

| Nominal Maximum Size of Total Air Content | Coarse Aggregate, mm (Inches) Percentage by Volume |
|---|---|
| 10 mm (3/8 in).6 to 10 | 13 mm (1/2 in).5 to 9 |
| 20 mm (3/4 in).4 to 8 | 25 mm (1 in).3-1/2 to 6-1/2 |
| 40 mm (1 1/2 in).3 to 6 | |

**TABLE IV
AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE**

| Nominal Maximum size of Total Air Content | Coarse Aggregate, mm's (Inches) Percentage by Volume |
|---|---|
| Greater than 10 mm (3/8 in) 4 to 8 | 10 mm (3/8 in) or less 5 to 9 |

- H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.
- I. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C \pm 1.7 degrees C (73.4 \pm 3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.
- J. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete,

concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

- K. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. For air content requirements see Table III or Table IV.
- L. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Resident Engineer may require any one or any combination of the following corrective actions, at no additional cost to the Government:
 - 1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
 - 2. Require additional curing and protection.
 - 3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Resident Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
 - 4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Resident Engineer may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
 - 5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Resident Engineer.

2.4 BATCHING AND MIXING:

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted.

Mixing process and equipment must be approved by Resident Engineer. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38°C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

| Atmospheric Temperature | Minimum Concrete Temperature |
|---|--------------------------------|
| -1. degrees to 4.4 degrees C (30 degrees to 40 degrees F) | 15.6 degrees C (60 degrees F.) |
| -17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.) | 21 degrees C (70 degrees F.) |

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the Resident Engineer for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise Resident Engineer.

PART 3 - EXECUTION

3.1 FORMWORK:

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Resident Engineer approves their reuse.
 2. Provide forms for concrete footings unless Resident Engineer determines forms are not necessary.
 3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
 1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.

2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than $1/270$ of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blue shingle or similar nails with thin flatheads.
- F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.
- G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
 2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge

boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.

1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
3. Do not install sleeves in beams, joists or columns except where shown or permitted by COR. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the COR, and require no structural changes, at no additional cost to the Government.
4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 PLACING REINFORCEMENT:

- A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
 - 1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Use epoxy-coated tie wire with epoxy-coated reinforcing. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
 - 2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
 - 3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
 - 1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
 - 2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (fy) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
 - a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.

- b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
 - c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by COR.
3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (fy) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
- a. Initial qualification: In the presence of COR, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
 - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by COR.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 VAPOR BARRIER:

- A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.
 - 1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
 - 2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
 - 3. Patch punctures and tears.

3.4 SLABS RECEIVING RESILIENT COVERING - RESERVED

.

3.5 CONSTRUCTION JOINTS:

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by COR.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.
- C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.
- D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.
- E. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.6 EXPANSION JOINTS AND CONTRACTION JOINTS:

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.
- C. Provide contraction (control) joints in floor slabs as indicated on the contract drawings. Joints shall be either formed or saw cut, to the indicated depth after the surface has been finished. Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.7 PLACING CONCRETE:

- A. Preparation:
 - 1. Remove hardened concrete, wood chips, shavings and other debris from forms.
 - 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.

3. Have forms and reinforcement inspected and approved by COR before depositing concrete.
 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
1. Preparing surface for applied topping:
 - a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
 - b. Broom clean and keep base slab wet for at least four hours before topping is applied.
 - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.
- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete is subject to approval of COR.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
 2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
 3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.

4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
 5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
 6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.
1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
 2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.8 HOT WEATHER:

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by COR.

3.9 COLD WEATHER:

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by COR.

3.10 PROTECTION AND CURING:

A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by COR.

1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m²/L (400 square feet per gallon) on steel troweled surfaces and 7.5m²/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.11 REMOVAL OF FORMS:

A. Remove in a manner to assure complete safety of structure after the following conditions have been met.

1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened

sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.

2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.

- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. // For post-tensioned systems supporting forms and shoring not removed until stressing is completed. // Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

3.12 CONCRETE SURFACE PREPARATION:

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as

specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.

- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.13 CONCRETE FINISHES:

A. Vertical and Overhead Surface Finishes:

1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.
2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by Resident Engineer, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
 - a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
 - b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 μ m (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
 - c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
 - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits

of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.

4. Textured: Finish as specified. Maximum quantity of patched area 0.2 m² (2 square feet) in each 93 m² (1000 square feet) of textured surface.

B. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to COR and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless COR determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.
3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.

5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by COR from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:

- a. Areas covered with carpeting, or not specified otherwise in b. below:

1) Slab on Grade:

- a) Specified overall value F_F 25/F_L 20
- b) Minimum local value F_F 17/F_L 15

2) Level suspended slabs (shored until after testing) and topping slabs:

- a) Specified overall value FF 25/FL 20
- b) Minimum local value FF 17/FL 15

3) Unshored suspended slabs:

- a) Specified overall value FF 25
- b) Minimum local value FF 17

4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.

- b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:

1) Slab on grade:

- a) Specified overall value FF 36/FL 20
- b) Minimum local value FF 24/FL 15

2) Level suspended slabs (shored until after testing) and topping slabs

- a) Specified overall value FF 30/FL 20
- b) Minimum local value FF 24/FL 15

3) Unshored suspended slabs:

- a) Specified overall value FF 30
- b) Minimum local value FF 24

4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.

- c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.

- d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will

be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

12. Measurements

- a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by COR, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.
- b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.

13. Acceptance/ Rejection:

- a. If individual slab section measures less than either of specified minimum local F_F/F_L numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
- b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall F_F/F_L numbers, then whole slab shall be rejected and remedial measures shall be required.

14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by COR, until a slab finish constructed within specified tolerances is accepted.

3.14 SURFACE TREATMENTS:

- A. Use on exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.

- B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.
- C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th m² (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.15 APPLIED TOPPING:

- A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 200 mm (8 inches) for concrete containing a high-range water-reducing admixture (superplasticizer) and 100 mm (4 inches) for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.
- B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

3.16 RESURFACING FLOORS:

Remove existing flooring areas to receive resurfacing to expose existing structural slab and extend not less than 25 mm (1 inch) below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, and dampening. Apply specified bonding grout. Place topping while the bonding grout is still tacky.

3.17 RETAINING WALLS:

- A. Use air-entrained concrete.
- B. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.
- C. Exposed surfaces finished to match adjacent concrete surfaces, new or existing.
- D. Place porous backfill as shown.

3.18 PRECAST CONCRETE ITEMS:

Precast concrete items, not specified elsewhere. Cast using 25 MPa (3000 psi) air-entrained concrete to shapes and dimensions shown. Finish to match corresponding adjacent concrete surfaces. Reinforce with steel for safe handling and erection.

- - - E N D - - -

**SECTION 04 01 00
MAINTENANCE OF MASONRY**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Repointing existing, damaged masonry joints.
2. Replacing existing, damaged masonry units.

1.2 RELATED REQUIREMENTS

A. Mortars for new masonry: Section 04 05 13, MASONRY MORTARING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
2. C144-11 - Aggregate for Masonry Mortar.
3. C150/C150M-15 - Portland Cement.
4. C207-06(2011) - Hydrated Lime for Masonry Purposes.
5. C216-15 - Facing Brick (Solid Masonry Units Made from Clay or Shale).
6. C270-14a - Mortar for Unit Masonry.
7. C295/C295M-12 - Petrographic Examination of Aggregates for Concrete.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Replacement units indicating manufacturer recommendation for each application.

C. Samples:

1. Pointing Mortar: Molded, 150 mm (6 inches) long for each type, texture, and color.

D. Test reports:

1. Preconstruction test results of existing masonry mortar and units.
2. Recommended mortar mix and mortar materials sources.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Documented experience in completion of work, similar in design, material, and extent specified.
- B. Preconstruction Testing:
 1. Existing Brick: according to ASTM C67.
 2. Existing Mortar: according to ASTM C295/C295M.
 - a. Recommend mortar mix compatible with existing and mortar material sources required to match existing color and texture.
- C. Mockups: Prepare mockup in size indicated on Drawings, demonstrating quality and aesthetics of tuck pointing, masonry unit replacement and cleaning.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store materials covered, protected from weather, and elevated above grade.
 1. Prevent contamination of aggregates.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 1. Cold Weather Requirements: Maintain mortar ingredients and substrate within temperature range between 4 degrees C (40 degrees F) and 49 degrees C (120 degrees F) when outside temperature is less than 4 degrees C (40 degrees F).
 2. Hot Weather Requirements: Protect mortar-joint from evaporation of moisture from mortar material. When required, provide adequately shaded work area.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Mortar Components:
 - 1. Hydrated Lime: ASTM C207, Type S.
 - 2. Aggregate: ASTM C144.
 - 3. Portland Cement: ASTM C150/C150M, Type I.
 - 4. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer.

2.3 REPLACEMENT MASONRY UNITS

- A. Other Masonry Units: Match existing.

2.4 MIXES

- A. Tuck Pointing Mortar: ASTM C270
 - 1. Type N, Type O or Type K.
 - 2. Type K: 1 part Portland cement, 4 parts hydrated lime and 11-1/4 to 15 parts fine sand.

2.5 ACCESSORIES

- A. Cleaning Agent: Soapless, non-acidic, detergent, specially prepared for cleaning brick, stone, concrete and masonry.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
 - 1. Protect from mortar droppings and cleaning operations.
- C. Remove existing fixtures and fittings concealing masonry joints to permit repointing and repair.

3.2 EXISTING MORTAR JOINTS

- A. Cut out existing bed and head mortar joints, to uniform depth of 19 mm (3/4 inches), or to sound mortar without damaging edges and faces of existing masonry units to remain.
- B. Remove dust and debris from joints.
 - 1. Do not rinse when temperature is below freezing.

3.3 TUCK POINTING

- A. Dampen joints immediately before tuck pointing. Allow masonry units to absorb surface water.
- B. Tightly pack tuck pointing mortar into joints in thin layers, 6 mm (1/4 inch) thick, maximum.
- C. Allow layer to become slightly hardened before applying next layer.
- D. Pack final layer flush with surfaces of masonry units.

3.4 MASONRY UNIT REPLACEMENT

- A. Cut out mortar joints surrounding masonry units requiring replacement.
 - 1. Remove existing masonry units creating opening for replacement masonry unit installation.
 - 2. Remove mortar, dust, and debris from opening perimeter surfaces.
 - 3. Prevent debris from falling into cavity.
- B. Dampen surfaces of surrounding existing masonry before installing replacement masonry units.
 - 1. Allow existing masonry to absorb surface moisture before installing replacement units.
 - 2. Butter contact surfaces of existing masonry and replacement masonry units with mortar.
 - 3. Center replacement masonry units in opening and press into position.
 - 4. Remove excess mortar.
 - 5. Tuck point replacement masonry units to ensure full head and bed joints.

3.5 JOINT TOOLING

- A. Tool repointed and replaced masonry joints when mortar becomes slightly hardened.
- B. Produce smooth, compacted, joint matching existing.

3.6 CLEANING

- A. Remove mortar splatter from exposed surfaces immediately.
- B. Clean exposed masonry surfaces on completion.
- C. Remove mortar droppings and other foreign substances from wall surfaces.
- D. Wet surfaces with clean water.
- E. Wash with cleaning agent.
- F. Brush masonry surfaces with stiff fiber brushes while washing.
- G. Immediately after washing, rinse with clean water.

1. Remove traces of detergent, foreign streaks or stains.

- - E N D - -

SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry mortar installed by other concrete and masonry sections.

1.2 RELATED REQUIREMENTS

A. Mortar used in Section:

1. Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE.
2. Section 04 01 00, MAINTENANCE OF MASONRY.
3. Section 04 05 16, MASONRY GROUTING.
4. Section 04 20 00, UNIT MASONRY.
5. Section 04 72 00, CAST STONE MASONRY.

B. Mortar Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C91/C91M-12 - Masonry Cement.
3. C144-11 -Aggregate for Masonry Mortar.
4. C150/C150M-15 - Portland Cement.
5. C207-06(2011) - Hydrated Lime for Masonry Purposes.
6. C270-14a - Mortar of Unit Masonry.
7. C595/C595M-15e1 - Blended Hydraulic Cements.
8. C780-15 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. C979/C979M-10 - Pigments for Integrally Colored Concrete.
10. C1329/C1329M-15 - Mortar Cement.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Test Reports: Certify each product complies with specifications.

1. Mortar.
2. Admixtures.

- D. Certificates: Certify each product complies with specifications.
 - 1. Portland cement.
 - 2. Masonry cement.
 - 3. Mortar cement.
 - 4. Hydrated lime.
 - 5. Fine aggregate.
 - 6. Color admixture.
- E. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Testing laboratory.

1.5 QUALITY ASSURANCE

- A. Preconstruction Testing:
 - 1. Engage independent testing laboratory to tests and submit reports.
 - a. Deliver samples to laboratory in number and quantity required for testing.
 - 2. Test mortar and materials specified.
 - 3. Mortar:
 - a. Test for compressive strength and water retention according to ASTM C270.
 - b. Minimum Mortar compressive strengths 28 days:
 - 1) Type M: 17.2 MPa (2,500 psi).
 - 2) Type S: 12.4 MPa (1,800 psi).
 - 3) Type N: 5.1 MPa (750 psi).
 - 4. Non Staining Cement: Test for water soluble alkali.
 - a. Water Soluble Alkali: Maximum 0.03 percent.
 - 5. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store masonry materials under waterproof covers on planking clear of ground.
 - 1. Protect loose, bulk materials from contamination.

- B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hydrated Lime: ASTM C207, Type S.
- B. Aggregate for Masonry Mortar: ASTM C144 and as follows:
 - 1. Light colored sand for mortar for laying face brick.
 - 2. White plastering sand meeting sieve analysis for mortar joints for pointing // and laying of structural facing tile units // except that 100 percent passes No. 8 sieve, and maximum 5 percent retained on No. 16 sieve.
 - 3. Test sand for color value according to ASTM C40/C40M. Sand producing color darker than specified standard is unacceptable.
- C. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, IP.
- D. Masonry Cement: ASTM C91/C91M. Type N, S, Or M.
 - 1. Use white masonry cement whenever white mortar is specified.
- E. Mortar Cement: ASTM C1329/C1329M, Type N, S or M.
- F. Portland Cement: ASTM C150/C150M, Type I.
 - 1. Use white Portland cement wherever white mortar is specified.
- G. Pigments: ASTM C979/C979M; inorganic, inert, mineral pigments only, unaffected by atmospheric conditions, nonfading, alkali resistant, and water insoluble.
- H. Water: Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer and from one production run.

2.3 MIXES

- A. Pointing Mortar for New Work:
 - 1. For Cast Stone or Precast Concrete: Proportion by volume; one part white Portland cement, two parts white sand, and 1/5 part hydrated lime.

2. Pointing Mortar for Glazed Structural Facing Tile:
 - a. Proportion by volume: One part white Portland cement, two parts of graded white sand passing Number 50 sieve, and 1/8 part hydrated lime.
- B. Tuck Pointing Mortar for Repair Work: Tuck pointing mortar specified in Section 04 01 00, MAINTENANCE OF MASONRY.
- C. Masonry Mortar: ASTM C270.
 1. Admixtures:
 - a. Do not use mortar admixtures, and color admixtures unless approved by Contracting Officer's Representative.
 - b. Do not use antifreeze compounds.
- D. Colored Mortar:
 1. Maintain uniform mortar color for exposed work, throughout.
 2. Alteration Work Mortar Color: Match existing mortar unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
 3. Proportion as specified by manufacturer.
 4. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.

3.2 MIXING

- A. Measure ingredients by volume using known capacity container.
- B. Mix for 3 to 5 minutes in a mechanically operated mortar mixer.
- C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
- D. Mortar Stiffened Because of Water Loss Through Evaporation:
 1. Re-temper by adding water to restore to proper consistency and workability.
 2. Discard mortar reaching initial set or unused within two hours of mixing.
- E. Pointing Mortar:
 1. Mix dry ingredients with enough water to produce damp mixture of workable consistency retaining shape when formed into ball.
 2. Allow mortar to stand in dampened condition for 60 to 90 minutes.

3. Add water to bring mortar to a workable consistency before use.

3.3 MORTARING

- A. Type M Mortar: Use for precast concrete panels, and parging below grade.
- B. Type S Mortar: Use for masonry below grade.
- C. Brick Veneer Over Frame Back Up Walls: Use Type S Portland cement-lime mortar.
- D. Type N Mortar: Use for other masonry work.
- E. Type N Mortar: Use for pointing items and tuck pointing specified.

3.4 FIELD QUALITY CONTROL

- A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
 1. Take and test samples during progress of work according to ASTM C780.

- - E N D - -

SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grout for filling hollow concrete masonry cores.

1.2 RELATED REQUIREMENTS

A. Grout used in Section:

1. Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE.
2. Section 04 20 00, UNIT MASONRY.
3. Section 04 72 00, CAST STONE MASONRY.

B. Grout Color: Section 09 06 00, SCHEDULE FOR FINISHES.

C. Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standards Institute (ANSI):

1. A118.6-10 - Standard Cement Grouts for Tile Installation.

C. ASTM International (ASTM):

1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C150/C150M-15 - Portland Cement.
3. C207-06(2011) - Hydrated Lime for Masonry Purposes.
4. C404-11 - Aggregates for Masonry Grout.
5. C476-11 - Grout for Masonry.
6. C595/C595M-15e1 - Blended Hydraulic Cement.
7. C979/C979M-10 - Pigments for Integrally Colored Concrete.
8. C1019-14 - Sampling and Testing Grout.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Sustainable Construction Submittals:

1. Recycled Content: Identify pre-consumer recycled content percentage by weight.

D. Test Reports: Certify each product complies with specifications.

1. Grout, each type.

2. Cement.
3. Aggregate.
- E. Certificates: Certify each product complies with specifications.
 1. Blended hydraulic cement.
 2. Portland cement.
 3. Grout.
 4. Hydrated lime.
 5. Aggregate.
 6. Color admixture.

1.5 QUALITY ASSURANCE

- A. Preconstruction Testing:
 1. Engage independent testing laboratory to perform tests and submit reports.
 - a. Deliver samples to laboratory in number and quantity required for testing.
 2. Grout:
 - a. Test compressive strength according to ASTM C1019 standard.
 3. Cement:
 - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - b. Nonstaining cement containing more than 0.03 percent water soluble alkali.
 4. Aggregate:
 - a. Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

1.7 STORAGE AND HANDLING

- A. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.
- B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Grout Components:
 - 1. Hydrated Lime: ASTM C207, Type S.
 - 2. Aggregate For Masonry Grout: ASTM C404, Size 8.
 - 3. Blended Hydraulic Cement: ASTM C595, Type IS, IP.
 - 4. Portland Cement: ASTM C150, Type I.
 - 5. Liquid Acrylic Resin:
 - a. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.
 - 6. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

- A. Provide each product from one manufacturer and from one production run.

2.3 MIXES

- A. Grout: ASTM C476; fine grout and coarse grout.
 - 1. Color Admixture:
 - a. Pigments: ASTM C979, inert, stable to atmospheric conditions, nonfading, alkali resistant, and water insoluble.
 - b. Use mineral pigments only. Organic pigments are not acceptable.
- B. Ready-Mixed Grout: ANSI A118.8.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Clean mortar from masonry cells protruding more than 13 mm (1/2 inch) to permit grout flow.
- D. Remove debris from grout spaces.
- E. Verify reinforcement is correctly placed before placing grout.

3.2 MIXING

- A. Mix grout in mechanically operated mixer.
 - 1. Mix grout for five minutes, minimum.
- B. Measure ingredients by volume using container of known capacity.
- C. Mix water with grout dry ingredients.
 - 1. Slump Range: 200 to 275 mm (8 to 11 inches).

3.3 GROUTING

- A. Install grout according to Section 04 20 00, UNIT MASONRY.
- B. Use fine grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is 50 mm (2 inches) or less.
- C. Use either fine grout or coarse grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is greater than 50 mm (2 inches).
- D. Use grout for filling bond beam or lintel units.

- - E N D - -

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Concrete masonry unit (CMU) assemblies for:
1. Exterior walls.

1.2 RELATED REQUIREMENTS

- A. Sealants and Sealant Installation: Section 07 92 00, JOINT SEALANTS.
- B. Color and Texture of Masonry Units: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Concrete Institute (ACI):
1. 315-99 - Details and Detailing of Concrete Reinforcement.
 2. 530.1/ASCE 6/TMS 602-13 - Specification for Masonry Structures.
- C. ASTM International (ASTM):
1. A615/A615M-15a1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 2. A951/A951M-14 - Steel Wire for Masonry Joint Reinforcement.
 3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 4. C34-13 - Structural Clay Load-Bearing Wall tile.
 5. C55-14a - Concrete Building Brick.
 6. C56-13 - Structural Clay Nonloadbearing Tile.
 7. C62-13a - Building Brick (Solid Masonry Units Made from Clay or Shale).
 8. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
 9. C90-14 - Load-Bearing Concrete Masonry Units.
 10. C126-15 - Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
 11. C216-15 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
 12. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
 13. C744-14 - Prefaced Concrete and Calcium Silicate Masonry Units.
 14. D1056-14 - Flexible Cellular Materials - Sponge or Expanded Rubber.
 15. D2240-05(2010) - Rubber Property-Durometer Hardness.

16. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

D. American Welding Society (AWS):

1. D1.4/D1.4M-11 - Structural Welding Code - Reinforcing Steel.

E. Brick Industry Association (BIA):

1. TN 11B-88 - Guide Specifications for Brick Masonry, Part 3.

F. Federal Specifications (Fed. Spec.):

1. FF-S-107C(2) - Screws, Tapping and Drive.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies.

2. Special masonry shapes, profiles, and placement.

3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.

C. Manufacturer's Literature and Data:

1. Description of each product.

2. Installation instructions.

D. Samples:

1. Face brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.

2. Ceramic Glazed Facing Brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.

3. Concrete masonry units, when exposed in finish work.

4. Anchors and Ties: Each type.

5. Joint Reinforcing: 1200 mm (48 inches) long each type.

6. Glazed Structural Facing Tile: Clipped panels (triplicate) of four wall units with base units, showing color range, each color and texture.

E. Sustainable Construction Submittals:

SPEC WRITER NOTE: Retain sustainable construction submittals appropriate to product.

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
- F. Test reports: Certify products comply with specifications.
 1. Ceramic glazed facing brick.
- G. Certificates: Certify products comply with specifications.
 1. Face brick.
 2. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
 3. Ceramic glazed facing brick.
 4. Glazed structural clay facing tile.
 5. Structural clay tile units.
- H. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1.5 QUALITY ASSURANCE

- A. Welders and Welding Procedures Qualifications: AWS D1.4/D1.4M.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products above grade, protected from contamination.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Hot and Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.

2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer and from one production run.

2.3 UNIT MASONRY PRODUCTS

- A. Brick:
 - 1. Face Brick:
 - a. ASTM C216, Grade SW, Type FBS.
 - b. Brick when tested according to ASTM C67: Classified slightly efflorescent or better.
 - c. Size:
 - 1) Modular.
 - 2) Thin Brick: 13 mm (1/2 inch) thick with angle shapes for corners.
 - 2. Building Brick: ASTM C62, Grade MW for backup and interior work; Grade SW where in contact with earth.
 - 3. Ceramic Glazed Facing Brick: ASTM C126.
 - 4. One Face Exposed: Grade S, Type I.
 - 5. Two Faces Exposed: Grade S, Type II.
- B. Concrete Masonry Units (CMU):
 - 1. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
 - a. Unit Weight: Normal weight.
 - b. Fire rated units for fire rated partitions.
 - 2. Sizes: Modular, 200 mm by 400 mm (8 inches by 16 inches) nominal face dimension; thickness as indicated on drawings.
 - 3. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
 - 4. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (1 inch) minimum radius rounded vertical exterior corners (bullnose units).
 - 5. Customized Units:

- a. Sound-Absorbing Units:
 - 1) Vertical slots in face to core areas.
 - 2) Acoustical absorption insert: Mineral fiber and metal septum, providing unit with NRC rating of 0.70.
- b. Glazed Face Units: Facing conform to ASTM C744.
- C. Concrete Brick: ASTM C55.

2.4 ANCHORS, TIES, AND REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615/A615M; Grade 60, deformed bars.
- B. Joint Reinforcement:
 - 1. Form from wire complying with ASTM A951/A951M.
 - 2. Hot dipped galvanized after fabrication.
 - 3. Width of joint reinforcement 40 mm (1.6 inches) less than nominal thickness of masonry wall or partition.
 - 4. Cross wires welded to longitudinal wires.
 - 5. Joint reinforcement minimum 3000 mm (10 feet) long, factory cut.
 - 6. Joint reinforcement with crimp formed drip is not acceptable.
 - 7. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
 - 8. Ladder Design:
 - a. Longitudinal wires deformed // 4 mm (0.16 inch) // 5 mm (0.20 inch) diameter wire //.
 - b. Cross wires // 2.6 mm (0.10 inch) // 4 mm (0.16 inch) diameter //.
 - 9. Trussed Design:
 - a. Longitudinal and cross wires minimum 4 mm (0.16 inch nominal) diameter.
 - b. Longitudinal wires deformed.
 - 10. Multiple Wythes and Cavity Wall Ties:
 - a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.
 - b. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe minimum 75 mm (3 inches) spaced 400 mm on center (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).
- C. Adjustable Veneer Anchor for Framed Walls:

1. Two piece, adjustable anchor and tie.
2. Anchor and tie may be either loop or angle type; provide only one type throughout.
3. Loop Type:
 - a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
 - b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage anchor and be embedded minimum 50 mm (2 inches) into bed joint of masonry veneer.
4. Angle Type:
 - a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
 - b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded minimum 50 mm (2 inches) into the bed joint of masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Dovetail Anchors:

1. Corrugated steel dovetail anchors formed of 1.5 mm (0.06 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend minimum 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
3. Form dovetail anchor slots from 0.6 mm (0.02 inch) thick galvanized steel (with felt or fiber filler).

E. Individual Ties:

1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to rectangular shape minimum 50 mm (2 inches) wide by

sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not acceptable.

2. Adjustable Cavity Wall Ties:

- a. Adjustable wall ties may be furnished at Contractor's option.
- b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
- c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
- d. Form one piece to rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into bed joint 50 mm (2 inches).
- e. Form other piece to 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having 75 mm (3 inch) long bent section for engaging 105 mm (4-1/8 inch) wide piece to form adjustable connection.

F. Wall Ties, (Mesh or Wire):

1. Mesh wall ties formed of ASTM A1064/A1064M, W0.5, 2 mm, (0.08 inch) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
2. Rectangular wire wall ties formed of W1.4, 3 mm, (0.12 inch) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

G. Adjustable Steel Column Anchor:

1. Two piece anchor consisting of a 6 mm (1/4 inch) diameter steel rod to be welded to steel with offset ends, rod to permit 100 mm (4 inch) vertical adjustment of wire anchor.
2. Triangular shaped wire anchor 100 mm (4 inches) wide formed from 5 (3/16 inch) diameter galvanized wire, to extend minimum 75 mm (3 inches) into joints of masonry.

H. Adjustable Steel Beam Anchor:

1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
2. Flange hook minimum 38 mm (1 1/2 inches) long.
3. Length to embed in masonry minimum 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
4. Bend masonry end minimum 40 mm (1 1/2 inches).

I. Ridge Wall Anchors:

1. Form from galvanized steel minimum 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
2. Other lengths as indicated on drawings.

2.5 ACCESSORIES

A. Shear Keys:

1. Solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with durometer hardness of approximately 80 when tested according to ASTM D2240, and minimum shear strength of 3.5 MPa (500 psi).
2. Shear Key Dimensions: Nominal 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

B. Weeps:

1. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
2. Weep Tubing: Round, polyethylene, 9 mm (3/8 inch) diameter, 100 mm (4 inches) long.
3. Weep Hole: Flexible PVC louvered configuration with rectangular closure strip at top.

C. Cavity Drain Material: Open mesh polyester sheets or strips to prevent mortar droppings from clogging the cavity.

D. Preformed Compressible Joint Filler:

1. Thickness and depth to fill joint.
2. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
3. Non-Combustible Type: ASTM C612, Type 5, Max. Temp. 1800 degrees F.

E. Box Board:

1. Mineral Fiber Board: ASTM C612, Type 1.
2. 25 mm (1 inch) thickness.
3. Other spacing material having similar characteristics is acceptable subject to Contracting Officer's Representative's approval.

F. Masonry Cleaner:

1. Detergent type cleaner selected for each type masonry.
2. Acid cleaners are not acceptable.
3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

G. Fasteners:

1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.
- H. Welding Materials: AWS D1.4/D1.4M, type to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- C. Wall Openings:
 1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
 2. When items are not available when walls are built, prepare openings for subsequent installation.
- D. Tooling Joints:
 1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
 3. Finish joints in exterior face masonry work with jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
 4. Tool Exposed interior joints in finish work concave unless specified otherwise.
- E. Before connecting new masonry with previously laid masonry, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.
- F. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.
- G. Wetting and Wetting Test:
 1. Test and wet brick and clay tile according to BIA TN 11B.

2. Do not wet concrete masonry units or glazed structural facing tile before laying.
- H. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
- I. Construct formwork to conform to shape, line and dimensions indicated on drawings. Make sufficiently tight to prevent mortar, grout, or concrete leakage. Brace, tie and support formwork as required to maintain position and shape during construction and curing of reinforced masonry.
- J. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary construction loads.

SPEC WRITER NOTE: The following dry times are recommended by BIA. Delete or revise as required for applicable construction.

- K. Minimum Curing Times Before Removing Shores and Forms:
 1. Girders and Beams: 10 days.
 2. Slabs: 7 days.
 3. Reinforced Masonry Soffits: 7 days.

3.2 INSTALLATION - ANCHORAGE

- A. Veneer to Framed Walls:
 1. Install adjustable veneer anchors.
 2. Fasten anchor to stud through sheathing with self-drilling and tapping screw, one at both ends of loop type anchor.
 3. Space anchors maximum 400 mm (16 inches) on center vertically at each stud.
- B. Veneer to Concrete Walls:
 1. Install dovetail slots in concrete vertically at 400 mm (16 inches) on centers.
 2. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
 3. Anchor new masonry facing to existing concrete with adjustable cavity wall ties spaced at 400 mm, (16 inches) maximum vertical intervals, and at 400 mm (16 inches) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.
- C. Masonry Facing to Backup and Cavity Wall Ties:

1. Use individual ties for new work.
2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 400 mm (16 inches) horizontally.
3. At openings, provide additional ties spaced maximum 900 mm (36 inches) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
4. Anchor new masonry facing to existing masonry with adjustable cavity wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
5. Option: Install joint reinforcing for multiple wythes and cavity wall ties spaced maximum 400 mm (16 inches) vertically.
6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals maximum 400 mm (16 inches) on center horizontally, and 400 mm (16 inches) on center vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

D. Anchorage of Abutting Masonry:

1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (24 inches) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with adjustable wall ties. Extend ties minimum 100 mm (4 inches) into joints of new masonry. Fasten ties to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid

anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

E. Masonry Furring:

1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with adjustable wall ties or dovetail anchors.
2. Space at maximum 400 mm (16 inches) on center in both directions.

F. Anchorage to Steel Beams or Columns:

1. Use adjustable beam anchors on each flange.
2. At columns weld steel rod to steel columns at 300 mm (12 inch) intervals, and place wire ties in masonry courses at 400 mm (16 inches) maximum vertically.

3.3 INSTALLATION - REINFORCEMENT

A. Joint Reinforcement:

1. Install joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing is acceptable in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
4. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry.
5. Wherever brick masonry is backed up with stacked bond masonry, install multiple wythe joint reinforcement in every two courses of CMU backup, and in corresponding joint of facing brick.

B. Steel Reinforcing Bars:

1. Install reinforcing bars in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for horizontal reinforcement. Install in wall cavities of reinforced masonry walls where indicated on drawings.
2. Bond Beams:
 - a. Form Bond beams of load-bearing concrete masonry units filled with grout and reinforced with two No. 15m (No. 5) reinforcing bars unless shown otherwise. Do not cut reinforcement.

- b. Brake bond beams only at expansion joints and at control joints, if shown.
- 3. Stack Bond:
 - a. Locate additional joint reinforcement in vertical and horizontal joints as indicated on drawings.
 - b. Anchor vertical reinforcement into foundation or wall or bond beam below.
 - c. Provide temporary bracing for walls over 8 feet tall until permanent horizontal bracing is completed.

SPEC WRITER NOTE: Subparagraphs regarding grout openings apply to high-lift grouting only.

- 4. Grout openings:
 - a. Leave cleanout holes in double wythe walls during construction by omitting units at base of one side of wall.
 - b. Locate 75 mm by 75 mm (3 inches. by 3 inches.) min. cleanout holes at location of vertical reinforcement.
 - c. Keep grout space clean of mortar accumulation and debris. Clean as work progresses and immediately before grouting.

3.4 INSTALLATION - BRICK EXPANSION AND CMU CONTROL JOINTS

- A. Provide brick expansion joint (EJ) and CMU control joints (CJ) where indicated on drawings.
- B. Keep joint free of mortar and other debris.
- C. Joints Occur In Masonry Walls:
 - 1. Install preformed compressible joint filler in brick wythe.
 - 2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on both sides of shear key.
- D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.
- E. Interrupt joint reinforcement at expansion and control joints.
- F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.5 INSTALLATION - BUILDING EXPANSION AND SEISMIC JOINTS

- A. Keep expansion and seismic joints open and free of mortar. Remove mortar and other debris.

- B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.
- C. Fill opening in exposed face of expansion and seismic joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.6 INSTALLATION - ISOLATION JOINT

- A. Where full height walls and partitions lie parallel or perpendicular to and under structural beams and shelf angles, provide minimum 9 mm (3/8 inch) separation between walls and partitions and bottom of beams and shelf angles.
- B. Insert continuous full width strip of non-combustible type compressible joint filler.
- C. Fill opening in exposed face of isolation joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 INSTALLATION - BRICKWORK

- A. Lay clay brick according to BIA TN 11B.
- B. Laying:
 - 1. Lay brick in one-half running bond with bonded corners, unless indicated otherwise. Match bond of existing building on alterations and additions.
 - 2. Maintain bond pattern throughout.
 - 3. Do not use brick smaller than half-brick at any angle, corner, break, and jamb.
 - 4. Where length of cut brick is greater than one half length, maintain vertical joint location.
 - 5. Lay exposed brickwork joints symmetrical about center lines of openings.
 - 6. Do not structurally bond multi-wythe brick walls, unless indicated on drawings.
 - 7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
 - 8. Lay brick for sills with wash and drip.
 - 9. Build solid brickwork as required for anchorage of items.
- C. Joints:
 - 1. Exterior And Interior Joint Widths: Lay for three equal joints in 200 mm (8 inches) vertically, unless shown otherwise.

2. Rake joints for pointing with colored mortar when colored mortar is not full depth.
3. Arches:
 - a. Flat arches (jack arches) lay with camber of 1 in 200 (1/16 inch per foot) of span.
 - b. Face radial arches with radial brick with center line of joints on radial lines.
 - c. Form Radial joints of equal width.
 - d. Bond arches into backing with metal ties in every other joint.
- D. Weep Holes:
 1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in wall.
 2. Form weep holes using wicks made of mineral fiber insulation strips turned up 200 mm (8 inches) in cavity. Anchor top of strip to backup to securely hold in place.
 3. Install sand or pea gravel in cavity approximately 75 mm (3 inches) high between weep holes.
- E. Solid Exterior Walls:
 1. Build with 100 mm (4 inches) of nominal thick facing brick, backed up with concrete masonry units or cast-in-place concrete
 2. Construct solid brick jambs minimum 20 mm (0.81 inches) wide at exterior wall openings and at recesses, except where exposed concrete unit backup is shown.
 3. Do not install full bonding headers.
 4. Parging:
 - a. For solid masonry walls, lay backup to height of six brick courses, parge backup with 13 mm (1/2 inch) of mortar troweled smooth; then lay exterior wythe to height of backup.
 - b. Make parging continuous over backup, and extend 150 mm (6 inches) onto adjacent concrete or masonry.
 - c. Parge ends and backs for recesses in exterior walls to thickness of 13 mm (1/2 inch).
 - d. Parge inside surface of exterior walls to produce true even surface to receive insulation.
 5. Coordinate with building insulation for thickness of insulation and allowance of air space behind exterior wythe.

6. In locations where hurricane driven rains are expected, install bituminous dampproofing on cavity side of inner wythe.

F. Cavity Walls:

1. Keep air space clean of mortar accumulations and debris.
2. Lay the interior wythe of the masonry wall full height where dampproofing, air barrier is required on cavity face. Coordinate to install dampproofing, air barrier before laying outer wythe.
3. Insulated Cavity Type Exterior Walls:
 - a. Install insulation against cavity face of inner masonry wythe.
 - b. Place insulation between rows of ties or joint reinforcing.
Adhere insulation to masonry surface with a bonding agent as recommended by insulation manufacturer.
 - c. Lay outer masonry wythe up with air space between insulation and masonry units.
4. Veneer Framed Walls:
 - a. Build with 100 mm (4 inches) of face brick over sheathed stud wall with air space.
 - b. Keep air space clean of mortar accumulations and debris.

3.8 INSTALLATION - CONCRETE MASONRY UNITS

A. Types and Uses:

1. Provide special concrete masonry shapes as required. Provide solid concrete masonry units, where full units cannot be installed, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Do not install brick jambs in exposed finish work.
4. Install concrete building brick only as filler in backup material where not exposed.
5. Construct fire resistance in fire rated partitions meeting fire ratings indicated on drawings.
6. Where lead-lined concrete masonry unit partitions terminate below underside of overhead floor or roof deck, fill remaining open space between top of partition and underside of overhead floor or roof deck, with standard concrete masonry units of same thickness as lead lined units.

B. Laying:

1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill voids with mortar or grout.
7. Provide 6 mm (1/4 inch) open joint for sealant between existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes indicated on drawings.
12. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
13. Place steel reinforcement at spacing indicated on drawings before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
16. Support vertical bars near each end and at maximum 192 bar diameter on center.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
19. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.

20. Install cavity and joint reinforcement as masonry work progresses.

21. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

C. Waterproofing Parging:

1. Parge earth side of concrete masonry unit basement walls with mortar applied in two coats, each coat 6 mm (1/4 inch) thick.
2. Clean wall surfaces to receive parging of dirt, oil, or grease, and moisten before application of first coat.
3. Roughen first coat when partially set, permit to hardened for 24 hours, and moisten before application of second coat.
4. Keep second coat damp for minimum 48 hours.
5. Thicken parging and round to form a cove at the junction of outside wall face and footing.

3.9 INSTALLATION - GLAZED STRUCTURAL FACING TILE - RESERVED

3.10 POINTING

- A. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.
- B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
- C. Tool exposed joints to smooth concave joint.
- D. At joints with existing work, match existing joint.

3.11 GROUTING

- A. Preparation:
 1. Clean grout space of mortar droppings before placing grout.
 2. Close cleanouts.
 3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
 4. Verify reinforcing bars are installed as indicated on drawings.
- B. Placing:
 1. Place grout in grout space in lifts as specified.
 2. Consolidate each grout lift after free water has disappeared but before plasticity is lost.
 3. Do not slush with mortar or use mortar with grout.
 4. Interruptions:

- a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inches) below top of last masonry course.
 - b. Grout from dam to dam on high lift method.
 - c. Longitudinal run of masonry may be stopped off only by raking back one-half masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.
- C. Puddling Method:
1. Consolidate by puddling with grout stick during and immediately after placing.
 2. Grout cores of concrete masonry units containing reinforcing bars solid as masonry work progresses.
- D. Low Lift Method:
1. Construct masonry to 1.5 m (5 feet) maximum height before grouting.
 2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.
- E. High Lift Method:
1. Do not pour grout until masonry wall has cured minimum of 4 hours.
 2. Place grout in 1.5 m (5 feet) maximum lifts.
 3. Exception:
 - a. Where following conditions are met, place grout in 3.86 m (12.67 feet) maximum lifts.
 - b. Masonry has cured minimum of 4 hours.
 - c. Grout slump is maintained between 250 and 275 mm (10 and 11 inches).
 - d. No intermediate reinforced bond beams are placed between top and bottom of grout lift.
 4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into preceding lift.

3.12 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install

horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.

- C. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- D. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.
- E. Weld splices where indicated on drawings according to AWS D1.4/D1.4M.
- F. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- G. Embed prefabricated horizontal joint reinforcement as work progresses, with minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement minimum 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- H. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.
- I. Anchor reinforced masonry walls at intersections with non-reinforced masonry.

3.13 INSTALLATION OF REINFORCED BRICK MASONRY - RESERVED

3.14 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to distance behind face equal to thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed 9 mm (3/8 inch) joint widths.
- C. Where solid CMU units are shown, lay with full mortar head and bed joints.
- D. 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. 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.

2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension 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.
3. Where horizontally reinforced beams (bond beams) are indicated on drawings, 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.

E. Columns, Piers and Pilasters:

1. Use CMU units of size, shape and number of vertical core spaces shown. If not shown, use units which provide 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.

F. Grouting:

1. Use fine grout for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use coarse grout for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At Contractor's option, use either low-lift or high-lift grouting techniques.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 sq. mm (8 sq. inches) in vertical cores to be grouted.
2. Place vertical reinforcement before grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).

3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 feet) height, or if bond beam occurs below 1.5 m (5 feet) height, stop pour 38 mm (1-1/2 inches) below top of bond beam.
4. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as indicated on drawings. Place grout in bond beam course before filling vertical cores above bond beam.

H. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 sq. mm (10 sq. inches), respectively.
2. Provide cleanout holes in first course at vertical cells which are to be filled with grout.
3. 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.
4. Construct masonry to full height of maximum grout pour before placing grout.
5. Limit grout lifts to maximum height of 1.5 m (5 feet) and grout pour to maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, to suit application. 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 3 m (10 feet).
7. 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.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as masonry units are laid.

10. Embed lateral tie reinforcement in mortar joints where indicated.
Place as masonry units are laid, at vertical spacing shown.
11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints.
Place as indicated on drawings, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide minimum 4.1 mm diameter (0.16 inch) wire ties spaced 400 mm (16 inches) on center for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) on center for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Before grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. 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.
14. Limit grout pours to sections which can be completed in one working day with maximum one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow minimum 30 minutes and maximum one hour between lifts. Mechanically consolidate each lift.
15. Place grout in lintels or beams over openings in one continuous pour.
16. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
17. 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 38 mm (1-1/2 inches) 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.

3.15 CONSTRUCTION TOLERANCES

- A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 and as follows:
- B. Maximum variation from plumb:
 - 1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
 - 2. In 6000 mm (20 feet) - 9 mm (3/8 inch).
 - 3. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:
 - 1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
 - 2. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
 - 1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
 - 2. In 12,000 mm (40 feet) or more - 19 mm (3/4 inch).
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
 - 1. Minus 6 mm (1/4 inch).
 - 2. Plus 13 mm (1/2 inch).
- F. Maximum variation in prepared opening dimensions:
 - 1. Accurate to minus 0 mm (0 inch).
 - 2. Plus 6 mm (1/4 inch).

3.16 CLEANING AND REPAIR

- A. General:
 - 1. Clean exposed masonry surfaces on completion.
 - 2. Protect adjoining construction materials and landscaping during cleaning operations.
 - 3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
 - 4. Remove mortar droppings and other foreign substances from wall surfaces.
- B. Brickwork:
 - 1. First wet surfaces with clean water, then wash down with detergent solution. Do not use muriatic acid.
 - 2. Brush with stiff fiber brushes while washing, and immediately wash with clean water.
 - 3. Remove traces of detergent, foreign streaks, or stains of any nature.
- C. Concrete Masonry Units:

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.
- D. Glazed Structural Facing Tile or Brick Units:
 1. Clean as recommended manufacturer. Protect light colored mortar joints from discoloration during cleaning.
 2. Use on solid masonry walls.
 3. Prepare schedule of test locations.

3.17 FIELD QUALITY CONTROL

- A. Water Penetration Testing:
 1. Seven days before plastering or painting, in presence of Contracting Officer's Representative, test solid exterior masonry walls for water penetration.
 2. Direct water on masonry for a period of one hour when wind velocity is less than five miles per hour.
 3. Should moisture appear on inside of walls tested, make additional tests at other areas as directed by Contracting Officer's Representative.
 4. Correct areas showing moisture on inside of walls, and repeat test at repaired areas, to ensure moisture penetration has been stopped.

- - E N D - -

SECTION 04 72 00
CAST STONE MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This sections specifies manufactured concrete units to simulate a natural stone.
- B. Installation of cast stone units.

1.2 RELATED WORK

- A. Setting and pointing mortar: Section 04 05 13, MASONRY MORTARING / Section 04 05 16, MASONRY GROUTING.
- B. Joint sealant and application: Section 07 92 00, JOINT SEALANTS.
- C. Color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Cast stone, sample panel, size 100 by 300 by 300 mm (4 by 12 by 12 inches) each color and finish.
 - 2. Show finish on two 100 mm (4-inch) edges and 300 by 300 mm (12 by 12 inch) surface.
- C. Shop Drawings:
 - 1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
 - 2. Setting drawings with setting mark.
- D. Certificates: Test results indicating that the cast stone meets specification requirements and proof of plant certification.
- E. Submit manufacturers test results of cast stone previously made by manufacturer.
- F. Laboratory Data: Description of testing laboratories facilities and qualifications of its principals and key personnel.
- G. List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store cast stone under waterproof covers on planking clear of ground.
- B. Protect from handling, dirt, stain, and water damage.
- C. Mark production units with the identification marks as shown on the shop drawings.

- D. Package units and protect them from staining or damage during shipping and storage.
- E. Provide an itemized list of product to support the bill of lading.

1.5 WARRANTY

Warranty exterior masonry walls against moisture leaks, any defects and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be two years.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.
- C. American Society for Testing and Materials (ASTM):
 - A167-99(R2009).....Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - A185-07.....Steel, Welded Wire Fabric, Plain for Concrete
 - A615/A615M-09.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - C33-11.....Concrete Aggregates
 - C150-09.....Portland Cement
 - C503-10.....Marble Dimension Stone (Exterior)
 - C568-10.....Limestone Dimension Stone
 - C615-11.....Granite Dimension Stone
 - C616-10.....Quartz-Based Dimension Stone
 - C979-10.....Pigments for Integrally Colored Concrete
 - C1194-03.....Compressive Strength of Architectural Cast Stone
 - C1195-03.....Absorption of Architectural Cast Stone
 - C1364-10.....Architectural Cast Stone.
 - D2244-09.....Calculation of Color Differences from Instrumentally Measured Color Coordinates.

1.7 QUALITY ASSURANCE

- A. The Manufacturer:
 - 1. Must have 5 years minimum continuous operating experience and have facilities for manufacturing cast stone as described herein.
- Manufacturer shall have sufficient plant facilities to produce the

- shapes, quantities and size of cast stone required in accordance with the project schedule.
2. Must be a member of the Cast Stone Institute.
 3. Must have a certified plant (certification by the Cast Stone Institute).
- B. Stone setter: Must have 5 years' experience setting cast or natural building stone.
- C. Testing: One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 m³) delivered to the job:
1. Three (3) field cut cube specimens from each of these sample shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as specified.
 2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
 3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.
 4. Manufacturer shall submit a written list of projects similar and at least three (3) years of age, along with owner, architect and contractor references.

1.8 MANUFACTURING TOLERANCES

- A. Cross section dimensions shall not deviate by more than + 1/8 in. (3 mm) from approved dimension.
- B. Length of units shall not deviate by more than length /360 or + 1/8 in. (3mm), whichever is greater, not to exceed + 1/4 in (6 mm). Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp bow or twist of units shall not exceed length/360 or + 1/8 in. (3 mm), whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features - On formed sides of unit, 1/8 in (3 mm), on unformed sides of unit, 3/8 in (9 mm) maximum deviation.

1.9 MOCK-UP

Provide full size unit(s) for use in construction of sample wall. The mock-up becomes the standard of workmanship for the project.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CAST STONE

- A. Comply with ASTM C 1364

B. Physical properties: Provide the following:

1. Compressive Strength - ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
2. Absorption - ASTM C 1195: 6% maximum by the cold water method, or 10% maximum by the boiling method for products as 28 days.
3. Air Content - ASTM C173 or C231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for vibrant dry tamp (VDT) products.
4. Freeze thaw - ASTM C 1364L The cumulative percent weight loss (CPWL) shall be less than 5% after 300 cycles of freezing and thawing.
5. Linear Shrinkage - ASTM C 426L Shrinkage shall not exceed 0.065%.

C. Job site testing - One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14m³) delivered to the job site:

1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.
2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

2.2 RAW MATERIALS

- A. Portland cement - Type I or Type III, white and/or grey, ASTM C 150.
- B. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.
- C. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.
- D. Colors - Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.
- E. Admixtures- Comply with the following:
 1. ASTM C 260 for air-entraining admixtures.
 2. ASTM C 494/C 495 M Types A-G for water reducing, retarding, accelerating and high range admixtures.
 3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as

suitable for use in concrete by proven field performance or through laboratory testing.

4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.

5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water - Potable

G. Reinforcing bars:

1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in. (37 mm).

2. Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.

H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

2.3 COLOR AND FINISH

A. Match sample on file.

B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 in² (25mm²) and not obvious under direct daylight illumination at a 5 ft. (1.5m) distance.

C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 ft (3m) distance.

D. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.

1. Total color difference - not greater than 6 units.

2. Total hue difference-not greater than 2 units.

2.4 REINFORCING

A. Reinforce the units as required by the drawings and for safe handling and structural stress.

1. Minimum reinforcing shall be 0.25 percent of the cross section area.

B. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5in. (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.

- C. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20-ft (6m) distance.
- D. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.
- E. Remove cement film, if required, from exposed surface prior to packaging for shipment.

2.5 CURING

Cure units in a warm curing chamber 100 F (37.8 C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70F (21.1 C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350-degree-days (i.e. 7 days @ 50F (10.0 C) or 5 days @ 70F (21.0 C) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

PART 3 - EXECUTION

3.1 EXAMINATION

Installing contractor shall check cast stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES

- A. Comply with Cast Stone Institute SM Technical Manual.
- B. Set stones 1/8 in. (3 mm) or less, within the plane of adjacent units.
- C. Joints, plus - 1/6 in. (1.5 mm), minus - 1/8 in. (3 mm).

3.3 JOINTING

- A. Joint size:
 - 1. At stone/brick joints 3/8 in. (9.5 mm).
 - 2. At stone/stone joints in vertical position 1/4 in. (6 mm) (3/8 in. (9.5 mm) optional).
 - 3. Stone/stone joint exposed on top 3/8 in. (.5 mm).
- B. Joint Materials:
 - 1. Mortar, Type N, ASTM C 270.
 - 2. Use a full bed of mortar at all bed joints.
 - 3. Flush vertical joints full with mortar.
 - 4. Leave all joints with exposed tops or under relieving angles open for sealant.
 - 5. Leave head joints in coping and projecting components open for sealant.
- B. Location of joints:

1. As shown on shop drawings.
2. At control and expansion joints unless otherwise shown.

3.4 SETTING

- A. Drench units with clean water prior to setting.
- B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- C. Set units in full bed of mortar, unless otherwise detailed.
- D. Rake mortar joints 3/4 in. (18 mm) in. for pointing.
- E. Remove excess mortar from unit faces immediately after setting.
- F. Tuck point unit joints to a slight concave profile.

3.5 JOINT PROTECTION

- A. Comply with requirements of Section 07 92 00, JOINT SEALANTS.
- B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6 REPAIR AND CLEANING

- A. Repair chips with touchup materials furnished by manufacturer.
- B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
- C. Consult with manufacturer for appropriate cleaners.

3.7 INSPECTION AND ACCEPTANCE

Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute.

- - - E N D - - -

SECTION 05 50 00
METAL FABRICATIONS

SPEC WRITER NOTE:

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
 - 1. Support for Wall and Ceiling Mounted Items: (SD055000-01, SD055000-02, SD102113-01, SD102600-01, SD123100-01 & SD123100-02)
 - 2. Frames:
 - 3. Guards
 - 4. Covers and Frames for Pits and Trenches.
 - 5. Gratings
 - 6. Loose Lintels
 - 7. Shelf Angles
 - 8. Gas Racks
 - 9. Plate Door Sill
 - 10. Safety Nosings
 - 11. Ladders
 - 12. Railings:
 - 13. Catwalks and Platforms
 - 14. Trap Doors with Ceiling Hatch
 - 15. Sidewalk Access Doors
 - 16. Screened Access Doors
 - 17. Steel Counter or Bench Top Frame and Leg
 - 18. Steel Pipe Bollards

1.2 RELATED WORK

- A. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Prime and finish painting: Section 09 91 00, PAINTING.
- D. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

| | |
|--------------------|----------------------|
| Grating, each type | Floor plate |
| Trap door | Wheel guards |
| Ceiling hatch | Sidewalk Access door |
| Manhole Covers | Safety nosing |

C. Shop Drawings:

1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
3. Provide templates and rough-in measurements as required.

D. Manufacturer's Certificates:

1. Anodized finish as specified.
2. Live load designs as specified.

E. Design Calculations for specified live loads including dead loads.

F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):

B18.6.1-97.....Wood Screws

B18.2.2-87(R2010).....Square and Hex Nuts

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

A36/A36M-14.....Structural Steel

A47-99(R2014).....Malleable Iron Castings

A48-03(R2012).....Gray Iron Castings

A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Welded and Seamless

A123-15.....Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products

A240/A240M-15.....Standard Specification for Chromium and
Chromium-Nickel Stainless Steel Plate, Sheet
and Strip for Pressure Vessels and for General
Applications.

A269-15.....Seamless and Welded Austenitic Stainless Steel
Tubing for General Service

A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI
Tensile Strength

A391/A391M-07(R2015)....Grade 80 Alloy Steel Chain

A786/A786M-15.....Rolled Steel Floor Plate

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Shapes, and Tubes

B456-11.....Electrodeposited Coatings of Copper Plus Nickel
Plus Chromium and Nickel Plus Chromium

B632-08.....Aluminum-Alloy Rolled Tread Plate

C1107-13.....Packaged Dry, Hydraulic-Cement Grout
(Nonshrink)

D3656-13.....Insect Screening and Louver Cloth Woven from
Vinyl-Coated Glass Yarns

F436-16.....Hardened Steel Washers

F468-06(R2015).....Nonferrous Bolts, Hex Cap Screws, Socket Head
Cap Screws and Studs for General Use

F593-13.....Stainless Steel Bolts, Hex Cap Screws, and
Studs

F1667-15.....Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):

D1.1-15.....Structural Welding Code Steel

D1.2-14.....Structural Welding Code Aluminum

D1.3-18.....Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)

AMP 521-01(R2012).....Pipe Railing Manual

AMP 500-06.....Metal Finishes Manual

MBG 531-09(R2017).....Metal Bar Grating Manual

MBG 532-09.....Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC)/Society of Protective
Coatings:

SP 1-15.....No. 1, Solvent Cleaning

SP 2-04.....No. 2, Hand Tool Cleaning

SP 3-04.....No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):

RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.
- C. Floor Plates, Gratings, Covers, Trap Doors, Catwalks, and Platforms: 500 kg/m² (100 pounds per square foot).
- D. Manhole Covers: 1200 kg/m² (250 pounds per square foot).

2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A240, Type 302 or 304.
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- D. Floor Plate:
 - 1. Steel ASTM A786.
 - 2. Aluminum: ASTM B632.
- E. Steel Pipe (Bollard): ASTM A53.
 - 1. Galvanized for exterior locations.
 - 2. Type S, Grade A unless specified otherwise.
 - 3. NPS (inside diameter) as shown.
- F. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- G. Malleable Iron Castings: A47.
- H. Primer Paint: As specified in Section 09 91 00, PAINTING.
- I. Stainless Steel Tubing: ASTM A269, type 302 or 304.

J. Modular Channel Units:

1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
2. Form channel within turned pyramid shaped clamping ridges on each side.
3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

2.3 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:

1. Bolts with Nuts:
 - a. ASME B18.2.2.
 - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
 - c. ASTM F468 for nonferrous bolts.
 - d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.

4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:

- a. Fabricate items to design shown.
- b. Furnish members in longest lengths commercially available within the limits shown and specified.
- c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
- d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
- e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
- f. Prepare members for the installation and fitting of hardware.
- g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
- h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:

- a. Weld in accordance with AWS.
- b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
- c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
- d. Finish welded joints to match finish of adjacent surface.

3. Joining:

- a. Miter or butt members at corners.
- b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.

4. Anchors:

- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
- b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.

5. Cutting and Fitting:

- a. Accurately cut, machine and fit joints, corners, copes, and miters.
- b. Fit removable members to be easily removed.
- c. Design and construct field connections in the most practical place for appearance and ease of installation.
- d. Fit pieces together as required.
- e. Fabricate connections for ease of assembly and disassembly without use of special tools.
- f. Joints firm when assembled.
- g. Conceal joining, fitting and welding on exposed work as far as practical.
- h. Do not show rivets and screws prominently on the exposed face.
- i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:

1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
 - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
 - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
 - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
 - d. Painted: AA-C22R10.

3. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. Surfaces exposed in the finished work:
 - 1) Finish smooth rough surfaces and remove projections.
 - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
 - c. Shop Prime Painting:
 - 1) Surfaces of Ferrous metal:
 - a) Items not specified to have other coatings.
 - b) Galvanized surfaces specified to have prime paint.
 - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
 - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
 - e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
 - 2) Non ferrous metals: Comply with MAAMM-500 series.
4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

SPEC WRITER NOTE: Specify items to receive chromium plating.

5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:

1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

B. For Ceiling Hung Toilet Stall:

1. Use a continuous steel channel above pilasters with hangers centered over pilasters.
2. Make provision for installation of stud bolts in lower flange of channel.
3. Provide a continuous steel angle at wall and channel braces spaced as shown.
4. Use threaded rod hangers.
5. Provide diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.

C. For Wall Mounted Items:

1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flattened for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

D. For Trapeze Bars:

1. Construct assembly above ceilings as shown and design to support not less than a 340 kg (750 pound) working load at any point.
2. Fabricate trapeze supports as shown, with all exposed members, including screws, nuts, bolts and washers, fabricated of stainless steel.
3. Fabricate concealed components of structural steel shapes unless shown otherwise.
4. Stainless steel ceiling plate drilled for eye bolt.
5. Continuously weld connections where welds shown.
6. Use modular channel where shown with manufacturers bolts and fittings.
 - a. Weld ends of steel angle braces to steel plates and secure to modular channel units as shown. Drill plates for anchor bolts.
 - b. Fabricate eye bolt, special clamp bolt, and plate closure full length of modular channel at ceiling line and secure to modular channel unit with manufacturers standard fittings.

- E. For Intravenous Track and Cubical Curtain Track:
 - 1. Fabricate assembly of steel angle as shown.
 - 2. Drill angle bent ends for anchor screws to acoustical suspension system and angle for hanger wires.
 - 3. Provide pipe sleeve welded to angle.
- F. Supports at Ceiling for Radiographic (x-ray) Equipment:
 - 1. Fabricate hangers braces, and track of modular channel units assembly as shown.
 - 2. Fabricate steel plates for anchor to structure above.
 - 3. Drill bent plates for bolting at mid height at concrete beams.
- G. For Operating Room Light:
 - 1. Fabricate as shown to suit equipment furnished.
 - 2. Drill leveling plate for light fixture bolts.
- H. Supports in Orthopedic Brace Shop:
 - 1. Fabricate from 25 mm (one inch) steel pipe, fasten to steel angles above and extend to a point 150 mm (6 inches) below finished ceiling.
 - 2. Lower end of the pipe shall have a standard pipe thread.
 - 3. Provide an escutcheon plate at ceiling.
- I. Supports for Accordion Partition Tracks, Exercise Equipment, and Items at Various Conditions at Suspended Ceilings:
 - 1. Fabricate of structural steel shapes as shown.
 - 2. Drill for anchor bolts of suspended item.
- J. Supports for Communion Rail Posts in Chapel:
 - 1. Fabricate one steel plate support for each post as shown.
 - 2. Drill for fasteners.

2.6 FRAMES

- A. Elevator Entrance Wall Opening.
 - 1. Fabricate of channel shapes, plates, and angles as shown.
 - 2. Weld or bolt head to jamb as shown.
 - 3. Weld clip angles to bottom of frame and top of jamb members extended to structure above for framed construction.
 - a. Provide holes for anchors.
 - b. Weld head to jamb members.
- B. Channel Door Frames:
 - 1. Fabricate of structural steel channels of size shown.
 - 2. Miter and weld frames at corners.

3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.
 4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
 5. Where closure plates are shown, continuously weld them to the channel flanges.
 6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
 7. Prepare frame for installation of hardware specified in Section 08 71 00, DOOR HARDWARE.
 - a. Cut a slot in the lock jamb to receive the lock bolt.
 - b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 450 mm (18 inches) on center.
- C. Frames for Breech Opening:
1. Fabricate from steel channels, or combination of steel plates and angles to size and contour shown.
 2. Weld strap anchors on back of frame at not over 600 mm (2 feet) on centers for concrete or masonry openings.
- D. Frames for Lead Lined Doors:
1. Obtain accurate dimensions and templates from suppliers of lead lined doors, finish hardware, and hollow steel door frames.
 2. Fabricate as shown for use in connection with lead lined doors.
 3. Deliver assembled frames with removable shipping spreaders at top and bottom.
 4. Extend angles at jambs from floor to structural slab above. At floors of interstitial spaces, terminate jamb sections and provide anchors as shown.

5. Continuously weld plates and reinforcements to frame members and head members of angle frames between jambs.
6. Weld strap anchors, not over 600 mm (24 inches) on centers, to the back of angles for embedment in masonry or concrete unless shown otherwise.
7. Type 15 Door Frames:
 - a. Structural steel angle frames with plate or bar full height to heads. Extend reinforcing at hinge cutouts two inches beyond cutout.
 - b. Fabricate top anchorage to beam side at mid height.
 - c. Weld clip angles to both legs of angle at top and bottom.
 - d. Drill clips and plates, at top and bottom for anchoring jamb angles with two 9 mm (3/8 inch) expansion bolts at each location.
 - e. Cut rabbet for pivot hinges and lock strike.

2.7 GUARDS - RESERVED

2.8 COVERS AND FRAMES FOR PITS AND TRENCHES

- A. Fabricate covers to support live loads specified.
- B. Galvanized steel members after fabrication in accordance with ASTM A123, G-90 coating.
- C. Steel Covers:
 1. Use 6 mm (1/4 inch) thick floor plate for covers unless otherwise shown. Use gratings where shown as specified in paragraph GRATINGS. Use smooth floor plate unless noted otherwise.
 2. Provide clearance at all sides to permit easy removal of covers.
 3. Make cutouts within 6 mm (1/4 inch) of penetration for passage of pipes and ducts.
 4. Drill covers for flat head countersunk screws.
 5. Make cover sections not to exceed 2.3 m² (25 square feet) in area and 90 kg (200 pounds) in weight.
 6. Fabricate trench cover sections not be over 900 mm (3 feet) long and if width of trench is more than 900 mm (3 feet) or over, equip one end of each section with an angle or "T" bar stiffener to support adjoining plate.
 7. Use two, 13 mm (1/2 inch) diameter steel bar flush drop handles for each cover section.
- D. Cast Iron Covers
 1. Fabricate covers to support live loads specified.

2. Fabricate from ASTM A48, cast-iron, 13 mm (1/2 inch) minimum metal thickness, cast with stiffeners as required.
3. Fabricate as flush type with frame, reasonably watertight and be equipped with flush type lifting rings. Provide seals where watertight covers noted.
4. Make covers in sections not over 90 kg (200 pounds) except round covers.

E. Steel Frames:

1. Form frame from structural steel angles as shown. Where not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles for frame openings over 1200 mm (4 feet) long and 50 x 50 x 6 mm (2 ix 2 x 1/4 inch) for frame openings less than 1200 mm (4 feet).
2. Fabricate intermediate supporting members from steel "T's" or angles; located to support cover section edges.
3. Where covers are required use steel border bars at frames so that top of cover will be flush with frame and finish floor.
4. Weld steel strap anchors to frame. Space straps not over 600 mm (24 inches) o.c., not shown otherwise between end anchors. Use 6 x 25 x 200 mm (1/4 x 1 x 8 inches) with 50 mm (2 inch) bent ends strap anchors unless shown otherwise.
5. Drill and tap frames for screw anchors where plate covers occur.

F. Cast Iron Frames:

1. Fabricate from ASTM A48 cast iron to shape shown.
2. Provide anchors for embedding in concrete, spaced near ends and not over 600 mm (24 inches) apart.

2.9 GRATINGS

- A. Fabricate gratings to support live loads specified and a concentrated load as specified.
- B. Provide clearance at all sides to permit easy removal of grating.
- C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.
- D. Fabricate in sections not to exceed 2.3 m² (25 square feet) in area and 90 kg (200 pounds) in weight.
- E. Fabricate sections of grating with end-banding bars.
- F. Fabricate angle frames and supports, including anchorage as shown.
 1. Fabricate intermediate supporting members from "T's" or angles.

2. Locate intermediate supports to support grating section edges.
3. Fabricate frame to finish flush with top of grating.
4. Locate anchors at ends and not over 600 mm (24 inches) o.c.
5. Butt or miter, and weld angle frame at corners.

G. Steel Bar Gratings:

1. Fabricate grating using steel bars, frames, supports and other members shown in accordance with Metal Bar Grating Manual.
2. Galvanize steel members after fabrication in accordance with ASTM A123, G-90 for exterior gratings, gratings in concrete floors, and interior grating where specified.
3. Interior gratings: Prime paint unless specified galvanized.
4. Use riveted grating in the following areas: catch basin

H. Aluminum Bar Gratings:

1. Fabricate grating and frame assembly from aluminum as shown in accordance with Metal Bar Grating Manual.
2. Use 25 x 5 mm (1 x 3/16 inch) minimum size bearing bars.
3. Mill finish unless specified otherwise.

I. Plank Gratings:

1. Conform to Fed. Spec. RR-G-1602.
2. Manufacturers standard widths, lengths and side channels to meet live load requirements.
3. Galvanize exterior steel gratings ASTM A123, G-90 after fabrication.
4. Fabricate interior steel gratings from galvanized steel sheet, ASTM A525, where bearing on concrete or masonry.
5. Fabricate other interior grating from steel sheet and finish with shop prime paint. Prime painted galvanized sheet may be used.

J. Cast Iron Gratings:

1. Fabricate gratings to support a live load of 23940 Pa (500 pounds per square foot).
2. Fabricate gratings and frames for gutter type drains from cast-iron conforming to ASTM A48.
3. Fabricate gratings in section not longer than 1200 mm (4 feet) or over 90 kg (200 pounds) and fit so as to be readily removable.

2.10 LOOSE LINTELS

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.

- B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.
- C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
 - 1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
 - 2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- E. Provide bearing plates for lintels where shown.
- F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.
- G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.
- H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.
- I. Elevator Entrance:
 - 1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 100 mm (4 inch) bearing each end.
 - 2. Cut away the front leg of the channel at each end to allow for concealment behind elevator hoistway entrance frame.

2.11 SHELF ANGLES

- A. Fabricate from steel angles of size shown.
- B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.
- C. Provide adjustable malleable iron inserts for embedded in concrete framing.

2.12 PLATE DOOR SILL - RESERVED

2.13 SAFETY NOSINGS - RESERVED

2.14 LADDERS

- A. Steel Ladders:
 - 1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.

2. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.
3. Provide holes for anchoring with expansion bolts through turned ends and brackets.
4. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
5. Galvanize exterior ladders after fabrication, ASTM A123, G-90.

B. Aluminum Ladders:

1. Fixed-rail type, constructed of structural aluminum, with mill finish.
2. Fabricate side rails and rungs of size and design shown, with the rungs shouldered and headed into and welded to the rails.
3. Where shown fabrication side rails curved, twisted and formed into gooseneck.
4. Fabricate angle brackets at top and bottom and intermediate brackets where shown. Drill for bolting.

C. Ladder Rungs:

1. Fabricate from 25 mm (one inch) diameter steel bars.
2. Fabricate so that rungs will extend at least 100 mm (4 inches) into wall with ends turned 50 mm (2 inches), project out from wall 175 mm (7 inches), be 400 mm (16 inches) wide and be designed so that foot cannot slide off end.
3. Galvanized after fabrication, ASTM A123, G-90 rungs for exterior use and for access to pits.

2.15 RAILINGS

- A. In addition to the dead load design railing assembly to support live load specified.
- B. Fabrication General:
 1. Provide continuous welded joints, dressed smooth and flush.
 2. Standard flush fittings, designed to be welded, may be used.
 3. Exposed threads will not be approved.
 4. Form handrail brackets to size and design shown.
 5. Exterior Post Anchors.
 - a. Fabricate tube or pipe sleeves with closed ends or plates as shown.

- b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
 - c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
 - 6. Interior Post Anchors:
 - a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
 - b. Weld or thread flanged fitting to posts at base.
 - c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
 - d. Provide sliding flange base plate on posts secured with set screws.
 - e. Weld flange base plate to removable posts set in sleeves.
- C. Handrails:
 - 1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
 - 2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.
- D. Steel Pipe Railings:
 - 1. Fabricate of steel pipe with welded joints.
 - 2. Number and space of rails as shown.
 - 3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
 - 4. Form handrail brackets from malleable iron.
 - 5. Fabricate removable sections with posts at end of section.
 - 6. Removable Rails:
 - a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
 - b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
 - c. Continuously weld brackets to post.
 - d. Provide slotted bolt holes in rail bracket.
 - e. Weld bolt heads flush with top of rail.

- f. Weld flanged fitting to post where posts are installed in sleeves.
- 7. Opening Guard Rails:
 - a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
 - b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
 - c. Fabricate rails for floor openings for anchorage in sleeves.
- 8. Gates:
 - a. Fabricate from steel pipe as specified for railings.
 - b. Fabricate gate fittings from either malleable iron or wrought steel.
 - c. Hang each gate on suitable spring hinges of clamp on or through bolted type. Use bronze hinges for exterior gates.
 - d. Provide suitable stops, so that gate will swing as shown.
- 9. Chains:
 - a. Chains: ASTM A391, Grade 63, straight link style, normal size chain bar 8 mm (5/16 inch) diameter, eight links per 25 mm (foot) and with boat type snap hook on one end, and through type eye bolt on other end.
 - b. Fabricate eye bolt for attaching chain to pipe posts, size not less than 9 mm (3/8 inch) diameter.
 - c. Fabricate anchor at walls, for engagement of snap hook of either a 9 mm (3/8 inch) diameter eye bolt or punched angle.
 - d. Galvanize chain and bolts after fabrication.
- E. Aluminum Railings:
 - 1. Fabricate from extruded aluminum.
 - 2. Use tubular posts not less than 3 mm (0.125 inch) wall thickness for exterior railings.
 - 3. Punch intermediate rails and bottom of top rails for passage of posts and machine to a close fit.
 - 4. Where shown use extruded channel sections for top rail with 13 mm (1/2 inch) thick top cover plates and closed ends.
 - 5. Fabricate brackets of extruded or wrought aluminum as shown.
 - 6. Fabricate stainless pipe sleeves with closed bottom at least six inches deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of posts where set in concrete.
- F. Stainless Steel Railings:

1. Fabricate from 38 mm (1-1/2 inches) outside diameter stainless steel tubing, ASTM A269, having a wall thickness of 1.6 mm (0.065 inch).
2. Join sections by an internal connector to form hairline joints where field assembled.
3. Fabricate with continuous welded connections.
4. Fabricate brackets of stainless steel to design shown.
5. Fabricate stainless steel sleeves at least 150 mm (6 inches) deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of post.

2.16 CATWALKS - RESERVED

2.17 TRAP DOOR AND FRAMES WITH CEILING HATCH

- A. Design to support a live load as specified.
- B. Frames:
 1. Fabricate steel angle frame to set in concrete slabs and design to set flush with finished concrete slab or curb. If not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles.
 2. Miter steel angles at corners and weld together.
 3. Weld steel bar stops to vertical leg of frame, to support doors flush with the top of the frame.
 4. Weld steel strap anchors on each side not over 600 mm (24 inches) on center to the backs of the frames. If not shown use 6 x 50 x 200 mm (1/4 x 2 x 8 inch) long straps with 50 mm (2 inch bent) ends.
 5. Form frames from steel angles with welded corners for reinforcing and bracing of well lining and support of ceiling hatch.
- C. Covers:
 1. Use 6 mm (1/4 inch) thick steel floor plate.
 2. Where double leaf covers are shown, reinforce at meeting edges.
 3. Use wrought steel hinges with fixed brass pins.
 - a. Weld to cover.
 - b. Secure to frame with machine screws.
 4. Where ladders occur, install hinges on the side opposite the ladder.
 5. Provide two bar type drop handles, flush with cover when closed for each leaf.
- D. Well Lining:
 1. Fabricate well linings, for access through concrete floor slabs and suspended ceilings, from hatch to ceiling hatch or ceiling openings.

2. Use steel sheet and shapes of size and thickness as shown. If not shown use 1.5 mm (0.0598 inch) thick steel sheet.
3. If not shown use 50 x 50 x 6 mm (2 x 2 x 1/4 inch) angle braces from ceiling level on each side angled at 45 degrees to structure above.
4. Use 25 x 25 x 3 mm (1 x 1 x 1/8 inch) angle bottom flange trim welded to well lining where no ceiling hatch occurs.

E. Ceiling Hatch:

1. Construct hatch with "T" or angle frame designed to support edge of ceiling and hatch, weld to well lining.
2. Form hatch panels of 3 mm (1/8 inch) steel, 5 mm (3/16 inch) aluminum or 1 mm (0.0359 inch) thick steel of pan type construction with 25 mm (one inch) of mineral fiber insulation between.
3. Use counter balance device, hinges, latch, hangers and other accessories required for installation and operation of hatch with not over 90 N (20 pounds) of force.
4. Fabricate panels flush and reinforced to remain flat.
5. Locate hatch panel flush with frame.

F. Finish with baked on prime coat.

2.18 SIDEWALK DOOR - RESERVED

2.19 SCREENED ACCESS DOORS AND FRAMES - RESERVED

2.20 STEEL COUNTER OR BENCH TOP FRAME AND LEGS

2.21 STEEL PIPE BOLLARD

Provide bollard in accordance with ASTM A53 with dimensions as shown in standard detail SD320523-04. Anchor posts in concrete and fill solidly with concrete with a minimum compressive strength of 17 MPa 2500psi.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
 1. Provide temporary bracing for such items until concrete or masonry is set.
 2. Place in accordance with setting drawings and instructions.
 3. Build strap anchors, into masonry as work progresses.

- C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
 - 1. Design and finish as specified for shop welding.
 - 2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.
- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

- A. Anchorage to structure.
 - 1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
 - 2. Secure supports to concrete inserts by bolting or continuous welding as shown.
 - 3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
 - 4. Secure steel plate or hat channels to studs as detailed.
- B. Ceiling Hung Toilet Stalls:
 - 1. Securely anchor hangers of continuous steel channel above pilasters to structure above.
 - 2. Bolt continuous steel angle at wall to masonry or weld to face of each metal stud.
 - 3. Secure brace for steel channels over toilet stall pilasters to wall angle supports with bolts at each end spaced as shown.
 - 4. Install diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.
 - 5. Install stud bolts in lower flange of channel before installing furred down ceiling over toilet stalls.

6. Install support for ceiling hung pilasters at entrance screen to toilet room similar to toilet stall pilasters.

C. Supports for Wall Mounted items:

1. Locate center of support at anchorage point of supported item.
2. Locate support at top and bottom of wall hung cabinets.
3. Locate support at top of floor cabinets and shelving installed against walls.
4. Locate supports where required for items shown.

D. Support at Ceiling for X-ray Tube Stand and Radiographic Equipment:

1. Bolt modular steel channel frames to hangers as shown, anchored to structure above.
2. Fasten frames with modular channel manufacturers fittings, bolts, and nuts. Space modular channel supports and hangers as shown and as required to suit equipment furnished.
3. Install closure plates in channels at ceiling where channel opening is visible. Coordinate and cut plates to fit tight against equipment anchors after equipment anchors are installed.

E. Ceiling Support for Operating Light:

1. Anchor support to structure above as shown.
2. Set leveling plate as shown level with ceiling.
3. Secure operating light to leveling plate in accordance with light manufacturer's requirements.

F. Supports for intravenous (IV) Track and Cubicle Curtain Track:

1. Install assembly where shown after ceiling suspension grid is installed.
2. Drill angle for bolt and weld nut to angle prior to installation of tile.

G. Support for cantilever grab bars:

1. Locate channels or tube in partition for support as shown, and extend full height from floor to underside of structural slab above.
2. Anchor at top and bottom with angle clips bolted to channels or tube with two, 9 mm (3/8 inch) diameter bolts.
3. Anchor to floors and overhead construction with two 9 mm (3/8 inch) diameter bolts.
4. Fasten clips to concrete with expansion bolts, and to steel with machine bolts or welds.

H. Supports for Trapeze Bars:

1. Secure plates to overhead construction with fasteners as shown.

2. Secure angle brace assembly to overhead construction with fasteners as shown and bolt plate to braces.
3. Fit modular channel unit flush with finish ceiling, and secure to plate with modular channel unit manufacturer's standard fittings through steel shims or spreaders as shown.
 - a. Install closure plates in channel between eye bolts.
 - b. Install eyebolts in channel.
- I. Support for Communion Rail Posts:
 1. Anchor steel plate supports for posts as shown.
 2. Use four bolts per plate, locate two at top and two at bottom.
 3. Use lag bolts.

3.3 COVERS AND FRAMES FOR PITS AND TRENCHES

- A. Set frame and cover flush with finish floor.
- B. Secure plates to frame with flat head countersunk screws.
- C. Set gratings loose in drainage trenches or over pits unless shown anchored.

3.4 FRAMES FOR LEAD LINED DOORS

- A. Secure jamb angle clips and plates, at top and bottom with two, 9 mm (3/8 inch) expansion bolts to concrete.
- B. Secure 150 x 90 x 13 mm (6 x 3-1/2 x 1/2 inch) angle to steel framing for anchorage when expansion bolts to concrete is not possible.
- C. Secure clips by welding to steel.
- D. At interstitial spaces, anchor jamb angles as shown.

3.5 DOOR FRAMES

- A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.
- B. Level and plumb frame; brace in position required.
- C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.
- D. Set frames in formwork for frames cast into concrete.
- E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

3.6 OTHER FRAMES

- A. Set frame flush with surface unless shown otherwise.
- B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.
- C. Set in formwork before concrete is placed.

3.7 GUARDS - RESERVED

3.8 GRATINGS

- A. Set grating flush with finish floor; top of curb, or areaway wall. Set frame so that horizontal leg of angle frame is flush with face of wall except when frame is installed on face of wall.
- B. Set frame in formwork before concrete is placed.
- C. Where grating terminates at a wall bolt frame to concrete or masonry with expansion bolts unless shown otherwise.
- D. Secure removable supporting members in place with stainless steel bolts.
- E. Bolt gratings to supports.

3.9 STEEL LINTELS

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.
- C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

3.10 SHELF ANGLES

- A. Anchor shelf angles with 19 mm (3/4 inch) bolts unless shown otherwise in adjustable malleable iron inserts, set level at elevation shown.
- B. Provide expansion space at end of members.

3.11 PLATE DOOR SILL

- A. Install after roofing base flashing and counter flashing work is completed.
- B. Set in sealant and bolt to curb.

3.12 SAFETY NOSINGS

- A. Except as specified and where preformed rubber treads are shown or specified install safety nosings at the following:
 - 1. Exterior concrete steps.
 - 2. Door sills of areaway entrances curbs.
 - 3. Exposed edges of curbs of door sills at transformer and service rooms.
 - 4. Interior concrete steps, including concrete filled treads of metal stairs of service stairs.
- B. Install flush with horizontal and vertical surfaces.
- C. Install nosing to within 100 mm (4 inches) of ends of concrete stair treads, except where shown to extend full width.

- D. Extend nosings full width of door openings.
- E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.13 LADDERS

- A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.
- B. In elevator pits, set ladders to clear all elevator equipment where shown on the drawings.
 - 1. Where ladders are interrupted by division beams, anchor ladders to beams by welding, and to floors with expansion bolts.
 - 2. Where ladders are adjacent to division beams, anchor ladders to beams with bent steel plates, and to floor with expansion bolts.
- C. Ladder Rungs:
 - 1. Set ladder rungs into formwork before concrete is placed. // Build ladder rungs into masonry as the work progresses. //
 - 2. Set step portion of rung 150 mm (6 inches) from wall.
 - 3. Space rungs approximately 300 mm (12 inches) on centers.
 - 4. Where only one rung is required, locate it 400 mm (16 inches) above the floor.

3.14 RAILINGS

- A. Steel Posts:
 - 1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
 - 2. Install sleeves in concrete formwork.
 - 3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS—on exterior posts.
 - 4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
 - 5. Secure sliding flanged fittings to posts at base with set screws.
 - 6. Secure fixed flanged fittings to concrete with expansion bolts.
 - 7. Secure posts to steel with welds.
- B. Aluminum Railing, Stainless Steel Railing, and Ornamental Railing Posts:

1. Install pipe sleeves in concrete formwork.
2. Set posts in sleeve and pour grout to surface on exterior locations and to within 6 mm (1/4 inch) of surface for interior locations except to where posts are required to be removable.
3. Apply beveled bead of urethane sealant over sleeve at post perimeter for exterior posts and flush with surface for interior posts as specified in Section 07 92 00, JOINT SEALANTS.

C. Anchor to Walls:

1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
 - a. Anchor steel plate to concrete or solid masonry with expansion bolts.
 - b. Anchor steel plate to hollow masonry with toggle bolts.
2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

D. Removable Rails:

1. Rest rails in brackets at each end and secure to bracket with stainless steel bolts and nuts where part of a continuous railing.
2. Rest rail posts in sleeves where not part of a continuous railing. Do not grout posts.

E. Gates:

1. Hang gate to swing as shown.
2. Bolt gate hinges to jamb post with clamp on or through bolts.

F. Chains:

1. Eye bolt chains to pipe posts.
2. Eye bolt anchoring at walls.
 - a. Expansion bolt to concrete or solid masonry.
 - b. Toggle bolt to hollow masonry of frame wall installed support.

G. Handrails:

1. Anchor brackets for metal handrails as detailed.
2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
3. Expansion bolt to concrete or solid masonry.
4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.15 CATWALK AND PLATFORMS - RESERVED

3.16 SIDEWALK DOOR, TRAP DOORS, AND FRAMES

- A. Set frame flush with finished concrete slab or curb.
- B. Secure well linings to structure with expansion bolts unless shown otherwise.
- C. Bolt ceiling hatch to well lining angle brace and to angle iron frames near corners and 300 mm (12 inches) on centers with not less than 9 mm (3/8 inch) roundhead machine screws.
- D. Coordinate sidewalk door drain connections with plumbing work.

3.17 SCREENED ACCESS DOOR - RESERVED

3.18 STEEL COMPONENTS FOR MILLWORK ITEMS

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

3.19 INSTALLATION OF STEEL PIPE BOLLARD

Set bollards vertically in concrete piers. Compressive strength of concrete piers shall be 21MPa 3000psi. For dimensions of concrete piers See standard detail SD320523-04.

3.20 CLEAN AND ADJUSTING

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

- - - E N D - - -

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.2 RELATED WORK:

- A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.
- C. Manufacturer's Literature and Data:
 - 1. Submit data for lumber, panels, hardware and adhesives.
 - 2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.
- E. Manufacturer's certificate for unmarked lumber.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having

firmly constructed over hanging roof with sufficient end wall to
protect lumber from driving rain.

1.5 QUALITY ASSURANCE:

- A. Installer: A firm with a minimum of three (3) years' experience in the
type of work required by this section.

1.6 GRADING AND MARKINGS:

- A. Any unmarked lumber or plywood panel for its grade and species will not
be allowed on VA Construction sites for lumber and material not
normally grade marked, provide manufacturer's certificates (approved by
an American Lumber Standards approved agency) attesting that lumber and
material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent
referenced. Publications are referenced in the text by basic
designation only.
- B. American Forest and Paper Association (AFPA):
NDS-15.....National Design Specification for Wood
Construction
WCD1-01.....Details for Conventional Wood Frame
Construction
- C. American Institute of Timber Construction (AITC):
A190.1-07.....Structural Glued Laminated Timber
- D. American Society of Mechanical Engineers (ASME):
B18.2.1-12(R2013).....Square and Hex Bolts and Screws
B18.2.2-10.....Square and Hex Nuts
B18.6.1-81(R2008).....Wood Screws
- E. American Plywood Association (APA):
E30-11.....Engineered Wood Construction Guide
- F. ASTM International (ASTM):
A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-
Iron Alloy Coated (Galvannealed) by the Hot Dip
Process
C954-11.....Steel Drill Screws for the Application of
Gypsum Board or Metal Plaster Bases to Steel
Studs from 0.033 inch (2.24 mm) to 0.112-inch
(2.84 mm) in thickness

- C1002-14.....Steel Self-Piercing Tapping Screws for the
Application of Gypsum Panel Products or Metal
Plaster Bases to Wood Studs or Metal Studs
- D198-14.....Test Methods of Static Tests of Lumber in
Structural Sizes
- D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer
Matrix Composite Materials and Their Laminates
- D2559-12a.....Adhesives for Structural Laminated Wood
Products for Use Under Exterior (Wet Use)
Exposure Conditions
- D3498-03 (R2011).....Adhesives for Field-Gluing Plywood to Lumber
Framing for Floor Systems
- D6108-13.....Test Method for Compressive Properties of
Plastic Lumber and Shapes
- D6109-13.....Test Methods for Flexural Properties of
Unreinforced and Reinforced Plastic Lumber and
Related Products
- D6111-13a.....Test Method for Bulk Density and Specific
Gravity of Plastic Lumber and Shapes by
Displacement
- D6112-13.....Test Methods for Compressive and Flexural Creep
and Creep-Rupture of Plastic Lumber and Shapes
- F844-07a (R2013).....Washers, Steel, Plan (Flat) Unhardened for
General Use
- F1667-13.....Nails, Spikes, and Staples
- G. American Wood Protection Association (AWPA):
AWPA Book of Standards
- H. Commercial Item Description (CID):
A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self
Threading Anchors)
- I. Forest Stewardship Council (FSC):
FSC-STD-01-001 (Ver. 4-0) FSC Principles and Criteria for Forest
Stewardship
- J. Military Specification (Mil. Spec.):
MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated
- K. Environmental Protection Agency (EPA):
40 CFR 59 (2014).....National Volatile Organic Compound Emission
Standards for Consumer and Commercial Products

L. Truss Plate Institute (TPI):

TPI-85.....Metal Plate Connected Wood Trusses

M. U.S. Department of Commerce Product Standard (PS)

PS 1-95.....Construction and Industrial Plywood

PS 20-10.....American Softwood Lumber Standard

N. ICC Evaluation Service (ICC ES):

AC09.....Quality Control of Wood Shakes and Shingles

AC174.....Deck Board Span Ratings and Guardrail Systems
(Guards and Handrails)

PART 2 - PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.

1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.

2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.

2. Framing lumber: Minimum extreme fiber stress in bending of 7584 kPa (1100 PSI).

3. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.

4. Board Sub-flooring: Shiplap edge, 25 mm (1 inch) thick, not less than 203 mm (8 inches) wide.

C. Sizes:

1. Conforming to PS 20.

2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:

1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
 - a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
 - b. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:

1. Comply with Mil Spec. MIL-L-19140.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.2 PLASTIC LUMBER - RESERVED

2.3 PLYWOOD:

- A. Comply with PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
 1. APA rated Exposure 1 or Exterior; panel grade CD or better.
 2. Wall sheathing:
 - a. Minimum 9 mm (11/32 inch) thick with supports 406 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 610 mm (24 inches) on center unless specified otherwise.

- b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
- 3. Roof sheathing:
 - a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 406 mm (16 inches) on center unless specified otherwise.
 - b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 610 mm (24 inches) on center.
- D. Subflooring:
 - 1. Under finish wood flooring or underlayment:
 - a. APA Rated sheathing, Exposure 1. panel grade CD.
 - b. Minimum 15 mm (19/32 inch) thick with span rating 32/16 or greater for supports at 406 mm (16 inches) on center and 18.25 mm (23/32 inch) thick with span rating 48/24 for supports at 610 mm (24 inches) on center.
 - 2. Combination subflooring-underlayment under resilient flooring or carpet:
 - a. APA Rated Stud-I-Floor Exterior or Exposure 1, T and G.
 - b. Minimum 15 mm (19/32 inch) thick or greater, span rating 16, for supports at 406 mm (16 inches) on center; 18 mm (23/32 inch) thick or greater, span rating 24, for supports at 610 mm (24 inches) on center.
 - //c. Minimum 19 mm (3/4-inch) thick or greater, span rating 32, for supports at 812 mm (32 inches) on center; 28 mm (1-1/8 inch) thick, span rating 48 for supports at 1219 mm (48 inches) on center. //
- E. Underlayment:
 - 1. APA rated Exposure 1 or Exterior, panel grade C-C Plugged.
 - 2. Minimum 6 mm (1/4 inch) thick or greater over plywood subflooring // and 9 mm (3/8 inch) thick or greater over board subflooring, // unless otherwise shown.

2.4 STRUCTURAL-USE PANELS - RESERVED

2.5 ROUGH HARDWARE AND ADHESIVES:

- A. Anchor Bolts:
 - 1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.

2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).
- B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers
 1. ASTM F844.
 2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.
- D. Screws:
 1. Wood to Wood: ASME B18.6.1 or ASTM C1002.
 2. Wood to Steel: ASTM C954, or ASTM C1002.
- E. Nails:
 1. Size and type best suited for purpose unless noted otherwise. Provide aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
 2. ASTM F1667:
 - a. Common: Type I, Style 10.
 - b. Concrete: Type I, Style 11.
 - c. Barbed: Type I, Style 26.
 - d. Underlayment: Type I, Style 25.
 - e. Masonry: Type I, Style 27.
 - f. Provide special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.
- F. Framing and Timber Connectors:
 1. Fabricate of ASTM A653/A653M, Grade A; steel sheet not less than 1.3 mm (0.052 inch) thick unless specified otherwise. Apply standard plating to steel timber connectors after punching, forming and assembly of parts.
 2. Framing Angles: Angle designed with bendable legs to provide three (3) way anchors.
 3. Straps:
 - a. Designed to provide wind and seismic ties with sizes as shown or specified.
 - b. Strap ties not less than 32 mm (1-1/4 inches) wide.
 - c. Punched for fastener.

4. Joist Hangers:

- a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design unless shown otherwise.
- b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch) thick sheet, U design with bent top flange to lap over beam.

5. Timber Connectors: Fabricated of steel to shapes indicated on contract drawings.

6. Joist Ties: Mild steel flats, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) size with ends bent about 30 degrees from horizontal, and extending at least 406 mm (16 inches) onto framing. Punch each end for three (3) spikes.

7. Wall Anchors for Joists and Rafters:

- a. Mild steel strap, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) with wall ends bent 50 mm (2 inches), or provide 9 mm by 130 mm (3/8 inch by 5 inch) pin through strap end built into masonry.
- b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.
- c. Strap not less than 101 mm (4 inches) embedded end.

8. Joint Plates:

- a. Steel plate punched for nails.
- b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
- c. Size for axial eccentricity, and fastener loads.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:

- 1. AFPA NDS for timber connectors.
- 2. AITC A190.1 Timber Construction Manual for heavy timber construction.
- 3. AFPA WCD1 for nailing and framing unless specified otherwise.
- 4. APA for installation of plywood or structural use panels.
- 5. TPI for metal plate connected wood trusses.

B. Fasteners:

1. Nails.

- a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail

spacing sufficient to develop adequate strength for the connection without splitting the members.

- b. Use special nails with framing connectors.
- c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
- d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
- e. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.
- f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
- g. Nailing Schedule; Using Common Nails:
 - 1) Joist bearing on sill or girder, toe nail three (3) 8d nails or framing anchor.
 - 2) Bridging to joist, toe nail each end two (2) 8d nails.
 - 3) Ledger strip to beam or girder three (3) 16d nails under each joint.
 - 4) Subflooring or Sheathing:
 - a) 152 mm (6 inch) wide or less to each joist face nail two (2) 8d nails.
 - b) Subflooring, more than 152 mm (6 inches) wide, to each stud or joint, face nail three (3) 8d nails.
 - c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 152 mm (6 inches) on center and at intermediate supports 254 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 305 mm (12 inches) at supported edges and 508 mm (20 inches) o.c. at intermediate supports.
 - 5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 406 mm (16 inches) on center.
 - 6) Top plate to stud, end nail two (2) 16d nails.
 - 7) Stud to sole plate, toe nail or framing anchor. Four (4) 8d nails.
 - 8) Doubled studs, face nail 16d at 610 mm (24 inches) on center.
 - 9) Built-up corner studs 16d at 610 mm (24 inches) (24 inches) on center.
 - 10) Doubled top plates, face nails 16d at 406 mm (16 inches) on center.

- 11) Top plates, laps, and intersections, face nail two (2) 16d.
 - 12) Continuous header, two pieces 16d at 406 mm (16 inches) on center along each edge.
 - 13) Ceiling joists to plate, toenail three (3) 8d or framing anchor.
 - 14) Continuous header to stud, four (4) 16d.
 - 15) Ceiling joists, laps over partitions, face nail three (3) 16d or framing anchor.
 - 16) Ceiling joists, to parallel rafters, face nail three (3) 16d.
 - 17) Rafter to plate, toe nail three (3) 8d or framing anchor.
Brace 25 mm (1 inch) thick board to each stud and plate, face nail three (3) 8d.
 - 18) Built-up girders and beams 20d at 812 mm (32 inches) on center along each edge.
2. Bolts:
- a. Fit bolt heads and nuts bearing on wood with washers.
 - b. Countersink bolt heads flush with the surface of nailers.
 - c. Embed in concrete and solid masonry or provide expansion bolts.
Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
 - d. Provide toggle bolts to hollow masonry or sheet metal.
 - e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
- a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
 - b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
- a. Where shown or option to nails.
 - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
 - c. Spaced same as nails.

7. Installation of Timber Connectors:
 - a. Conform to applicable requirements of the AFPA NDS.
 - b. Fit wood to connectors and drill holes for fasteners so wood is not split.
- C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
 1. Space anchor bolts 1219 mm (4 feet) on centers between ends and within 152 mm (6 inches) of end. Stagger bolts from side to side on plates over 178 mm (7 inches) in width.
 2. Provide shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
 3. Closely fit, and set to required lines.
- D. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- E. Blocking Nailers, and Furring:
 1. Install furring, blocking, nailers, and grounds where shown.
 2. Provide longest lengths practicable.
 3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.
4. Layers of Blocking or Plates:
 - a. Stagger end joints between upper and lower pieces.
 - b. Nail at ends and not over 610 mm (24 inches) between ends.
 - c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

- - - E N D - - -

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior millwork for family prayer rooms (chapel) in hospitals.

B. Items specified:

1. // Seats and benches. //
2. // Communication Center Counter. //
3. // Folding Shelf: Dressing (Make-Up). //
4. // Counter Shelf. //
5. // Interview Booth. //
6. // Counter or Work Tops. //
7. // Wall Paneling. //
8. // Pegboard (Perforated Hardboard). //
9. // Mounting Strips, Shelves, and Rods. //
10. // Chair Rail. //
11. // Moldings and Staff Beads. //
12. // Base. //
13. // Wood Bumpers. //

1.2 RELATED REQUIREMENTS

- A. Adhesive, Paint, and Finish VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- B. Woodwork Finish and Color: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.
- D. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- E. Wood doors: Section 08 14 00, WOOD DOORS.
- F. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.
- G. Stock Casework: Section 12 32 00, MANUFACTURED WOOD CASEWORK.
- H. Other Countertops: Division 11, EQUIPMENT and Division 12, FURNISHINGS.
- I. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International:
 1. A36/A36M-14 - Carbon Structural Steel.

2. A53/A53M-12 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
 3. A240/A240M-15b - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 4. B26/B26M-14e1 - Aluminum-Alloy Sand Castings.
 5. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 6. E84-15b - Surface Burning Characteristics of Building Materials.
- C. American Hardboard Association (AHA):
1. A135.4-04 - Basic Hardboard.
- D. Architectural Woodwork Institute (AWI):
1. AWI-09 - Architectural Woodwork Quality Standards and Quality Certification Program.
- E. Builders Hardware Manufacturers Association (BHMA):
1. A156.9-10 - Cabinet Hardware.
 2. A156.11-14 - Cabinet Locks.
 3. A156.16-13 - Auxiliary Hardware.
- F. Federal Specifications (Fed. Spec.):
1. A-A-1922A - Shield Expansion (Calking Anchors, Single Lead).
 2. A-A-1936A - Adhesive, Contact, Neoprene Rubber.
 3. FF-N-836E- Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding.
 4. FF-S-111D(1) - Screw, Wood (Notice 1 inactive for new design).
 5. MM-L-736C(1) - Lumber, Hardwood.
- G. Hardwood Plywood and Veneer Association (HPVA):
1. HP1-09 - Hardwood and Decorative Plywood.
- H. Military Specification (Mil. Spec):
1. MIL-L-19140E - Lumber and Plywood, Fire-Retardant Treated.
- I. National Particleboard Association (NPA):
1. A208.1-09 - Wood Particleboard.
- J. National Electrical Manufacturers Association (NEMA):
1. LD 3-05 - High-Pressure Decorative Laminates.
- K. U.S. Department of Commerce, Product Standard (PS):
1. PS1-07 - Construction and Industrial Plywood.
 2. PS20-10 - American Softwood Lumber Standard.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. // Architect/Engineer. // and Interior Designer. //
 - c. // VA Interior Designer. //
 - d. Contractor.
 - e. Installer.
 - 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.
 - e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Other items affecting successful completion.
 - 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
 - 2. Millwork items - Half full size scale for sections and details 1: 50 (1/4 inch) for elevations and plans.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - a. Finish hardware.
 - b. Sinks with fittings.
 - c. Electrical components.
 - 2. List of acceptable sealers for fire retardant materials.
 - 3. Installation instructions.
- D. Samples:

1. Plastic Laminate Finished Plywood and Particleboard: 150 mm by 300 mm (6 by 12 inches) // long // square //, each type and color //.
 - a. Submit quantity required to show full color // and texture // range.
 2. Approved samples may be incorporated into work.
- E. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
 2. Low Pollutant-Emitting Materials:
 - a. Show volatile organic compound types and quantities.
 - b. Certify each // composite wood // and agrifiber // product contains no added urea formaldehyde.
- F. Certificates: Certify // each product complies // products comply // with specifications.
1. Fire retardant treatment of materials.
 2. Moisture content of materials.
- G. Qualifications: Substantiate qualifications comply with specifications.
1. Fabricator // with project experience list //.
 2. Installer // with project experience list //.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications:
1. Regularly fabricates specified products.
 2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
 - a. // Project Experience List: Provide contact names and addresses for completed projects. //
- B. Installer Qualifications:
1. Regularly installs specified products.
 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. // Project Experience List: Provide contact names and addresses for completed projects. //

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original sealed packaging.

- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, // color, // production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.
- D. Store products indoors in dry, weathertight // conditioned // facility.
- E. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
 - 2. Work Area Ambient Conditions: HVAC systems are complete, operational, and maintaining facility design operating conditions continuously, beginning 48 hours before installation until Government occupancy.
 - 3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.
 - 4. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.
- B. Field Measurements: Verify field conditions affecting // _____ // fabrication and installation. Show field measurements on Submittal Drawings.
 - 1. Coordinate field measurement and fabrication schedule to avoid delay.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Design acoustical panel complying with specified performance:
 - 1. Surface Burning Characteristics: When tested according to ASTM E84.
 - a. Flame Spread Rating: // 25 // 75 // 200 // maximum.
 - b. Smoke Developed Rating: 450 maximum.

2.2 MATERIALS

- A. Grading and Marking: Factory mark with grade stamp lumber and plywood of inspection agency approved by the Board of Review, American Lumber Standard Committee.
- B. Lumber:
 - 1. Sizes:
 - a. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes within manufacturing tolerances allowed by the standard under which product is produced.
 - b. Millwork, standing and running trim, and rails: Actual size as shown or specified.
 - 2. Hardwood: MM-L-736, species as specified for each item.
 - 3. Softwood: PS-20, exposed to view appearance grades:
 - a. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
 - b. Use Prime for painted or opaque finish.
 - 4. Use edge grain Wood members exposed to weather.
 - 5. Moisture Content:
 - a. 32 mm (1-1/4 inches) or less nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
 - b. Other materials: According to standards under which the products are produced.
 - 6. Fire Retardant Treatment: Mil. Spec. MIL-L-19140E.
 - a. Treatment and performance inspection by an independent and qualified testing agency that establishes performance ratings.
 - b. Each piece of treated material bear identification of the testing agency and indicate performance according to such rating of flame spread and smoke developed.
 - c. Treat wood for maximum flame spread of 25 and smoke developed of 25.
 - d. Fire Resistant Softwood Plywood:
 - 1) Grade A, Exterior, plywood for treatment.
 - 2) Surface Burning Characteristics: When tested according to ASTM E84.
 - a) Flame spread: 0 to 25.
 - b) Smoke developed: 100 maximum.
 - e. Fire Resistant Hardwood Plywood:

- 1) Core: Fire retardant treated softwood plywood.
- 2) Hardwood face and back veneers untreated.
- 3) Factory seal panel edges.

C. Plywood:

1. Softwood Plywood: DOC PS1.
 - a. Plywood, 13 mm (1/2 inch) and thicker; minimum five ply construction, except 32 mm (1-1/4 inch) thick plywood minimum seven ply.
 - b. Plastic Laminate Plywood Cores:
 - 1) Exterior Type, and species group.
 - 2) Veneer Grade: A-C.
 - c. Shelving Plywood:
 - 1) Interior Type, any species group.
 - 2) Veneer Grade: A-B or B-C.
 - d. Other: As specified for item.
2. Hardwood Plywood: HPVA: HP.1.
 - a. Species of Face Veneer: As shown or as specified with each particular item.
 - b. Grade:
 - 1) Transparent Finish: Type II (interior) A grade veneer.
 - 2) Paint Finish: Type II (interior) Sound Grade veneer.
 - c. Species and Cut: Plain sliced red oak // rotary cut white birch // unless specified otherwise.

D. Particleboard: NPA A208.1, // Type 1, Grade 1-M-3 // Type 2, Grade 2-M-2 //.

1. Plastic Laminate Particleboard Cores:
 - a. // Type 1, Grade 1-M-3, // Type 2, Grade 2-M-2, // unless otherwise specified.
 - b. // Type 2, Grade 2-M-2, exterior bond, for tops with sinks. //

E. Building Board (Hardboard):

1. ANSI/AHA A135.4, 6 mm (1/4 inch) thick unless specified otherwise.
2. Perforated hardboard (Pegboard): Type 1, Tempered perforated 6 mm (1/4 inch) diameter holes, on 25 mm (1 inch) centers each way, smooth surface one side.
3. // Wall paneling at gas chain rack: Type 1, tempered, Fire Retardant treated, smooth surface on side. //

F. Plastic Laminate: NEMA LD-3.

1. Exposed Laminate Surfaces including Countertops, and Sides of Cabinet Doors: Grade HGL.
2. Cabinet Interiors including Shelving: NEMA, CLS as a minimum, with the following:
 - a. Plastic laminate clad plywood or particle board.
 - b. Resin impregnated decorative paper thermally fused to particle board.
3. Plastic Laminate Covered Wood Tops Backing: Grade HGP.
4. Postformed Surfaces: Grade HGP.
- G. Stainless Steel: ASTM A240, Type 302 or 304.
- H. Cast Aluminum: ASTM B26.
- I. Extruded Aluminum: ASTM B221.

2.3 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer // and from one production run //.
- C. Sustainable Construction Requirements:
 1. // _____ // Recycled Content: // _____ // percent // post-consumer // total // recycled content, minimum. // Select products with recycled content to achieve overall Project recycled content requirement. //
 2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS for the following products:
 - a. Non-flooring adhesives and sealants.
 - b. Aerosol adhesives.
 - c. Paints and coatings.
 - d. Wall base and accessories.
 - e. Composite wood and agrifiber.
- D. Acoustical Panel: Fabric-covered glass fiber panel.
 1. NRC 19 mm (3/4 inch) adhesive mounting direct to substrate.
 2. Glass Fiber Panel: 25 mm (1 inch) thick minimum, self-supporting of density required for minimum NRC.
 3. Fabric: Bonded directly to glass fiber panel face, flat wrinkle-free surface, stain and soil resistant.
 4. Adhesive: As recommended by panel manufacturers.

2.4 FABRICATION

A. General:

1. AWI Custom Grade for interior millwork.
2. Finish woodwork, free from pitch pockets.
3. Trim, standard stock molding and members of same species, except where special profiles are shown.
4. Plywood, minimum 13 mm (1/2 inch), unless otherwise shown on Drawings or specified.
5. Edges of members in contact with concrete or masonry having a square corner caulking rebate.
6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
7. Fabricate interior trim and items of millwork to be painted from jointed, built-up, or laminated members, unless otherwise shown on Drawings or specified.
8. Plastic Laminate Work:
 - a. Factory glued to either a plywood or a particle board core, thickness as shown on Drawings or specified.
 - b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown on drawings or specified. Use plastic molded edge strips on 19 mm (3/4 inch) thick or thinner core material.
 - c. Provide plastic backing sheet on underside of countertops, vanity tops, thru-wall counter // and sills // including back splashes and end splashes of countertops.
 - d. Use backing sheet on concealed large panel surface when decorative face does not occur.

B. Seats and Benches:

1. Fabricate from 50 mm (2 inch) stock strips of plain-sawed White Oak, or Maple.
2. Solid seats securely glued together of spliced, doweled, or double tongued and grooved wood pieces. Where open joints are indicated, work each wood piece from solid stock.
3. Round top edges and corners where exposed.

C. Mounting Strips, Shelves and Rods:

1. Cut mounting strips from softwood stocks, 25 mm by 100 mm (1 by 4 inches), exposed edge slightly rounded.

2. Cut wood shelf from softwood 1 inch stock, of width shown, exposed edge slightly rounded.
 - a. Option: Provide 19 mm (3/4 inch) thick plywood with 19 mm (3/4 inch) softwood edge nosing on exposed edge, slightly rounded.
 3. Plastic laminate cover, 19 mm (3/4 inch) thick plywood or particle board core with plastic molded edge and end strips. Size, finish and number as shown on Drawings.
 4. Rod or Closet Bar: L03131.
 5. Combination Garment and Shelf Support, Intermediate Support for Closet Bar: B04051 for rods over 1800 mm (6 feet) long.
- D. Pegboard:
1. Perforated hardboard sheet size as shown on Drawings.
 2. Spacing strip: 13 mm by 13 mm (1/2 by 1/2 inch); glued to hardboard sheet.
 - a. Locate at perimeter of sheet edge.
 - b. Locate material intermediate spacing strips at 800 mm (32 inches)o.c.
 3. Cover exposed edge with 19 mm (3/4 inch) one quarter round edge trim and finish flush with hardboard surface. Glue to spacing strip and hard board.
- E. Communications Center Counter:
1. Fabricate to AWI premium grade construction Section 400, CASEWORK.
 2. Structural Framing Members: Softwood, standard sizes, space maximum 400 mm (16 inches) on center.
 3. Species: Red oak for exposed hardwood trim and edging.
 4. Cabinet Exposed Surfaces: Decorative plastic laminate including interior of cupboard cabinet.
 5. Frame: Overlay frame of apron with drawer and door face.
 6. Hardware:
 - a. Drawer guides on drawers with pulls.
 - b. Pulls and concealed hinges on doors.
 - c. Adjustable shelf standards with shelf rests.
 7. Provide cut outs for electrical devices and outlets.
- F. Interview Booth:
1. Fabricate to AWI premium grade construction.

2. Provide softwood for framing, space members not over 600 mm (24 inches) on center. Provide softwood for counter concealed members and mounting strip for writing surface.
 3. Red oak for exposed hardwood trim.
 4. Red oak veneer plywood for exposed wood finish.
 5. Glue acoustical panel to plywood substrate.
 6. Provide decorative plastic laminate writing surface pattern on counter.
 7. Fasten writing surfaces to divided panels with screws, to center support with mounting strips screwed to panel, and top at underside.
- G. Folding Shelves: Dressing (Make-Up) Type B Counter and Counter Shelf Type A.
1. Red oak back stop and mounting strips.
 2. Fabricate fold down shelf with plastic laminate finish over core.
 3. Hardwood mounting strip at wall behind folding shelf bracket in thickness to permit shelf to fold down without interfering back stop. Secure to back stop.
- H. Thru-Wall Counter or Pass-Thru Counter.
1. Fabricate counter as shown on Drawings. Return hardwood edge to metal frame at ends. Fabricate to join other counters where shown.
 2. Cut to fit metal frame profile.
 3. // Fabricate to receive sliding pass window track when shown; specified in Section 08 56 19, PASS WINDOWS. //
 4. Provide angle and fabricated shelf bracket supports.
- I. Receiving shelf in Agent Cashier:
1. Fabricate shelf as shown on Drawings over 19 mm (3/4 inch) thick core.
 2. Shelf Bracket: B04041.
- J. Wall Paneling in Rehabilitation Medicine Corrective Therapy Main Clinic:
1. Fire-retardant treated.
 2. Hardwood Plywood:
 - a. Vertical V-grooved planked // V-groove random planked // flush ungrooved.
 - b. Thickness: 19 mm (3/4 inch) unless shown otherwise.
 - c. // Unfinished // Prefinished, type of finish is specified in Section 09 06 00, SCHEDULE FOR FINISHES.

- d. Use full height panels where possible without end joints.
- 3. Solid Hardwood:
 - a. White oak or red oak, number one common grade.
 - b. Tongue and groove, including end matched.
 - c. Thickness: Minimum 19 mm (3/4 inch).
 - d. Random Lengths minimum 600 mm (24 inches), 57 mm (2-1/4 inches) wide.
- 4. Trim and Base:
 - a. Quarter round at ceiling and vertical edge.
 - b. Two-member base as shown on Drawings.
- 5. Furring Strips: Nominal 25 mm by 100 mm (1 inch by 4 inch) softwood.
- K. Desk in Credit Union:
 - 1. Fabricate to AWI premium grade construction top with compartment as shown on Drawings.
 - 2. Assemble compartment to counter top with one screw in each compartment.
- L. Plastic Laminate Counter or Work Tops:
 - 1. Thickness: 32 mm (1-1/4 inch) thick core unless shown otherwise.
 - a. Edges:
 - 1) Decorative laminate for exposed edges of tops, back, and endsplash, 38 mm (1-1/2 inches) wide.
 - 2) Plastic or metal edges for top edges less than 38 mm (1-1/2 inches) wide.
 - b. Assemble backsplash and end splash to counter top.
 - c. Use one piece counters for straight runs.
 - d. Miter corners for field joints with overlapping blocking on underside of joint.
 - 2. Fabricate wood counter for work benches as shown on Drawings.
- M. Wood Handrails:
 - 1. AWI Premium Grade.
 - 2. Species: Maple or Birch.
 - 3. Fabricate in one piece and one length when practical.
 - 4. Fabricate curved sections for ends of rails to return to wall and where rails change slope or direction.
 - 5. Joints are permitted only where rail changes direction or slope, or where necessary for field erection or shipping.

6. Scarf or dowel all joints to provide a smooth and rigid connection.
Glue all joints.
7. Fit joints, to produce a hair-line crack.
8. Completely shop fabricated according to approved shop drawings.

2.5 ACCESSORIES

A. Hardware:

1. Rough Hardware:

- a. Provide rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process.
Galvanized where specified.

b. Fasteners:

- 1) Bolts with Nuts: FF-N-836.
- 2) Expansion Bolts: A-A-1922A.
- 3) Screws: Fed. Spec. FF-S-111.

2. Finish Hardware:

a. Cabinet Hardware: ANSI A156.9.

- 1) Door/Drawer Pulls: B02011. Door in seismic zones: B03182.
- 2) Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm (3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.
- 3) Sliding Door Tracks: B07063.
- 4) Adjustable Shelf Standards: B4061 with shelf rest B04083.
- 5) Concealed Hinges: B1601, minimum 110 degree opening.
- 6) Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
- 7) Cabinet Door Catch: B0371 or B03172.
- 8) Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.

b. Cabinet Locks: ANSI A156.11.

- 1) Drawers and Hinged Door: E07262.
- 2) Sliding Door: E07162.

c. Auxiliary Hardware: ANSI A156.16.

- 1) Shelf Bracket: B04041, japanned or enameled finish.
- 2) Combination Garment rod and Shelf Support: B04051 japanned or enamel finish.
- 3) Closet Bar: L03131 chrome finish of required length.

- 4) Handrail Brackets: L03081 or L03101.
 - a) Cast Aluminum, satin polished finish.
 - b) Cast Malleable Iron, japanned or enamel finish.
- d. Steel Channel Frame and Leg supports for Counter top. Fabricated under Section 05 50 00, METAL FABRICATIONS.
- e. Pipe Bench Supports:
 - 1) Pipe: ASTM A53.
- f. Fabricated Wall Bench Supports:
 - 1) Steel Angles: ASTM A36 steel with chrome finish, or ASTM A167, stainless steel with countersunk wood screws, holes at 64 mm (2-1/2 inches) on center on horizontal member.
 - 2) Use 38 mm by 38 mm by 5 mm (1-1/2 by 1-1/2 by 3/16 inch) angle thick drilled for screw and bolt holes unless shown otherwise. Drill 6 mm (1/4 inch) holes for anchors on vertical member, maximum 200 mm (8 inches) on center between ends or corners.
 - 3) Stainless Steel Bars Brackets: ASTM A167, fabricated to shapes shown on Drawings, Number 4 finish. Provide 50 mm by 5 mm (2 inch by 3/16 inch) bars unless shown otherwise. Drill for anchors and screws. Drill countersunk wood screw holes at 64 mm (2-1/2 inches) on center on horizontal members and minimum two 13 mm (1/4 inch) hole for anchors on vertical member.
- g. Thru-Wall Counter Brackets:
 - 1) Steel angles drilled for fasteners on 100 mm (4 inches) centers.
 - 2) Baked enamel prime coat finish.
- h. Folding Shelf Bracket:
 - 1) Steel Shelf bracket, approximately 400 mm by 400 mm (16 by 16 inches), folding type, baked gray enamel finish or chrome plated finish.
 - 2) Bracket legs nominal 28 mm (1-1/8 inches) wide.
 - 3) Distance from center line of hinge pin to back of vertical leg to be 44 mm (1-3/4 inches) or provide for wood spacer when hinge line is at joint of vertical and horizontal leg.
 - 4) Distance from face to face of bracket when closed: 50 mm (2 inches).

5) Brackets shall automatically lock when counter is raised parallel to floor and unlock manually.

6) Each bracket capable of supporting a minimum of 68 kg (150 pounds), evenly distributed.

i. Edge Strips Moldings:

1) Driven type "T" shape with serrated retaining stem; vinyl plastic to match plastic laminate color, stainless steel, or 3 mm (1/8 inch) thick extruded aluminum.

2) Stainless steel or extruded aluminum channels.

3) Stainless steel, number 4 finish; aluminum, mechanical applied medium satin finish, clear anodized 0.1 mm (0.4 mils) thick.

j. Rubber or Vinyl molding:

1) Rubber or vinyl standard stock and in longest lengths practicable.

2) Design for closures at joints with walls and adhesive anchorage.

3) Adhesive as recommended by molding manufacturer.

k. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

B. Adhesive:

1. Plastic Laminate: Fed. Spec. A-A-1936.

2. Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Remove existing // _____ // to permit new installation.

1. Retain existing // _____ // for reuse.

2. Dispose of // other // removed materials.

D. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION

A. Installation:

1. Prime millwork receiving transparent finish and back-paint concealed surfaces.
2. Fasten trim with fine finishing nails, screws, or glue as required.
3. Set nails for putty stopping. Provide washers under bolt heads where no other bearing plate occurs.
4. Seal cut edges of fire retardant treated wood materials with a certified acceptable sealer.
5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
6. Plumb and level items unless shown otherwise.
7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
8. Apply adhesive uniformly for full contact between // _____ // and substrate.

B. Seats and Benches:

1. Provide stainless steel countersunk screws to secure wood seats to brackets, angle, or pipe supports.
2. Provide stainless steel or chrome plated steel bolts for anchorage to walls. Use 6 mm (1/4 inch) toggle bolts in steel stud walls and hollow masonry. Use 6 mm (1/4 inch) expansion bolts in solid masonry or concrete.
3. Wall Benches: Fasten wall benches on stainless steel bar brackets, 150 mm (6 inches) near ends and maximum 900 mm (3 feet) on centers.
4. Corner Seats: Support on continuous angles secured to seat and walls.
5. Freestanding Benches: Provide pipe bench support within 200 mm (8 inches) of ends and maximum 900 mm (3 feet) on centers.

C. Communication Center Counters and Interview Booths:

1. Secure framing to floor with expansion bolts.
2. Secure counter top to support with wood cleats or metal angles screwed on 150 mm (6 inch) centers.
3. Conceal fasteners on corridor side. Exposed fasteners permitted under counter top and in knee spaces on staff side.

D. Pegboard or Perforated Hardboard:

1. Install board with chromium plated steel round-head toggle bolts or other fasteners capable of supporting board when loaded at 122 kg/sq. m (25 psf) of board.
2. Install board with spacers to allow insertion and removal of hooks and accessories.
3. Install round trim, 6 mm (1/4 inch) at perimeter to finish flush with face of board and close space between wall and hardboard.

E. Wall Paneling:

1. Solid Hardwood Boards:
 - a. Install furring strips, 25 by 75 mm (1 by 3 inch) at 400 mm (16 inch) centers horizontally between top and bottom strips. Fasten each stud with two screws.
 - b. Install paneling laid vertically with end joints staggered between adjacent boards.
 - c. Tightly butt joints and blind nail each board at each furring strip.
2. Plywood Paneling:
 - a. Install furring strips horizontally, 25 by 75 mm (1 by 3 inch) under end joints of plywood and 300 mm (16 inches) on center between end strips. Install cross furring strips centered vertically at side joints of plywood paneling less than 13 mm (1/2 inch) thick. Fasten each stud with two screws.
 - b. Install panels with long edge vertically and end joints aligned where exposed to view.
 - c. Align V-grooves where end joints meet and maintain continuity of pattern.
 - d. Apply continuous bead of adhesive to each furring strip to securely bond panel according to adhesive manufacturer's specifications.
 - e. Nailing:
 - 1) Nail in V-grooves to horizontal furring strips and at panel edges and within 25 mm (1 inch) of ends except within 50 mm (2 inches) of end when panel end abutts other surfaces. Do not space nails in V-grooves over 150 mm (6 inches), on center.
 - 2) Nail ungrooved panels at 400 mm (16 inches) centers to horizontal furring strips between end or edge nails. Set

nails and fill hole with filler to match wood panel for panels thicker than 13 mm (1/2 inch). // Set nails flush with surface of panel thinner than 13 mm (1/2 inch). //

- 3) Use colored nails matching panel finish for prefinished panels or panels less than 13 mm (1/2 inch) thick.

3. Edge Trim and Base: Install solid wood as shown on Drawings, species same as wall paneling.

F. Shelves:

1. Install mounting strip at back wall and end wall for shelves in closets where shown secured with toggle bolts at each end, not over 600 mm (24 inch) centers between ends.
 - a. Nail Shelf to mounting strip at ends and to back wall strip at not over 900 mm (36 inches) on center.
 - b. Install metal bracket, ANSI A156.16, B04041, not over 1200 mm (4 feet) centers when shelves exceed 1800 mm (6 feet) in length.
 - c. Install metal bracket, ANSI A156.16, B04051, not over 1200 mm (4 feet) on centers where shelf length exceeds 1800 mm (6 feet) in length with metal rods, clothes hanger bars ANSI A156.16, L03131, of required length, full length of shelf.
2. Install vertical slotted shelf standards to studs with toggle bolts through each fastener opening. Double slotted shelf standards is acceptable where adjacent shelves terminate.
 - a. Install brackets providing supports for shelf not over 900 mm (36 inches) on center and within 13 mm (1/2 inch) of shelf end unless shown otherwise.
 - b. Install shelves on brackets so front edge is restrained by bracket.

G. Interview Booths:

1. Anchor divider panel floor plates to floor with expansion bolts at ends and not over 900 mm (36 inch) centers.
2. Install writing surface on mounting strips secured to divider panels and center support with screws if not shop assembled. Field assemble according to shop drawings.

H. Handrails:

1. Install in one piece and one length when practical.
2. Where rails change slope or direction, install special curved sections and ends of rails to return to wall, glue all field joints.

3. // Secure rails with wood screws at 450 mm (18 inches) on centers to metal balustrades top rail. //
4. Install brackets within 300 mm (12 inches) of ends of handrails and at every spaced intervals between not exceeding 1500 mm (5 feet) on centers at intervals between as shown. Anchor brackets as detailed and rails to brackets with screws.
- I. Install with butt joints in straight runs and miter at corners.

3.3 CLEANING

- A. Remove excess adhesive before adhesive sets.
- B. Clean exposed surfaces. Remove contaminants and stains.
- C. Touch up damaged factory finishes.
 1. Repair painted surfaces with touch up primer.

3.4 PROTECTION

- A. Protect finish carpentry from // traffic and // construction operations.
- B. Cover finish carpentry with reinforced kraft paper, and plywood or hardboard.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

- - - E N D - - -

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):

- A. Sealing of Site Work Concrete Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- B. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY.

1.3 QUALITY ASSURANCE:

- A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.
- B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:

1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.
 2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
 3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the Contracting Officer Representative (COR) and the COR has given written approval to proceed with the work.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
1. Locate test joints where indicated in construction documents or, if not indicated, as directed by COR.
 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
 3. Notify COR seven (7) days in advance of dates and times when test joints will be erected.
- F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections and to demonstrate aesthetic effects and qualities of materials and execution:
1. Joints in mockups of assemblies that are indicated to receive elastomeric joint sealants.

1.4 CERTIFICATION:

- A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Installer qualifications.
- C. Contractor certification.
- D. Manufacturer's installation instructions for each product used.
- E. Cured samples of exposed sealants for each color.
- F. Manufacturer's Literature and Data:
 - 1. Primers
 - 2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- G. Manufacturer warranty.

1.6 PROJECT CONDITIONS:

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
 - 1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE:

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS:

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Backing Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.10 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International (ASTM):

C509-06.....Elastomeric Cellular Preformed Gasket and
Sealing Material

C612-14.....Mineral Fiber Block and Board Thermal
Insulation

C717-14a.....Standard Terminology of Building Seals and
Sealants

C734-06 (R2012).....Test Method for Low-Temperature Flexibility of
Latex Sealants after Artificial Weathering

C794-10.....Test Method for Adhesion-in-Peel of Elastomeric
Joint Sealants

C919-12.....Use of Sealants in Acoustical Applications.

C920-14a.....Elastomeric Joint Sealants.

C1021-08 (R2014).....Laboratories Engaged in Testing of Building
Sealants

C1193-13.....Standard Guide for Use of Joint Sealants.

C1248-08 (R2012).....Test Method for Staining of Porous Substrate by
Joint Sealants

C1330-02 (R2013).....Cylindrical Sealant Backing for Use with Cold
Liquid Applied Sealants

C1521-13.....Standard Practice for Evaluating Adhesion of
Installed Weatherproofing Sealant Joints

D217-10.....Test Methods for Cone Penetration of
Lubricating Grease

D1056-14.....Specification for Flexible Cellular Materials—
Sponge or Expanded Rubber

E84-09.....Surface Burning Characteristics of Building

Materials

C. Sealant, Waterproofing and Restoration Institute (SWRI).

The Professionals' Guide

D. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission

Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SEALANTS:

A. S-1:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40

B. S-2:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade P.
5. Shore A hardness of 25-40.

C. S-11:

1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.

D. S-12:

1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.S-1 Vertical surfaces, provide non-staining ASTM C920,
Type S or M, Grade NS, Class 25, Use NT.

2.2 COLOR:

- A. Sealants used with exposed masonry are to match color of mortar joints.
- B. Sealants used with unpainted concrete are to match color of adjacent
concrete.

- C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 WEEPS - RESERVED

2.5 FILLER:

- A. Mineral fiberboard: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POROUS SURFACES:

- A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

- A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
 - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous surfaces include but are not limited to the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

- A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.
- D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.4 SEALANT DEPTHS AND GEOMETRY:

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

- A. General:
 1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
 2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
 3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.

4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
 5. Avoid dropping or smearing compound on adjacent surfaces.
 6. Fill joints solidly with compound and finish compound smooth.
 7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
 8. Finish paving or floor joints flush unless joint is otherwise detailed.
 9. Apply compounds with nozzle size to fit joint width.
 10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
 11. Replace sealant which is damaged during construction process.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.

3.6 FIELD QUALITY CONTROL:

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform one test for each 305 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:

1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
 2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 3. Whether sealants filled joint cavities and are free from voids.
 4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING:

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.
- B. Leave adjacent surfaces in a clean and unstained condition.

- - - E N D - - -

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:

1. Prime coats which may be applied in shop under other sections.
2. Prime painting unprimed surfaces to be painted under this Section.
3. Painting items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
4. Painting ferrous metal (except stainless steel) exposed to view.
5. Painting galvanized ferrous metals exposed to view.
6. Painting interior concrete block exposed to view.
7. Painting gypsum drywall exposed to view.
8. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
9. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
10. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
11. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
12. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
13. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

1.2 RELATED WORK:

- A. Activity Hazard Analysis: Section 01 35 26, SAFETY REQUIREMENTS.
- //B. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS. //
- C. Lead Paint Removal: Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
- D. Masonry Repairs: Section 04 05 13, MASONRY MORTARING // Section 04 05 16, MASONRY GROUTING //.
- E. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS; Division 10 - SPECIALTIES; Division 11 - EQUIPMENT; Division 12 - FURNISHINGS; Division 13 - SPECIAL CONSTRUCTION; Division 14 - CONVEYING EQUIPMENT; Division 21 - FIRE SUPPRESSION; Division 22 - PLUMBING; Division 23 - HEATING; VENTILATION AND AIR-CONDITIONING; Division 26 - ELECTRICAL; Division 27 - COMMUNICATIONS; and Division 28 - ELECTRONIC SAFETY AND SECURITY sections.
- F. Prefinished flush doors with transparent finishes: Section 08 14 00, WOOD DOORS.
- G. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09 06 00, SCHEDULE FOR FINISHES.
- H. Glazed wall surfacing or tile like coatings: Section 09 96 59, HIGH-BUILD GLAZED COATINGS.
- I. Multi-color Textured Wall Finish: Section 09 94 19, MULTICOLOR INTERIOR FINISHING.
- J. Asphalt and concrete pavement marking: Section 32 17 23, PAVEMENT MARKINGS.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- //B. Sustainable Design Submittals as described below:
 - //1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.// //
- C. Painter qualifications.
- D. Manufacturer's Literature and Data:
 - 1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of

this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one (1) list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

E. Sample Panels:

1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
3. Panel to Show Transparent Finishes: Wood of same species and grain pattern as wood approved for use, 100 x 250 mm (4 x 10 inch face) minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 x 50 mm (2 x 2 inch) minimum or actual wood member to show complete finish.
4. Attach labels to panel stating the following:
 - a. Federal Specification Number or manufacturers name and product number of paints used.
 - b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
 - c. Product type and color.
 - d. Name of project.
5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

F. Sample of identity markers if used.

G. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
4. Intumescent clear coating or fire retardant paint.
5. Plastic floor coating.

1.4 DELIVERY AND STORAGE:

A. Deliver materials to site in manufacturer's sealed container marked to show following:

1. Name of manufacturer.
2. Product type.

3. Batch number.
 4. Instructions for use.
 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
1. Federal Specification Number, where applicable, and name of material.
 2. Surface upon which material is to be applied.
 3. Specify Coat Types: Prime; body; finish; etc.
- C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

1.5 QUALITY ASSURANCE:

- A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.
- B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

//1.6 MOCK-UP PANEL:

SPEC WRITER NOTES:

1. Define spaces and other finishes where sample panel is required on construction documents.
 2. Mock-up must be approved by COR in the project's design phase before including requirement in specification.
- A. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 3.05 m (10 feet) wide, floor to ceiling

of wall surfaces, before proceeding with the remainder of the work, for approval by the COR. Paint mock-ups to include one (1) door and frame assembly.

- B. Finish and texture approved by COR will be used as a standard of quality and workmanship for remainder of work.
- C. Repaint individual areas which are not approved, as determined by the COR, until approval is received. //

1.7 REGULATORY REQUIREMENTS:

- A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
 - 1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
 - 2. Lead-Base Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
 - c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.
 - d. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
 - 3. Asbestos: Provide materials that do not contain asbestos.
 - 4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
 - 5. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
 - 6. Use high performance acrylic paints in place of alkyd paints.

1.8 SAFETY AND HEALTH

- A. Apply paint materials using safety methods and equipment in accordance with the following:
 - 1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS.

The AHA is to include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

- B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.
- C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:
 - 1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
 - 2. 29 CFR 1910.1000.
 - 3. ACHIH-BKLT and ACGIH-DOC, threshold limit values.

1.9 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
 - ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
 - ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. ASME International (ASME):
 - A13.1-07(R2013).....Scheme for the Identification of Piping Systems
- D. Code of Federal Regulation (CFR):
 - 40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating
- E. Commercial Item Description (CID):
 - A-A-1272A.....Plaster Gypsum (Spackling Compound)
- F. Federal Specifications (Fed Spec):
 - TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- G. Master Painters Institute (MPI):
 - 1.....Aluminum Paint
 - 4.....Interior/ Exterior Latex Block Filler
 - 5.....Exterior Alkyd Wood Primer
 - 7.....Exterior Oil Wood Primer
 - 8.....Exterior Alkyd, Flat MPI Gloss Level 1

- 9.....Exterior Alkyd Enamel MPI Gloss Level 6
- 10.....Exterior Latex, Flat
- 11.....Exterior Latex, Semi-Gloss
- 18.....Organic Zinc Rich Primer
- 22.....Aluminum Paint, High Heat (up to 590° - 1100F)
- 27.....Exterior / Interior Alkyd Floor Enamel, Gloss
- 31.....Polyurethane, Moisture Cured, Clear Gloss
- 36.....Knot Sealer
- 43.....Interior Satin Latex, MPI Gloss Level 4
- 44.....Interior Low Sheen Latex, MPI Gloss Level 2
- 45.....Interior Primer Sealer
- 46.....Interior Enamel Undercoat
- 47.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
- 48.....Interior Alkyd, Gloss, MPI Gloss Level 6
- 50.....Interior Latex Primer Sealer
- 51.....Interior Alkyd, Eggshell, MPI Gloss Level 3
- 52.....Interior Latex, MPI Gloss Level 3
- 53.....Interior Latex, Flat, MPI Gloss Level 1
- 54.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
- 59.....Interior/Exterior Alkyd Porch & Floor Enamel, Low
Gloss
- 60.....Interior/Exterior Latex Porch & Floor Paint, Low
Gloss
- 66.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC
Approved)
- 67.....Interior Latex Fire Retardant, Top-Coat (ULC
Approved)
- 68.....Interior/ Exterior Latex Porch & Floor Paint,
Gloss
- 71.....Polyurethane, Moisture Cured, Clear, Flat
- 77.....Epoxy Cold Cured, Gloss
- 79.....Marine Alkyd Metal Primer
- 90.....Interior Wood Stain, Semi-Transparent
- 91.....Wood Filler Paste
- 94.....Exterior Alkyd, Semi-Gloss
- 95.....Fast Drying Metal Primer
- 98.....High Build Epoxy Coating
- 101.....Epoxy Anti-Corrosive Metal Primer

- 108.....High Build Epoxy Coating, Low Gloss
- 114.....Interior Latex, Gloss
- 119.....Exterior Latex, High Gloss (acrylic)
- 134.....Galvanized Water Based Primer
- 135.....Non-Cementitious Galvanized Primer
- 138.....Interior High Performance Latex, MPI Gloss Level 2
- 139.....Interior High Performance Latex, MPI Gloss Level 3
- 140.....Interior High Performance Latex, MPI Gloss Level 4
- 141.....Interior High Performance Latex (SG) MPI Gloss
Level 5
- 163.....Exterior Water Based Semi-Gloss Light Industrial
Coating, MPI Gloss Level 5

G. Society for Protective Coatings (SSPC):

- SSPC SP 1-82 (R2004).....Solvent Cleaning
- SSPC SP 2-82 (R2004).....Hand Tool Cleaning
- SSPC SP 3-28 (R2004).....Power Tool Cleaning
- SSPC SP 10/NACE No.2.....Near-White Blast Cleaning
- SSPC PA Guide 10.....Guide to Safety and Health Requirements

H. Maple Flooring Manufacturer's Association (MFMA):

I. U.S. National Archives and Records Administration (NARA):

- 29 CFR 1910.1000.....Air Contaminants

J. Underwriter's Laboratory (UL)

PART 2 - PRODUCTS

SPEC WRITER NOTES:

1. Coordinate material requirements to agree with applicable requirements specified in the referenced Applicable Publications.
2. Update and specify only that which applies to the project with paint schedule and Section 09 06 00, SCHEDULE FOR FINISHES.

2.1 MATERIALS:

- A. Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

2.2 PAINT PROPERTIES:

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.
- C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommended limits.
- //D. VOC Content: For field applications that are inside the weatherproofing system, paints and coating to comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Non-flat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
 - 5. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.
 - 8. Shellacs, Clear: 730 g/L.
 - 9. Shellacs, Pigmented: 550 g/L. //
- E. VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's (SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

2.3 PLASTIC TAPE:

- A. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
- B. Pressure sensitive adhesive back.
- //C. Snap on coil plastic markers.//
- D. Widths as shown on construction documents.

2.4 Biobased Content

- A. Paint products shall comply with following bio-based standards for biobased materials:

| Material Type | Percent by Weight |
|--|------------------------------|
| Interior Paint | 20 percent biobased material |
| Interior Paint- Oil Based and Solvent Alkyd | 67 percent biobased material |
| Exterior Paint | 20 percent biobased material |
| Wood & Concrete Stain | 39 percent biobased content |
| Polyurethane Coatings | 25 percent biobased content |
| Water Tank Coatings | 59 percent biobased content |
| Wood & Concrete Sealer- Membrane Concrete Sealers | 11 percent biobased content |
| Wood & Concrete Sealer- Penetrating Liquid | 79 percent biobased content |

- B. The minimum-content standards are based on the weight (not the volume) of the material.

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.
- B. Atmospheric and Surface Conditions:
1. Do not apply coating when air or substrate conditions are:
 - a. Less than 3 degrees C (5 degrees F) above dew point.
 - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the COR and the product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.
 - c. When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
 2. Maintain interior temperatures until paint dries hard.
 3. Do no exterior painting when it is windy and dusty.
 4. Do not paint in direct sunlight or on surfaces that the sun will warm.

5. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
 - b. Concrete and masonry when permitted by manufacturer's recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.
6. Varnishing:
 - a. Apply in clean areas and in still air.
 - b. Before varnishing vacuum and dust area.
 - c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 INSPECTION:

- A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL WORKMANSHIP REQUIREMENTS:

- A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.
- B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.
- C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.
- D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.
- E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

- F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.
- G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.
- H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.
- I. All suction spots or "hot spots" in plaster after the application of the first coat are to be touched up before applying the second coat.
- J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

SPEC WRITER NOTES:

- 1. Insure other technical sections specify acceptable surface conditions to receive paint including patching and repair of new and existing surfaces.
- 2. Check structural sections specifying ferrous metal; mechanical and electrical sections of the specifications for proper surface condition and compatible prime coats to suit finishes specified. For instance, finish on concrete required to have cementitious coating; type of shop coat on bar joists required to be painted; will any parts of mechanical equipment have to be field painted; what kind of primers are specified, if any.

3.4 SURFACE PREPARATION:

A. General:

- 1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
- 2. See other sections of specifications for specified surface conditions and prime coat.

3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
 4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
 5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Fiber-Cement Board: 12 percent.
 - c. Masonry (Clay and CMU's): 12 percent.
 - d. Wood: 15 percent.
 - e. Gypsum Board: 12 percent.
 - f. Plaster: 12 percent.
- B. Wood:
1. Sand to a smooth even surface and then dust off.
 2. Sand surfaces showing raised grain smooth between each coat.
 3. Wipe surface with a tack rag prior to applying finish.
 4. Surface painted with an opaque finish:
 - a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
 - b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
 5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
 6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
 7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
 - a. Thin filler in accordance with manufacturer's instructions for application.
 - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

C. Ferrous Metals:

1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
 2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). // Where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.//
 3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
 - a. Fill flat head countersunk screws used for permanent anchors.
 - b. Do not fill screws of item intended for removal such as glazing beads.
 4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
 5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.
- D. // Zinc-Coated (Galvanized) Metal, // // Aluminum, // // Copper and Copper Alloys // Surfaces Specified Painted:
1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
 2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.
- E. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:
1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
 2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
 3. Remove loose mortar in masonry work.

4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13, MASONRY MORTARING // Section 04 05 16, MASONRY GROUTING //. Do not fill weep holes. Finish to match adjacent surfaces.
5. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three (3) days and brush thoroughly free of crystals.
6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in Division 03, CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

F. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.5 PAINT PREPARATION:

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.6 APPLICATION:

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

- B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.

SPEC WRITER NOTE: Do not allow spray painting at existing buildings occupied during the course of the work. Spray painting may be allowed in certain areas of new additions or separate buildings. Coordinate restrictions with COR.

- E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from COR in writing.

SPEC WRITER NOTE: Check application requirements with manufacturer of materials specified to determine if below paragraphs are applicable.

- 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
- 2. In new construction and in existing occupied spaces, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in "Building and Structural Work Field Painting"; "Work not Painted"; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

- F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.7 PRIME PAINTING:

- A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.

D. Prime rabbets for stop and face glazing of wood, and for face glazing of steel.

E. Wood and Wood Particleboard:

1. Use same kind of primer specified for exposed face surface.
 - a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5 (Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent) is scheduled.
 - b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
 - c. Transparent finishes as specified under "Transparent Finishes on Wood Except Floors Article" // and "Finish for Wood Floors Article" //.
2. Apply two (2) coats of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one (1) coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
5. Apply MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved) to wood for fire retardant finish.

F. Metals except boilers, incinerator stacks, and engine exhaust pipes:

1. Steel and iron: // MPI 79 (Marine Alkyd Metal Primer) // // MPI 95 (Fast Drying Metal Primer) //. Use MPI 101 (Cold Curing Epoxy Primer) where // MPI 77 (Epoxy Cold Cured, Gloss // // MPI 98 (High Build Epoxy Coating) // // MPI 108 (High Build Epoxy Marine Coating // finish is specified.
2. Zinc-coated steel and iron: // MPI 134 (Waterborne Galvanized Primer) // // MPI 135 (Non-Cementitious Galvanized Primer) //.
3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).

4. Terne Metal: // MPI 79 (Marine Alkyd Metal Primer) // // MPI 95 (Fast Drying Metal Primer) //.
5. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
6. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel).
7. Asphalt coated metal: MPI 1 (Aluminum Paint).
8. Metal over 94 degrees C (201 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating).

G. Gypsum Board // and Hardboard //:

1. Surfaces scheduled to have // MPI 10 (Exterior Latex, Flat) // // MPI 11 (Exterior Latex, Semi-Gloss) // // MPI 119 (Exterior Latex, High Gloss (acrylic)) // // MPI 53 (Interior Latex, Flat) //, MPI Gloss Level 1 // MPI 52 (Interior Latex, MPI Gloss Level 3) // // MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) finish: Use // MPI 10 (Exterior Latex, Flat) // // MPI 11 (Exterior Latex, Semi-Gloss) // // MPI 119 (Exterior Latex, High Gloss (acrylic)) // // MPI 53 (Interior Latex, MPI Gloss Level 3) // // MPI 52 (Interior Latex, MPI Gloss Level 3) // // MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) respectively //.

SPEC WRITER NOTE: List the names of other spaces, where steam will be generated or that have high humidity for pigmented sealer.

2. Primer: // MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) // // MPI 46 (Interior Enamel Undercoat) // in shower and bathrooms.
3. Surfaces scheduled to receive vinyl coated fabric wall covering: // Use MPI 45 (Interior Primer Sealer) // // MPI 46 (Interior Enamel Undercoat) //.
4. Use // MPI 101 (Cold Curing Epoxy Primer) for surfaces scheduled to receive MPI 77 (Epoxy Cold Cured, Gloss) // // MPI 98 (High Build Epoxy Coating) // // MPI 108 (High Build Epoxy Marine Coating) finish //.

H. Gypsum Plaster and Veneer Plaster:

1. Surfaces scheduled to receive vinyl coated fabric wall covering: Use MPI 45 (Interior Primer Sealer).
2. MPI 45 (Interior Primer Sealer), except use MPI 50 (Interior Latex Primer Sealer) when an alkyd flat finish is specified.

3. Surfaces scheduled to have // MPI 10 (Exterior Latex, Flat) //
// MPI 11 (Exterior Latex, Semi-Gloss) // // MPI 119 (Exterior Latex,
High Gloss (acrylic)) // // MPI 53 (Interior Latex, Flat, MPI Gloss
Level 1) // // MPI 52 (Interior Latex, MPI Gloss Level 3) // // MPI 54
(Interior Latex, Semi-Gloss, MPI Gloss Level 5) // // MPI 114 (Interior
Latex, Gloss) // finish: Use MPI 10 (Exterior Latex, Flat) // MPI 11
(Exterior Latex, Semi-Gloss) // // MPI 119 (Exterior Latex, High Gloss
(acrylic)) // // MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) // // MPI 52 Latex, MPI Gloss Level 3) // // MPI 54 (Interior Latex, Semi-
Gloss, MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) //
respectively.
4. Use // MPI 101 (Cold Curing Epoxy Primer) for surfaces scheduled to
receive // // MPI 77 (Epoxy Cold Cured, Gloss) // // MPI 108 (High
Build Epoxy Marine Coating) // finish.
- I. Concrete Masonry Units except glazed or integrally colored and decorative
units:
 1. MPI 4 (Block Filler) on interior surfaces.
 2. Prime exterior surface as specified for exterior finishes.
- J. Cement Plaster or stucco // Concrete Masonry, Brick Masonry // and
// Cement board // Interior Surfaces of Ceilings and Walls:
 1. // MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) // // MPI 52
(Interior Latex, MPI Gloss Level 3) // // MPI 54 (Interior Latex, Semi-
Gloss, MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) //
except use two (2) coats where substrate has aged less than six (6)
months.
 2. Use // MPI 138 (Interior High Performance Latex, MPI Gloss Level 2) //
// MPI 139 (Interior High Performance Latex, MPI Gloss level 3) //
// MPI 140 (Interior High Performance latex, MPI Gloss Level 4) //
// MPI 141 (Interior High Performance Latex, MPI Gloss Level 5) //
// MPI 114 (Interior Latex, Gloss) // // TT-P-1411A (Paint, Copolymer
Resin, Cementitious) Type II // // MPI 77 (Epoxy Cold Cured, Gloss) //
// MPI 98 (High Build Epoxy Coating) // MPI 108 (High Build Epoxy
Marine Coating) as scheduled.
- K. Concrete Floors: // MPI 68 (Interior/ Exterior Latex Porch & Floor Paint,
Gloss) // // MPI 60 (Interior/ Exterior Latex Porch & Floor Paint, Low
Gloss) //. // MPI 99 (Water-based Acrylic Curing and Sealing Compound).//

3.8 EXTERIOR FINISHES:

- A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Wood:
1. Do not apply finish coats on surfaces concealed after installation, top and bottom edges of wood doors and sash, or on edges of wood framed insect screens.
 2. Two (2) coats of // MPI 10 Exterior Latex, Flat) // // MPI 11 (Exterior Latex, Semi-Gloss) // // MPI 119 (Exterior Latex, High Gloss (acrylic)) // on exposed surfaces, except where transparent finish is specified.
 3. Two (2) coats of // MPI 31 (Polyurethane, Moisture Cured, Clear Gloss) // // MPI 71 (Polyurethane, Moisture Cured, Clear Flat) // for transparent finish.
- C. Steel and Ferrous Metal //, Including Tern //:
1. Two (2) coats of // MPI 8 (Exterior Alkyd, Flat) // // MPI 9 (Exterior Alkyd Enamel) // // MPI 94 (Exterior Alkyd, Semi-Gloss) // on exposed surfaces, except on surfaces over 94 degrees C (201 degrees F).
 2. One (1) coat of MPI 22 (High Heat Resistant Coating) on surfaces over 94 degrees K (290 degrees F) and on surfaces of // boiler // //, incinerator // //, stacks // engine exhaust pipes.
- D. Machinery without factory finish except for primer: One (1) coat // MPI 8 (Exterior Alkyd, Flat) // // MPI 9 (Exterior Alkyd Enamel) // // MPI 94 (Exterior Alkyd, Semi-Gloss) //.

SPEC WRITER NOTES:

1. The following finishes are applicable to brick, concrete masonry units, concrete, cement board, cement plaster and stucco.
2. Exterior concrete, brick, stucco or cement plaster and cement boards are normally not painted. Coordinate with Section 09 06 00, SCHEDULE FOR FINISHES and specify additional surfaces scheduled for paint.
3. These paints will fill and seal pores and waterproof the wall but allow transmission of water vapor.
4. Cementitious paint TT-P-1411A (Paint, Co-polymer-Resin, Cementitious (CEP)) is a factory prepared mix ready to apply by brush.

- E. Concrete Masonry Units // Brick // // Cement Plaster // // Concrete //:
1. General:

- a. Where specified in Section 09 06 00, SCHEDULE FOR FINISHES or shown.
 - b. Mix as specified in manufacturer's printed directions.
 - c. Do not mix more paint than can be used within four (4) hours after mixing. Discard paint that has started to set.
 - d. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.
 - e. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.
2. Use two (2) coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious), unless specified otherwise.

3.9 INTERIOR FINISHES:

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.

SPECS WRITER NOTE: List other metals and finish coats required for field painting in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
 - a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) unless specified otherwise.
 - b. Two (2) coats of // MPI 48 (Interior Alkyd Gloss) // // MPI 51 (Interior Alkyd, Eggshell) //.
 - c. One (1) coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss) on exposed interior surfaces of alkyd-amine enamel prime finished windows.
 - d. One (1) coat of MPI 101 primer over two (2) coats of waterborne light industrial coating MPI 163 on exposed surfaces in // battery rooms // // pool area // // chlorinator rooms //. Steel is to be blast cleaned to SSPC 10/NACE No. 2.
 - e. Machinery: One (1) coat MPI 9 (Exterior Alkyd Enamel).
 - f. Asphalt Coated Metal: One (1) coat MPI 1 (Aluminum Paint).
 - g. Ferrous Metal over 94 degrees K (290 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One (1) coat MPI 22 (High Heat Resistant Coating).

C. Gypsum Board:

1. One (1) coat of // MPI 45 (Interior Primer Sealer) // // MPI 46 (Interior Enamel Undercoat) // plus one (1) coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3).
2. Two (2) coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2).
3. One (1) coat of // MPI 45 (Interior Primer Sealer) // // MPI 46 (Interior Enamel Undercoat) // plus one (1) coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) or MPI 114 (Interior Latex, Gloss).
4. One (1) coat of // MPI 45 (Interior Primer Sealer) // MPI 46 (Interior Enamel Undercoat) // plus one (1) coat of MPI 48 (Interior Alkyd Gloss).

D. Plaster:

1. One (1) coat of // MPI 45 (Interior Primer Sealer) // MPI 46 (Interior Enamel Undercoat) // MPI 50 (Interior Latex Primer Sealer) // plus one (1) coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3).
2. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).
3. One (1) coat of // MPI 45 (Interior Primer Sealer) // // MPI 46 (Interior Enamel Undercoat) // or MPI 50 (Interior Latex Primer Sealer) plus one (1) coat of 139 (Interior High Performance Latex, MPI Gloss level 3).
4. One (1) coat MPI 101 (Cold Curing Epoxy Prime).

E. Masonry and Concrete Walls:

1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
2. Two (2) coats of // MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) // // MPI 52 (Interior Latex, MPI Gloss Level 3) // // MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) //.
3. Two (2) coats of // MPI 138 (Interior High Performance Latex, MPI Gloss Level 2) // // MPI 139 (Interior High Performance Latex, MPI Gloss Level 3) // // MPI 140 (Interior High Performance Latex MPI Gloss Level 4) // // MPI 141 (Interior High Performance Latex MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) //.

F. Wood:

1. Sanding:
 - a. Use 220-grit sandpaper.

- b. Sand sealers and varnish between coats.
 - c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.
2. Sealers:
- a. MPI 31 (gloss) or MPI 71 (flat) thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.
 - b. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
 - c. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
 - d. Sand as specified.
3. Paint Finish:
- a. One (1) coat of // MPI 45 (Interior Primer Sealer) // // MPI 46 (Interior Enamel Undercoat) // plus one (1) coat of MPI 47 (Interior Alkyd, Semi-Gloss).
 - b. One (1) coat // MPI 66 (Interior Alkyd Fire retardant, Clear Top-Coat (UL Approved) // // MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved), intumescent type, on exposed wood // in attics with floors used for mechanical equipment // // and above ceilings where shown //.
 - c. One (1) coat of // MPI 45 Interior Primer Sealer) // // MPI 46 (Interior Enamel Undercoat) // plus one (1) coat of MPI 48 (Interior Alkyd Gloss).
 - d. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).
4. Transparent Finishes on Wood Except Floors.
- a. Natural Finish:
 - 1) One (1) coat of sealer // MPI 31 (gloss) // // MPI 71 (flat) // thinned with thinner recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.
 - 2) Two (2) coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat // MPI 31 (Polyurethane, Moisture Cured, Clear Gloss).

SPEC WRITER NOTES:

- 1. Stain may be used when transparent finishes are specified to change the color of sapwood to match heartwood, and to enhance or even the color of the wood as required to match the finish specified.

2. Verify requirements for stain with
Section 09 06 00, SCHEDULE FOR FINISHES
and woods used.

b. Stain Finish:

- 1) One (1) coat of MPI 90 (Interior Wood Stain, Semi-Transparent).
- 2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.
- 3) One (1) coat of sealer // MPI 31 (gloss) // // MPI 71 (flat) // thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.
- 4) Two (2) coats of // MPI 71 (Polyurethane, Moisture Cured, Clear Flat) // // MPI 31 (Polyurethane Moisture Cured, Clear Gloss) //.

c. Varnish Finish:

- 1) One (1) coat of sealer // MPI 31 (gloss) // // MPI 71 (flat) // thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.
- 2) Two (2) coats of // MPI 71 (Polyurethane, Moisture Cured, Clear Flat) // // MPI 31 (Polyurethane Moisture Cured, Clear Gloss) //.

d. Fire Retardant Intumescent Varnish:

- 1) MPI 66 (Interior Alkyd Fire Retardant, Clear Top-Coat (UL Approved)) Intumescent Type, Fire Retardant Coating where scheduled: Two (2) coats.

5. Finish for Wood Floors:

a. Hardwood Flooring:

- 1) Apply MPI 91 (Wood Filler Paste) to open grained wood. Remove surplus filler and wipe clean.
- 2) Sand lightly when dry. Remove dust.
- 3) Apply two (2) coats of CID-A-A-2335 (Sealer, Surface).
- 4) Apply two (2) thin coats of P-W-155 (Wax Floor, Water Emulsion) and machine buff to uniform luster.

b. Stage Floor: Sand only. No filling, sealing, or waxing is required.

c. // Exercise Area // // Recreation Hall //, // Gymnasium //,
// Handball Boards in Exercise Area // Floor Finish:

- 1) Floor-Sealer Formulation: Pliable, penetrating type, MFMA Group I, Sealers.
- 2) Finish-Coat Formulation: Formulated for gloss finish and multicoat application.
 - a) Type: MFMA Group 5, Water-Based Finishes.

- 3) Allow 48 hours between coats.
- 4) Apply in one (1) continuous operation with squeegee or lamb's wool applicator with application free from streaks in accordance with plastic coating manufacturer's directions.

SPEC WRITER NOTE: Verify stripe width, layouts and colors are to be shown in construction documents.

d. Striping:

- 1) Where striping is shown on construction documents for wood floors, apply pressure sensitive adhesive back vinyl plastic tape stripes in widths shown in construction documents.
- 2) Do striping when floor coating is dry.
- 3) Install stripes to straight lines and true curves.
- 4) Provide colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or indicated in construction documents.

G. Cement Board: One (1) coat of // MPI 138 (Interior High Performance Latex, MPI Gloss Level 2) // // MPI 139 (Interior High Performance Latex, MPI Gloss Level 3) // // MPI 140 (Interior High Performance Latex MPI Gloss Level 4) // // MPI 141 (Interior High Performance Latex, MPI Gloss Level 5 // // MPI 114 (Interior Latex, Gloss) //.

H. Concrete Floors: One (1) coat of MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss).

I. Miscellaneous:

1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
2. MPI 1 (Aluminum Paint): Two (2) coats of aluminum paint.
3. Existing acoustical units scheduled to be repainted except acoustical units with a vinyl finish:
 - a. Clean units free of dust, dirt, grease, and other deterrents to paint adhesion.
 - b. Mineral fiber units: One (1) coat of // MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) // // MPI 52 (Interior Latex, MPI Gloss Level 3) // // MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) //.
 - c. Units of organic fiber or other material not having a class A rating: One (1) coat of // MPI 66 (Interior Alkyd Fire Retardant, Clear Top-Coat (UL Approved)) // // MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved)) // fire retardant paint.

4. Interstitial floor markings: One (1) coat // MPI 27 (Exterior/ Interior Alkyd Floor Enamel, Gloss) // // MPI 59 ((Interior/ Exterior Alkyd Porch & Floor Enamel, Low Gloss) // // MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss) // // MPI 60 (interior/ Exterior Latex Porch & Floor Paint, Low Gloss) //.

3.10 REFINISHING EXISTING PAINTED SURFACES:

- A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.
- B. Remove and reinstall items as specified under "General Workmanship Requirements".
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one (1) coat of // MPI 31 (Polyurethane, Moisture Cured, Clear Gloss) // // MPI 71 (Polyurethane, Moisture Cured, Clear Flat) //.
- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.11 PAINT COLOR:

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. For additional requirements regarding color see Articles, "REFINISHING EXISTING PAINTED SURFACE" and "MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE".
- C. Coat Colors:
 - 1. Color of priming coat: Lighter than body coat.

2. Color of body coat: Lighter than finish coat.

3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:

1. Paint to match color of casework where casework has a paint finish.

2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.12 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE:

A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.

B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified below.

C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.

D. Paint after tests have been completed.

E. Omit prime coat from factory prime-coated items.

F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.

G. Omit field painting of items specified in "BUILDING AND STRUCTURAL WORK FIELD PAINTING"; "Building and Structural Work not Painted".

H. Color:

1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.

2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:

SPEC WRITER NOTE: Do not change the following color designation.

a. White: Exterior unfinished surfaces of enameled plumbing fixtures.
Insulation coverings on breeching and uptake inside boiler house,

drums and drum-heads, oil heaters, condensate tanks and condensate piping.

- b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
 - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
 - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
 - e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
 - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.
- I. Apply paint systems on properly prepared and primed surface as follows:
- 1. Exterior Locations:
 - a. Apply two (2) coats of // MPI 8 (Exterior Alkyd, Flat) // // MPI 94 (Exterior Alkyd, Semi-gloss) // // MPI 9 (Exterior Alkyd Enamel) // to the following ferrous metal items:

Vent and exhaust pipes with temperatures under 94 degrees C (201 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
 - b. Apply two (2) coats of // MPI 10 (Exterior Latex, Flat) // // MPI 11 (Exterior Latex, Semi-Gloss) // // MPI 119 (Exterior Latex, High Gloss (acrylic)) // to galvanized and zinc-copper alloy metal.
 - c. Apply one (1) coat of MPI 22 (High Heat Resistant Coating), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
 - 2. Interior Locations:
 - a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) to following items:
 - 1) Metal under 94 degrees C (201 degrees F) of items such as bare piping, fittings, hangers and supports.

- 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
- 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
- b. Ferrous metal exposed in hydrotherapy equipment room and chlorinator room of water and sewerage treatment plants: One (1) coat of MPI 101 (Cold Curing Epoxy Primer) and one (1) coat of // MPI 77 (Epoxy Cold Cured, Gloss // // MPI 98 (High Build Epoxy Coating)) // // MPI 108 (High Build Epoxy Marine coating) //.
- c. Apply one (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of // MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) // // MPI 44 (Interior Low Sheen Latex) // // MPI 52 (Interior Latex, MPI Gloss Level 3) // //MPI 43 (Interior Satin Latex) // // MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) // // MPI 114 (Interior Latex, Gloss) // on finish of insulation on boiler breeching and uptakes inside boiler house, drums, drumheads, oil heaters, feed water heaters, tanks and piping.
- d. Apply two (2) coats of MPI 22 (High Heat Resistant Coating) to ferrous metal surface over 94 degrees K (290 degrees F) of following items:
 - 1) Garbage and trash incinerator.
 - 2) Medical waste incinerator.
 - 3) Exterior of boilers and ferrous metal in connection with boiler settings including supporting members, doors and door frames and fuel oil burning equipment.
 - 4) Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (290 degrees F).
 - 5) Engine generator exhaust piping and muffler.
- e. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of // MPI 9 (Exterior Alkyd Enamel) // // MPI 8 (Exterior Alkyd, Flat) // // MPI 94 (Exterior Alkyd, Semi-gloss) // in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
3. Other exposed locations:
 - a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two (2) coats of MPI 1 (Aluminum Paint).

- b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of // MPI 10 (Exterior Latex, Flat) // // MPI 11 (Exterior Latex Semi-Gloss // // MPI 119 (Exterior Latex, High Gloss (acrylic)) //.

3.13 BUILDING AND STRUCTURAL WORK FIELD PAINTING:

- A. Painting and finishing of interior and exterior work except as specified here-in-after.
 - 1. Painting and finishing of new // and existing // work including colors and gloss of finish selected is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES.
 - 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
 - 3. Painting of ferrous metal and galvanized metal.
 - 4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space (except shingles).
 - 5. Identity painting and safety painting.
- B. Building and Structural Work not Painted:
 - 1. Prefinished items:
 - a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
 - b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
 - 2. Finished surfaces:
 - a. Hardware except ferrous metal.
 - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
 - c. Signs, fixtures, and other similar items integrally finished.
 - 3. Concealed surfaces:
 - a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
 - b. Inside walls or other spaces behind access doors or panels.
 - c. Surfaces concealed behind permanently installed casework and equipment.
 - 4. Moving and operating parts:

- a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
- b. Tracks for overhead or coiling doors, shutters, and grilles.
- 5. Labels:
 - a. Code required label, such as Underwriters Laboratories Inc., Intertek Testing Service or Factory Mutual Research Corporation.
 - b. Identification plates, instruction plates, performance rating, and nomenclature.
- 6. Galvanized metal:
 - a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
 - b. Gas Storage Racks.
 - c. Except where specifically specified to be painted.
- 7. Metal safety treads and nosings.
- 8. Gaskets.

SPEC WRITER NOTES:

- 1. Edit other exposed concrete surfaces not required to be painted.
 - 2. Coordinate with Section 09 06 00, SCHEDULE FOR FINISHES to schedule exceptions to not painted surfaces.
- 9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
 - 10. Face brick.
 - 11. Structural steel encased in concrete, masonry, or other enclosure.
 - 12. Structural steel to receive sprayed-on fire proofing.
 - 13. Ceilings, walls, columns in interstitial spaces.
 - 14. Ceilings, walls, and columns in pipe basements.
 - 15. Wood Shingles.

3.14 IDENTITY PAINTING SCHEDULE:

- A. Identify designated service in new buildings or projects with extensive remodeling in accordance with ASME A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels. For existing spaces where work is minor match existing.
 - 1. Legend may be identified using snap-on coil plastic markers or by paint stencil applications.
 - 2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories

such as valves, regulators, strainers and cleanouts a minimum of 12.2 M (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.

3. Locate Legends clearly visible from operating position.
4. Use arrow to indicate direction of flow using black stencil paint.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on construction documents where asterisk appears for High, Medium, and Low Pressure designations as follows:
 - a. High Pressure - 414 kPa (60 psig) and above.
 - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
 - c. Low Pressure - 103 kPa (14 psig) and below.
 - d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

SPEC WRITER NOTES:

1. Check with mechanical sections to determine legends required, and pressures.
2. Define Fuel oil grade.

| PIPING | COLOR OF EXPOSED PIPING | COLOR OF BACKGROUND | COLOR OF LETTERS | LEGEND ABBREVIATIONS |
|--------------------------------------|----------------------------|------------------------|---------------------|-------------------------|
| Blow-off | | Green | White | Blow-off |
| Boiler Feedwater | | Green | White | Blr Feed |
| A/C Condenser Water Supply | | Green | White | A/C Cond Wtr Sup |
| A/C Condenser Water Return | | Green | White | A/C Cond Wtr Ret |
| Chilled Water Supply | | Green | White | Ch. Wtr Sup |
| Chilled Water Return | | Green | White | Ch. Wtr Ret |
| Shop Compressed Air | | Blue | White | Shop Air |
| Air-Instrument Controls | | Green | White | Air-Inst Cont |
| Drain Line | | Green | White | Drain |
| Emergency Shower | | Green | White | Emg Shower |
| High Pressure Steam | | Green | White | H.P. _____* |
| High Pressure Condensate Return | | Green | White | H.P. Ret _____* |
| Medium Pressure Steam | | Green | White | M. P. Stm _____* |
| Medium Pressure Condensate Return | | Green | White | M.P. Ret _____* |
| Low Pressure Steam | | Green | White | L.P. Stm _____* |

Site Repairs and Catch Basin Restoration
VANJHCS, East Orange Campus
Construction Documents
Low Pressure Condensate

Project No. 561-19-152
East Orange, NJ 07018
October 2, 2019

| | | | | |
|---------------------------------------|-------|--------|-------|----------------------|
| Return | | Green | White | L.P. Ret _____ * |
| High Temperature Water | | | | |
| Supply | | Green | White | H. Temp Wtr Sup |
| High Temperature Water | | | | |
| Return | | Green | White | H. Temp Wtr Ret |
| Hot Water Heating Supply | | Green | White | H. W. Htg Sup |
| Hot Water Heating Return | | Green | White | H. W. Htg Ret |
| Gravity Condensate Return | | Green | White | Gravity Cond Ret |
| Pumped Condensate Return | | Green | White | Pumped Cond Ret |
| Vacuum Condensate Return | | Green | White | Vac Cond Ret |
| Fuel Oil - Grade // // | | Brown | White | Fuel Oil-Grade // // |
| (Diesel Fuel included under Fuel Oil) | | | | |
| Boiler Water Sampling | | Green | White | Sample |
| Chemical Feed | | Green | White | Chem Feed |
| Continuous Blow-Down | | Green | White | Cont. B D |
| Pumped Condensate | | Green | White | Pump Cond |
| Pump Recirculating | | Green | White | Pump-Recirc. |
| Vent Line | | Green | White | Vent |
| Alkali | | Orange | Black | Alk |
| Bleach | | Orange | Black | Bleach |
| Detergent | | Yellow | Black | Det |
| Liquid Supply | | Yellow | Black | Liq Sup |
| Reuse Water | | Yellow | Black | Reuse Wtr |
| Cold Water (Domestic) | White | Green | White | C.W. Dom |
| Hot Water (Domestic) | | | | |
| Supply | White | Yellow | Black | H.W. Dom |
| Return | White | Yellow | Black | H.W. Dom Ret |
| Tempered Water | White | Yellow | Black | Temp. Wtr |
| Ice Water | | | | |
| Supply | White | Green | White | Ice Wtr |
| Return | White | Green | White | Ice Wtr Ret |
| Reagent Grade Water | | Green | White | RG |
| Reverse Osmosis | | Green | White | RO |
| Sanitary Waste | | Green | White | San Waste |
| Sanitary Vent | | Green | White | San Vent |
| Storm Drainage | | Green | White | St Drain |
| Pump Drainage | | Green | White | Pump Disch |
| Chemical Resistant Pipe | | | | |
| Waste | | Orange | Black | Acid Waste |
| Vent | | Orange | Black | Acid Vent |
| Atmospheric Vent | | Green | White | ATV |
| Silver Recovery | | Green | White | Silver Rec |
| Oral Evacuation | | Green | White | Oral Evac |

Site Repairs and Catch Basin Restoration
 VANJHCS, East Orange Campus
 Construction Documents

Project No. 561-19-152
 East Orange, NJ 07018
 October 2, 2019

| | | | | |
|-----------------------|-----|--------|-------|----------|
| Fuel Gas | | Yellow | Black | Gas |
| Fire Protection Water | | | | |
| Sprinkler | Red | Red | White | Auto Spr |
| Standpipe | Red | Red | White | Stand |
| Sprinkler | Red | Red | White | Drain |

SPEC WRITER NOTE: If solar hot water system is on project, include the following.

| | | | | |
|---------------------------|--|-------|-------|--------------------|
| // Hot Water Supply Dom./ | | | | |
| Solar Water | | Green | White | H.W. Sup Dom/SW |
| Hot Water Return Dom./ | | | | |
| Solar Water | | Green | White | H.W. Ret Dom/SW // |

SPEC WRITE NOTE: Coordinate with Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS / Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS / Section 28 05 33, RACEWAYS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Electrical conduits carrying high voltage require labels in compliance with Occupational Safety and Health Office. Label is to be listed as class 5000, 15000, and 25000 and not exact voltage.

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6096 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, // 5000 // // 15000 // // 25000 //.
8. See Sections for methods of identification, legends, and abbreviations of the following:
 - a. Regular compressed air lines: Section 22 15 00, GENERAL SERVICE COMPRESSED-AIR SYSTEMS.
 - b. Dental compressed air lines: Section 22 61 13.74, DENTAL COMPRESSED-AIR PIPING / Section 22 61 19.74, DENTAL COMPRESSED-AIR EQUIPMENT.
 - c. Laboratory gas and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
 - d. Oral evacuation lines: Section 22 62 19.74, DENTAL VACUUM AND EVACUATION EQUIPMENT.
 - e. Medical Gases and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.

f. Conduits containing high voltage feeders over 600 volts:

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS /
Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS /
Section 28 05 33, RACEWAYS AND BOXES FOR ELECTRONIC SAFETY AND
SECURITY.

B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
4. Use semi-gloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:

1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.
2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (18 inches) below overhead structural slab.
3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.
4. Color:
 - a. Use black on concrete columns.
 - b. Use white or contrasting color on steel columns.

3.15 PROTECTION CLEAN UP, AND TOUCH-UP:

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

SECTION 31 20 00
EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:

1. Site preparation.
2. Excavation.
3. Underpinning.
4. Filling and backfilling.
5. Grading.
6. Soil Disposal.
7. Clean Up.

1.2 DEFINITIONS:

A. Unsuitable Materials:

1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D698, D1557.
2. Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.

B. Building Earthwork: Earthwork operations required in area enclosed by a line located 1500 mm (5 feet) outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.

C. Trench Earthwork: Trenchwork required for utility lines.

D. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.

- E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D6938.
- F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- G. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- H. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the Resident Engineer. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- I. Authorized additional excavation: Removal of additional material authorized by the Resident Engineer based on the determination by the Government's soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
- K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- M. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- N. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the springline of the pipe.
- O. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.
- P. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

- Q. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- R. Contaminated soils: Soil that contains contaminants as defined and determined by the Resident Engineer or the Government's testing agency.

1.3 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.
- E. Erosion Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, and Section 32 90 00, PLANTING.
- F. Site preparation: Section 02 41 00, DEMOLITION.
- G. Paving sub-grade requirements: Section 32 12 16, ASPHALT PAVING.

1.4 CLASSIFICATION OF EXCAVATION:

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.
- B. Classified Excavation: Removal and disposal of all material not defined as Rock.

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

- A. Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00

00, GENERAL REQUIREMENTS. The measurement will include authorized excavation of satisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow pits, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

1.6 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION - RESERVED

1.7 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Furnish to Resident Engineer:
 - 1. Contactor shall furnish resumes with all personnel involved in the project including Project Manager, Superintendent, and on-site Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.
 - 2. Soil samples.
 - a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
 - b. Laboratory compaction curve in accordance with ASTM D698, D1557 for each on site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
 - c. Test reports for compliance with ASTM D2940 requirements for subbase material.
 - d. Pre-excavation photographs and videotape in the vicinity of the existing structures to document existing site features, including surfaces finishes, cracks, or other structural blemishes that might be misconstrued as damage caused by earthwork operations.
 - e. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.
 - 3. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on

the opening of excavation or borrow areas. Advance notice on
shoulder construction for rigid pavements.

1.8 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent
referenced. Publications are referenced in text by basic designation
only.

B. American Association of State Highway and Transportation Officials
(AASHTO):

T99-10.....Standard Method of Test for Moisture-Density
Relations of Soils Using a 2.5 kg (5.5 lb)
Rammer and a 305 mm (12 inch) Drop
T180-10.....Standard Method of Test for Moisture-Density
Relations of Soils using a 4.54 kg (10 lb)
Rammer and a 457 mm (18 inch) Drop

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

C33-03.....Concrete Aggregate
D448-08.....Standard Classification for Sizes of Aggregate
for Road and Bridge Construction
D698-07e1.....Standard Test Method for Laboratory Compaction
Characteristics of Soil Using Standard Effort
(12,400 ft. lbf/ft³ (600 kN m/m³))

D1140-00.....Amount of Material in Soils Finer than the No.
200 (75-micrometer) Sieve
D1556-07.....Standard Test Method for Density and Unit
Weight of Soil in Place by the Sand Cone Method
D1557-09.....Standard Test Methods for Laboratory Compaction
Characteristics of Soil Using Modified Effort
(56,000 ft-lbf/ft³ (2700 kN m/m³))
D2167-08.....Standard Test Method for Density and Unit
Weight of Soil in Place by the Rubber Balloon
Method
D2487-11.....Standard Classification of Soils for
Engineering Purposes (Unified Soil
Classification System)
D2940-09.....Standard Specifications for Graded Aggregate
Material for Bases or Subbases for Highways or
Airports

D6938-10.....Standard Test Method for In-Place Density and
Water Content of Soil and Soil-Aggregate by
Nuclear Methods (Shallow Depth)

D. Society of Automotive Engineers (SAE):

J732-07.....Specification Definitions - Loaders

J1179-08.....Hydraulic Excavator and Backhoe Digging Forces

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.
- B. Fills: Material in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups; free of rock or gravel larger than 75 mm (3 inches) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material approved from on site or off site sources having a minimum dry density of 1760 kg/m³ (110 pcf), a maximum Plasticity Index of 15, and a maximum Liquid Limit of 40.
- C. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 37.5-mm (1 1/2-inch) sieve and not more than 12 percent passing a 75-µm (No. 200) sieve, per ASTM D2940;.
- D. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75-µm (No. 200) sieve.
- E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 37.5 mm (1 1/2-inch) sieve and 0 to 5 percent passing a 2.36 mm (No. 8) sieve.
- F. Granular Fill:
 - 1. Under concrete slab, - granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C 33 with a maximum of 3 percent by weight passing ASTM D 1140.

2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No 4), per ASTM D2940.

G. Requirements for Offsite Soils: Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall not fail the TCLP test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846.3-3a Method 5030/8020. TCLP shall be performed in accordance with EPA SW-846.3-3a Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Medical Center.
- B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.
- C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from areas within 4500 mm (15 feet) of new construction and 2250 mm (7.5 feet) of utility lines when removal is approved in advance by COR. Remove materials from Medical Center. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in construction area. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer to trees and shrubs, that are to remain, than farthest extension of their limbs.
- D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil

shall be capable of growing healthy horticultural crops of grasses.

Stockpile topsoil and protect as directed by Resident Engineer.

Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 0.014 m³ (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed.

- E. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from Medical Center.
- F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.
1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
 2. Locations of existing and proposed elevations indicated on plan, except spot elevations, are approximate. Contractor is responsible to notify COR of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify COR of any differences between existing or constructed grades, as compared to those shown on the plans.
 3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.

4. Finish grading is specified in Section 32 90 00, PLANTING.

G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheet piling and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the Resident Engineer, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.

1. Design of the temporary support of excavation system is the responsibility of the Contractor. The Contractor shall submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheet piling shall be removed as excavations are backfilled, in a manner to prevent caving.
2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the Resident Engineer.
3. Extend shoring and bracing to a minimum of 1500 mm (5 feet) below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations.
5. The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheet piling and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Resident Engineer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be

available to meet with the Resident Engineer at any time throughout the contract duration.

- B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from Resident Engineer. Approval by the COR is also required before placement of the permanent work on all subgrades. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 0.9 m (3 feet) of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material.
- C. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the Resident Engineer.
- D. Proofrolling:
1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.
 2. Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade.
- F. Building Earthwork:
1. Excavation shall be accomplished as required by drawings and specifications.
 2. Excavate foundation excavations to solid undisturbed subgrade.
 3. Remove loose or soft materials to a solid bottom.

4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete poured separately from the footings.
5. Do not tamp earth for backfilling in footing bottoms, except as specified.
6. Slope grades to direct water away from excavations and to prevent ponding.
7. Capillary water barrier (granular fill) under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.
8. Ensure that footing subgrades have been inspected and approved by the Resident Engineer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Resident Engineer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

G. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):
 - a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
 - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.
 - c. Support piping on suitable undisturbed earth unless a mechanical support is shown. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
 - d. Length of open trench in advance of piping laying shall not be greater than is authorized by Resident Engineer.
 - e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
 - f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3

feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

- g. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:

- 1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
- 2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

2. Sanitary and storm sewer trenches:

- a. Trench width below a point 150 mm (6 inches) above top of pipe shall be 600 mm (24 inches) maximum for pipe up to and including 300 mm (12 inches) diameter, and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (12 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
 - 1) Bed bottom quadrant of pipe on suitable undisturbed soil or granular fill. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6

- inches) loose thickness. 1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe shall be clean earth placed and tamped by hand.
- 2) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one sixth of pipe diameter below pipe to 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.
- c. Place and compact as specified remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
- d. Use granular fill for bedding where rock or rocky materials are excavated.
- e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
- f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
- g. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:

- 1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
- 2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

H. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by Resident Engineer as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the contractor shall obtain samples of the material, under the direction of the Resident Engineer, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on volume in cut section only.

1. Site Grading:

- a. Provide a smooth transition between adjacent existing grades and new grades.
- b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:

- 1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
 - 2) Walks: Plus or minus 25 mm (1 inch).
 - 3) Pavements: Plus or minus 13 mm (1 inch).
- d. Grading Inside Building Lines: Finish subgrade to a tolerance of 13 mm (1/2 inch) when tested with a 3000 mm (10 foot) straightedge.

3.3 UNDERPINNING - RESERVED

3.4 FILLING AND BACKFILLING:

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by Resident Engineer.
- B. Placing: Place materials in horizontal layers not exceeding 200 mm (8 inches) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.
- C. Compaction: Compact with approved tamping rollers, sheepsfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without prior approval of Resident Engineer. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the

structure. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 or ASTM D1557 as specified below:

1. Fills, Embankments, and Backfill

- a. Under proposed structures, building slabs, steps, and paved areas, scarify and recompact top 300 mm (12 inches) of existing subgrade and each layer of backfill or fill material in accordance with ASTM D698 D1557 95 percent.
- b. Curbs, curbs and gutters, ASTM D698 & D1557 95 percent.
- c. Under Sidewalks, scarify and recompact top 150 mm (6 inches) below subgrade and compact each layer of backfill or fill material in accordance with ASTM D698 & D1557 95 percent.

2. Natural Ground (Cut or Existing)

- a. Under building slabs, steps and paved areas, top 150 mm (6 inches), ASTM D698 & D1557 95 percent.
- b. Curbs, curbs and gutters, top 150 mm (6 inches), ASTM D698 & D1557 95 percent.
- c. Under sidewalks, top 150 mm (6 inches), ASTM D698 & D1557 95 percent.

D. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

E. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the Resident Engineer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be

excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 GRADING:

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.
- C. Slope backfill outside building away from building walls for a minimum distance of 1800 mm (6 feet).
- D. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.
- E. Finished grade shall be at least 150 mm (6 inches) below bottom line of window or other building wall openings unless greater depth is shown.
- F. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 150 mm (6 inches) unless otherwise shown.
- G. Finish subgrade in a condition acceptable to Resident Engineer at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.
- H. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center.
- B. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- E. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from Medical Center.

----- E N D -----

SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subbase for concrete pavements.
2. Curbs, gutters, and combination curbs and gutters wheel stops.
3. Pedestrian Pavement: Walks, grade slabs, pedestrian crossings, wheelchair curb ramps, terraces, steps and patios.
4. Vehicular Pavement: Service courts, driveways, parking lots, and loading docks.

1.2 RELATED REQUIREMENTS

- A. Field Testing: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Step Nosings and Railings: Section 05 50 00, METAL FABRICATIONS.
- C. Subgrade Preparation and Subbase Compaction: Section 31 20 00, EARTHWORK.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 1. M147-65-UL-04 - Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
 2. M233-86 - Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
- C. American Concrete Institute (ACI):
 1. 305R-10 - Guide to Hot Weather Concreting.
 2. 306R-10 - Guide to Cold Weather Concreting.
- D. American National Standards Institute (ANSI):
 1. B101.3 - Wet DOCF of Common Hard Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).
- E. ASTM International (ASTM):
 1. A615/A615M-16 - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
 2. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

3. A1064/A1064M-16 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
4. C33/C33M-16 - Concrete Aggregates.
5. C94/C94M-16 - Ready Mixed Concrete.
6. C143/C143M-15a - Slump of Hydraulic Cement Concrete.
7. C150/C150M-16 - Portland Cement.
8. C171-16 - Sheet Materials for Curing Concrete.
9. C260/C260M-10a - Air Entraining Admixtures for Concrete.
10. C309-11 - Liquid Membrane Forming Compounds for Curing Concrete.
11. C494/C494M-15a - Chemical Admixtures for Concrete.
12. C618-15 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
13. C979/C979M-16 - Pigments for Integrally Colored Concrete.
14. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
15. C1240-15 - Silica Fume Used in Cementitious Mixtures.
16. D1751-04(2013)e1 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
17. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
18. D6690-15 - Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Contractor.
 - c. Installer.
 - d. Other installers responsible for adjacent and intersecting work, including excavation, plantings and traffic markings,
 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Installation schedule.
 - b. Installation sequence.
 - c. Preparatory work.
 - d. Protection before, during, and after installation.

- e. Installation.
 - f. Terminations.
 - g. Transitions and connections to other work.
 - h. Inspecting and testing.
 - i. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
 - 2. Show reinforcing.
 - 3. Include jointing plan for concrete pavements, curbs and gutters.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.
- D. Samples:
 - 1. Exposed Aggregate Concrete Panel: 0.4 sq. m by 50 mm (4 sq. ft. by 2 inches) thick, 2 required, each color and finish.
 - 2. Colored Concrete Panel: As specified in Section 09 06 00, SCHEDULE FOR FINISHES, with mix data.
- E. Test reports: Certify products comply with specifications.
 - 1. Concrete materials.
 - 2. Select subbase materials.
 - 3. Field test reports.
- F. Certificates: Certify products comply with specifications.
 - 1. Expansion joint filler.
 - 2. Reinforcement.
 - 3. Curing materials.
 - 4. Concrete protective coating.
- G. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Installer with project experience list.
 - 2. Land surveyor.
- H. Concrete mix design.
- I. Select subbase job-mix design.
- J. Proposed hot and cold weather concreting methods.

- K. Land surveyor's construction staking notes, before placing concrete.
 - 1. Identify discrepancies between field conditions and Drawings.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on five similar installations.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
- B. Land Surveyor: Professional land surveyor or engineer registered to provide land surveys in jurisdiction where project is located.
- C. Preconstruction Testing:
 - 1. Engage independent testing laboratory to perform tests and submit reports.
 - a. Deliver samples to laboratory in number and quantity required for testing.
 - 2. Concrete mix design.
 - 3. Select subbase job-mix design. Report the following:
 - a. Material sources.
 - b. Gradation.
 - c. Plasticity index.
 - d. Liquid limit.
 - e. Laboratory compaction curves indicating maximum density at optimum moisture content.

1.7 DELIVERY

- A. Deliver steel reinforcement to prevent damage.
- B. Before installation, return or dispose of distorted or damaged steel reinforcement.
- C. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

1.8 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight facility.
- B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

- A. Hot Weather Concreting Procedures: ACI 305R.
- B. Cold Weather Concreting Procedures: ACI 306R.
 - 1. Use non-corrosive, non-chloride accelerator admixture.
 - 2. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

1.10 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II.
- B. Pozzolans:
 - 1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.
- C. Coarse Aggregate: ASTM C33/C33M;
- D. Fine Aggregate: ASTM C33/C33M.
- E. Mixing Water: Fresh, clean, and potable.
- F. Air-Entraining Admixture: ASTM C260/C260M.
- G. Chemical Admixtures: ASTM C494/C494M.
- H. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, Grade 420 (60) deformed.
- I. Welded Wire Fabric: ASTM A1064/A1064M, plain; Grade 450 (65)
- J. Expansion Joint Filler: ASTM D1751.
- K. Sheet Materials for Curing Concrete: ASTM C171.
- L. Color Pigment: ASTM C979/C979M, colored and white powder pigments.

2.2 SELECT SUBBASE

- A. Subbase: AASHTO M147; Grade A, Grade B, Grade C, Grade D, Grade E, Grade F.
 - 1. Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials.

| SUBBASE GRADING REQUIREMENTS | |
|------------------------------|----------------------------|
| Sieve Size | Percentage Passing by Mass |

| SUBBASE GRADING REQUIREMENTS | | | | | | | |
|------------------------------|---------|----------------------------|-------|-------|--------|--------|--------|
| Sieve Size | | Percentage Passing by Mass | | | | | |
| | | Grades | | | | | |
| (mm) | (in) | A | B | C | D | E | F |
| 50 | 2 | 100 | 100 | | | | |
| 25 | 1 | | 75-95 | 100 | 100 | 100 | 100 |
| 9.5 | 3/8 | 30-65 | 40-75 | 50-85 | 60-100 | | |
| 4.47 | No. 4 | 25-55 | 30-60 | 35-65 | 50-85 | 55-100 | 70-100 |
| 2.00 | No. 10 | 15-40 | 20-45 | 25-50 | 40-70 | 40-100 | 55-100 |
| 0.425 | No. 40 | 8-20 | 15-30 | 15-30 | 25-45 | 20-50 | 30-70 |
| 0.075 | No. 200 | 2-8 | 5-20 | 5-15 | 5-20 | 6-20 | 8-25 |

B. Other Acceptable Gradations: Materials within three to five percent, plus or minus, of specified gradation, or as recommended by the geotechnical engineer and approved by the Contracting Officer's Representative.

2.3 FORMS

- A. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer's Representative, of grade or type suitable to obtain type of finish specified.
1. Plywood: Exterior grade, free of defects and patches on contact surface.
 2. Lumber: Sound, grade-marked, S4S stress graded softwood, minimum 50 mm (2 inches) thick, free from warp, twist, loose knots, splits, or other defects.
 3. Form Coating: As recommended by Architect/Engineer.
- B. Provide forms suitable in cross-section, depth, and strength to resist springing during depositing and consolidating concrete.
1. Do not use forms varying from straight line more than 3 mm in 3000 mm (1/8 inch in 10 feet), horizontally and vertically.
- C. Provide flexible or curved forms for forming radii.

2.4 CONCRETE CURING MATERIALS

- A. Concrete curing materials, conform to one of the following:
1. Burlap: Minimum 233 g/sq. m (7 ounces/sq. yd.) dry.
 2. Sheet Materials for Curing Concrete: ASTM C171.
 3. Curing Compound: ASTM C309, Type 1 without paraffin or petroleum.

2.5 CONCRETE MIXES

- A. Design concrete mixes according to ASTM C94/C94M, Option C.
- B. Concrete Type: Air-entrained. See Table I.

| TABLE I - CONCRETE TYPES | | | | | |
|---|---|-------------------------------------|-------------------------|-------------------------------------|-------------------------|
| Concrete Type | Minimum 28 Day Compressive Strength f'c MPa (psi) | Non-Air-Entrained | | Air-Entrained | |
| | | Min. Cement kg/cu. m (lbs./cu. yd.) | Max. Water Cement Ratio | Min. Cement kg/cu. m (lbs./cu. yd.) | Max. Water Cement Ratio |
| A | 35 (5000)1,3 | 375 (630) | 0.45 | 385 (650) | 0.40 |
| B | 30 (4000)1,3 | 325 (550) | 0.55 | 340 (570) | 0.50 |
| C | 25 (3000)1,3 | 280 (470) | 0.65 | 290 (490) | 0.55 |
| D | 25 (3000)1,2 | 300 (500) | * | 310 (520) | * |
| Footnotes: | | | | | |
| 1. If trial mixes are used, achieve compressive strength 8.3 MPa (1,200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve compressive strength 9.7 MPa (1,400 psi) in excess of f'c. | | | | | |
| 2. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44. | | | | | |
| 3. Laboratory Determined according to ACI 211.1 for normal weight concrete. | | | | | |

- C. Maximum Slump: ASTM C143/C143M. See Table II.

| TABLE II - MAXIMUM SLUMP | |
|--------------------------|-----------------------------------|
| APPLICATION | MAXIMUM SLUMP |
| Curb & Gutter | 75 mm (3 inches) |
| Pedestrian Pavement | 75 mm (3 inches) |
| Vehicular Pavement | 50 mm (2 inches) Machine Finished |
| | 100 mm (4 inches) Hand Finished |
| Equipment Pad | 75 to 100 mm (3 to 4 inches) |

2.6 ACCESSORIES

- A. Equipment and Tools: Obtain Contracting Officer's Representative's, approval of equipment and tools needed for handling materials and performing work before work begins.
- B. Maintain equipment and tools in satisfactory working condition.
- C. Sealants:

1. Concrete Paving Expansion Joints: ASTM D5893/D5893M, Type SL, single component, self-leveling, silicone joint sealant.
 2. Concrete Paving Joints: ASTM D6690, Type IV, hot-applied, single component joint sealant.
- D. Concrete Protective Coating: AASHTO M233 linseed oil mixture.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Prepare, construct, and finish subgrade. See Section 31 20 00, EARTHWORK.
- D. Maintain subgrade in smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE

- A. Placing:
 1. Place subbase material on prepared subgrade in uniform layer to required contour and grades, and to maximum 200 mm (8 inches) loose depth.
 2. When required compacted thickness exceeds 150 mm (6 inches), place subbase material in equal thickness layers.
 3. When subbase elevation is 13 mm (1/2 inch) or more below required grade, excavate subbase minimum 75 mm (3 inches) deep. Place and compact subbase to required grade.
- B. Compaction:
 1. Perform compaction with approved hand or mechanical equipment well suited to the material being compacted.
 2. Maintain subbase at optimum moisture content for compaction.
 3. Compact each subbase layer to minimum 95 percent or 100 percent of maximum density as specified in Section 31 20 00, EARTHWORK.
- C. Subbase Tolerances:
 1. Variation from Indicated Grade: Maximum 9 mm (3/8 inch).
 2. Variation from Indicated Thickness: Maximum 13 mm (1/2 inch).
- D. Protection:
 1. Protect subbase from damage until concrete is placed.
 2. Reconstruct damaged subbase before placing concrete.

3.3 SETTING FORMS

- A. Form Substrate:
 - 1. Compact form substrate to uniformly support forms along entire length.
 - 2. Correct substrate imperfections and variations by cutting, filling, and compacting.
- B. Form Setting:
 - 1. Set forms to indicated line and grade with tight joints. Rigidly brace forms preventing movement.
 - 2. Remove forms when removal will not damage concrete and when required for finishing.
 - 3. Clean and oil forms before each use.
 - 4. Correct forms, when required, immediately before placing concrete.
- C. Land Surveyor: Establish control, alignment, and grade for forms.
 - 1. Notify Contracting Officer's Representative immediately when discrepancies exist between field conditions and drawings.
 - 2. Correct discrepancies greater than 25 mm (1 inch) before placing concrete.
- D. Form Tolerances:
 - 1. Variation from Indicated Line: Maximum 6 mm (1/4 inch).
 - 2. Variation from Indicated Grade: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).

3.4 PLACING REINFORCEMENT

- A. Keep reinforcement clean from contamination preventing concrete bond.
- B. Install reinforcement shown on drawings.
- C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.
- D. Obtain Contracting Officer's Representative's reinforcement placement approval before placing concrete.

3.5 JOINTS - GENERAL

- A. Place joints, where shown on approved submittal Drawings.
 - 1. Conform to details shown.
 - 2. Install joints perpendicular to finished concrete surface.
- B. Make joints straight and continuous from edge to edge of pavement.

3.6 CONSTRUCTION JOINTS

- A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown on approved submittal Drawings.
- B. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.
- C. Provide butt-type joint with dowels in curb and gutter at planned joint locations.
- D. Provide keyed joints with tie bars when joint occurs in middle third of planned curb and gutter joint interval.

3.7 CONTRACTION JOINTS

- A. Tool or cut joints to width, depth, and radius edge shown on drawings using grooving tool, jointer, or saw.
- B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to curb and gutter cross sections.
 - 1. Keep plates in place until concrete can hold its shape.
- C. Finish joint edges with edging tool.
- D. Score pedestrian pavement with grooving tool or jointer.

3.8 EXPANSION JOINTS

- A. Form expansion joints with expansion joint filler of thickness shown on drawings.
 - 1. Locate joints around perimeter of structures and features abutting site work concrete.
 - 2. Create complete, uniform separation between structure and site work concrete.
- B. Extend expansion joint material full depth of concrete with top edge of joint filler below finished concrete surface where sealant is indicated on Drawings.
- C. Cut and shape material matching cross section.
- D. Anchor with approved devices to prevent displacing during placing and finishing operations.
- E. Round joint edges with edging tool.

3.9 PLACING CONCRETE - GENERAL

- A. Preparation before Placing Concrete:
 - 1. Obtain Contracting Officer's Representative approval.
 - 2. Remove debris and other foreign material.
 - 3. Uniformly moisten substrate, without standing water.

- B. Convey concrete from mixer to final location without segregation or loss of ingredients. Deposit concrete to minimize handling.
- C. During placement, consolidate concrete by spading or vibrating to minimize voids, honeycomb, and rock pockets.
 - 1. Vibrate concrete against forms and along joints.
 - 2. Avoid excess vibration and handling causing segregation.
- D. Place concrete continuously between joints without bulkheads.
- E. Install construction joint in concrete placement suspended for more than 30 minutes.
- F. Replace concrete with cracks, chips, bird baths, and other defects to nearest joints, approved by Contracting Officer's Representative.

3.10 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

- A. Place concrete in one layer conforming to cross section shown on Drawings after consolidating and finishing.
- B. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.
- C. Strike concrete surface to proper section ready for consolidation.
- D. Consolidate concrete by tamping and spading.
- E. Finish concrete surface with wood or metal float.
- F. Construct concrete pads and pavements with sufficient slope to drain, preventing standing water.

3.11 PLACING CONCRETE FOR VEHICULAR PAVEMENT

- A. Deposit concrete as close as possible to its final position.
- B. Place concrete continuously between construction joints without cold joints.
- C. Strike and consolidate concrete with finishing machine, vibrating screed, or by hand-finishing.
- D. Finish concrete surface to elevation and crown shown on drawings.
- E. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.
- F. Obtain Contracting Officer's Representative's approval before placing adjacent lanes.

3.12 FORM REMOVAL

- A. Keep forms in place minimum 12 hours after concrete placement. Remove forms without damaging concrete.

- B. Do not use bars or heavy tools against concrete to remove forms. Repair damage concrete found after form removal.

3.13 CONCRETE FINISHING - GENERAL

- A. Follow operation sequence below, unless otherwise indicated on Drawings:
 - 1. Consolidating, floating, striking, troweling, texturing, and joint edging.
- B. Use edging tool with 6 mm (1/4 inch) radius.
- C. Keep finishing equipment and tools clean and suitable for use.

3.14 CONCRETE FINISHING - PEDESTRIAN PAVEMENT

- A. Walks, Grade Slabs, Lawn Mower Crossings, Wheelchair Curb Ramps, Terraces:
 - 1. Finish concrete surfaces with metal float, troweled smooth, and finished with a broom moistened with clear water.
 - 2. Finish slab edges and formed transverse joints with edger.
 - 3. Broom surfaces transverse to traffic direction.
 - a. Use brooming to eliminate flat surface produced by edger.
 - b. Produce uniform corrugations, maximum 1.5 mm (1/16 inch) deep profile.
 - 4. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.
 - 5. Paving Tolerances:
 - a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).
 - b. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
 - 6. Replace paving within joint boundary when paving exceeds specified tolerances.
- B. Step Treads, Risers and Sidewalls: Finish as specified for pedestrian pavement, except as follows:
 - 1. Remove riser forms sequentially, starting with top riser.
 - 2. Rub riser face with wood or concrete rubbing block and water. Remove blemishes, form marks, and tool marks. Use outside edger to round nosing; use inside edger to finish bottom of riser.
 - 3. Apply uniform brush finish to treads, risers, and sidewall.
 - a. Apply stiff brush finish to treads to provide slip resistant surface complying with ANSI B101.3.

4. Step Tolerance:

- a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).

3.15 CONCRETE FINISHING - VEHICULAR PAVEMENT

- A. Align finish surfaces where new and existing pavements abut.
- B. Longitudinally float pavement surface to profile and grade indicated on drawings.
- C. Straighten surface removing irregularities and maintaining specified tolerances while concrete is plastic.
- D. Finish pavement edges and joints with edging tool.
- E. Broom finish concrete surface after bleed water dissipates and before concrete hardens.
 1. Broom surface transverse to traffic direction.
 - a. Use brooming to eliminate flat surface produced by edger.
 - b. Produce uniform corrugations, maximum 3 mm (1/8 inch) deep profile.
- F. Pavement Tolerances:
 1. Variation from Indicated Plane: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet) tested parallel and perpendicular to traffic direction at maximum 1500 mm (5 feet) intervals.
 2. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
- G. Replace paving within joint boundary when paving exceeds specified tolerances.

3.16 CONCRETE FINISHING - CURBS AND GUTTERS

- A. Round edges of gutter and top of curb with edging tool.
- B. Gutter and Curb Top:
 1. Float surfaces and finish with smooth wood or metal float until true to grade and section and uniform color.
 2. Finish surfaces, while still plastic, longitudinally with bristle brush.
- C. Curb Face:
 1. Remove curb form and immediately rub curb face with wood or concrete rubbing block removing blemishes, form marks, and tool marks and providing uniform color.
 2. Brush curb face, while still plastic, matching gutter and curb top.
- D. Curb and Gutter Tolerances:

1. Variation from Indicated Plane and Grade:
 - a. Gutter: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
 - b. Curb Top and Face: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet).

- E. Replace curbs and gutters within joint boundary when curbs and gutters exceed specified tolerances.
- F. Correct depressions causing standing water.

3.17 CONCRETE FINISHING - EQUIPMENT PADS

- A. Strike pad surface to elevation shown on Drawings.
- B. Provide smooth, dense float finish, free from depressions or irregularities.
- C. Finish pad edges with edger.
- D. After removing forms, rub pad edge faces with wood or concrete rubbing block, removing blemishes, form marks, and tool marks and providing uniform color.
- E. Pad Tolerances:
 1. Variation from Indicated Plane: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
 2. Variation from Indicated Elevation: Maximum 6 mm (1/4 inch).
 3. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
- F. Replace pads when pads exceed specified tolerances.

3.18 SPECIAL FINISHES - RESERVED

3.19 CONCRETE CURING

- A. Concrete Protection:
 1. Protect unhardened concrete from rain and flowing water.
 2. Provide sufficient curing and protection materials available and ready for use before concrete placement begins.
 3. Protect concrete to prevent pavement cracking from ambient temperature changes during curing period.
 - a. Replace pavement damaged by curing method allowing concrete cracking.
 - b. Employ another curing method as directed by Contracting Officer's Representative.
- B. Cure concrete for minimum 7 days by one of the following methods appropriate to weather conditions preventing moisture loss and rapid temperature change:

1. Burlap Mat: Provide minimum two layers kept saturated with water during curing period. Overlap Mats at least 150 mm (6 inches).
2. Sheet Materials:
 - a. Wet exposed concrete surface with fine water spray and cover with sheet materials.
 - b. Overlap sheets minimum 300 mm (12 inches).
 - c. Securely anchor sheet materials preventing displacement.
3. Curing Compound:
 - a. Protect joints indicated to receive sealants preventing contamination from curing compound.
 - b. Insert moistened paper or fiber rope into joint or cover joint with waterproof paper.
 - c. Apply curing compound before concrete dries.
 - d. Apply curing compound in two coats at right angles to each other.
 - e. Application Rate: Maximum 5 sq. m/L (200 sq. ft./gallon), both coats.
 - f. Immediately reapply curing compound to surfaces damaged during curing period.

3.20 CONCRETE PROTECTIVE COATING

- A. Apply protective coating of linseed oil mixture to exposed-to-view concrete surfaces, drainage structures, and features that project through, into, or against concrete exterior improvements to protect the concrete against deicing materials.
- B. Complete backfilling and curing operation before applying protective coating.
- C. Dry and thoroughly clean concrete before each application.
- D. Apply two coats, with maximum coverage of 11 sq. m/L (50 sq. yds./gal.); first coat, and maximum 16 sq. m/L (70 sq. yds./gal.); second coat, except apply commercially prepared mixture according to manufacturer's instructions.
- E. Protect coated surfaces from vehicular and pedestrian traffic until dry.
- F. Do not heat protective coating, and do not expose protective coating to open flame, sparks, or fire adjacent to open containers or applicators. Do not apply material at temperatures lower than 10 degrees C (50 degrees F).

3.21 FIELD QUALITY CONTROL

- A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
 - 1. Compaction.
 - a. Pavement subgrade.
 - b. Curb, gutter, and sidewalk.
 - 2. Concrete:
 - a. Delivery samples.
 - b. Field samples.
 - 3. Slip Resistance: Steps and pedestrian paving.

3.22 CLEANING

- A. After completing curing:
 - 1. Remove burlap and sheet curing materials.
 - 2. Sweep concrete clean, removing foreign matter from the joints.
 - 3. Seal joints as specified.

3.23 PROTECTION

- A. Protect exterior improvements from traffic and construction operations.
 - 1. Prohibit traffic on paving for minimum seven days after placement, or longer as directed by Contracting Officer's Representative.
- B. Remove protective materials immediately before acceptance.
- C. Repair damage.
 - 1. Replace concrete containing excessive cracking, fractures, spalling, and other defects within joint boundary, when directed by Contracting Officer's Representative, and at no additional cost to the Government.

- - - E N D - - -

SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.2 RELATED WORK

- A. Laboratory and field testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Paragraph 3.3 and Section 31 20 00, EARTHWORK.
- C. Pavement Markings: Section 32 17 23, PAVEMENT MARKINGS.

1.3 INSPECTION OF PLANT AND EQUIPMENT

The COR shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

1.4 ALIGNMENT AND GRADE CONTROL

The Contractor's Registered Professional Land Surveyor shall establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Data and Test Reports:
 - 1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by State Highway Department.
 - 2. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.

3. Job-mix formula.

C. Certifications:

1. Asphalt prime and tack coat material certificate of conformance to State Highway Department requirements.
2. Asphalt cement certificate of conformance to State Highway Department requirements.
3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the State Highway Specification.

D. One copy of State Highway Department Specifications.

E. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

PART 2 - PRODUCTS

2.1 GENERAL

A. Aggregate base and asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the VA COR or VA Contracting Officer.

2.2 AGGREGATES

- A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.
- B. Subbase aggregate (where required) maximum size: 38mm(1-1/2").
- C. Base aggregate maximum size:
1. Base course over 152mm(6") thick: 38mm(1-1/2");
 2. Other base courses: 19mm(3/4").
- D. Asphaltic base course:
1. Maximum particle size not to exceed 25.4mm(1").
 2. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.
- E. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

| <u>Sieve Sizes</u> | <u>Percentage Passing</u> |
|--------------------|---------------------------|
| 19mm (3/4") | 100 |

| | |
|---------------------|----------|
| 9.5mm (3/8") | 67 to 85 |
| 6.4mm (1/4") | 50 to 65 |
| 2.4mm (No. 8 mesh) | 37 to 50 |
| 600µm (No. 30 mesh) | 15 to 25 |
| 75µm (No. 200 mesh) | 3 to 8 |

plus 50/60 penetration liquid asphalt at 5 percent to 6-1/2 percent of the combined dry aggregates.

2.3 ASPHALTS

A. Comply with provisions of Asphalt Institute Specification SS2:

1. Asphalt cement: Penetration grade 50/60
2. Prime coat: Cut-back type, grade MC-250
3. Tack coat: Uniformly emulsified, grade SS-1H

2.4 SEALER

- A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.
- B. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

PART 3 - EXECUTION

3.1 GENERAL

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

- A. Provide hot plant-mixed asphaltic concrete paving materials.
1. Temperature leaving the plant: 143 degrees C (290 degrees F) minimum, 160 degrees C (320 degrees F) maximum.
 2. Temperature at time of placing: 138 degrees C (280 degrees F) minimum.

3.3 SUBGRADE

- A. Shape to line and grade and compact with self-propelled rollers.
- B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.

- C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.
- D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.
- E. Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA Resident Engineer or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

3.4 BASE COURSES

- A. Subbase (when required)
 - 1. Spread and compact to the thickness shown on the drawings.
 - 2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
 - 3. After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.
- B. Base
 - 1. Spread and compact to the thickness shown on the drawings.
 - 2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
 - 3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.
- C. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").
- D. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).
- E. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING

- A. Remove all loose materials from the compacted base.
- B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.
- C. Receipt of asphaltic concrete materials:
 - 1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C (280 degrees F).

2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.

D. Spreading:

1. Spread material in a manner that requires the least handling.
2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
 - a. No depressions which will retain standing water.
 - b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

3.6 APPLICATION OF SEAL COAT

- A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.
- B. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.
- C. When sealing new asphalt paving wait an entire year to allow for the expansion and contraction of a year's cycle of both warm and cool temperatures. This allows for the asphalt's oils to properly cure and begin oxidation before applying a seal coat.
- D. When seal coating in less than a year apply two coats, spray applied. This application method is preferred for less than a year application when there is still plenty of asphalt cement present for the seal coat to bond to.
- E. When seal coating existing paving that has new asphalt patches, apply two coats sprayed to the existing asphalt and a single lighter coat on new patch work, just enough to make the color of the new patches match the rest of the reseal coated paving.//
- F. When resealing existing paving 5, 10, 15 years and older, that is oxidized and is very light in color, squeegee apply the first coat of seal coat and spray on a second coat. Two coats are preferred in older paving when the asphalt cement has oxidized leaving the seal coat with

nothing to bond to other than the aggregate that in many cases has
polished over time leaving less than a desirable surface to bond to.//

3.7 PROTECTION

Protect the asphaltic concrete paved areas from traffic until the
sealer is set and cured and does not pick up under foot or wheeled
traffic.

3.8 FINAL CLEAN-UP

Remove all debris, rubbish, and excess material from the work area.

- - - E N D - - -

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Paint and reflective glass beads on pavement surfaces, in form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings.

1.2 RELATED REQUIREMENTS

- A. Paint Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. Federal Specifications (Fed. Spec.):
1. TT-B-1325D - Beads (Glass Spheres) Retro-Reflective.
 2. TT-P-1952F - Paint, Traffic and Airfield Marking, Waterborne.
- C. Master Painters Institute (MPI):
1. No. 97 - Traffic Marking Paint, Latex.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
1. Show pavement marking configuration and dimensions.
 2. Show international symbol of accessibility at designated parking spaces.
- C. Manufacturer's Literature and Data:
1. Description of each product.
 2. Application instructions.
- D. Samples:
1. Paint: 200 mm (8 inches) square, each type and color.
- E. Certificates: Certify products comply with specifications.
- F. Qualifications: Substantiate qualifications comply with specifications.
1. Installer with project experience list.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Regularly installs specified products.

2. Installed specified products with satisfactory service on five similar installations for minimum five years.

a. Project Experience List: Provide contact names and addresses for completed projects.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Store products indoors in dry, weathertight conditioned facility.
- B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

- A. Environment:
 - 1. Product Temperature: Minimum 13 degrees C (55 degrees F) for minimum 48 hours before installation.
 - a. Surface to be painted and ambient temperature: Minimum 10 degrees C (50 degrees F) and maximum 35 degrees C (95 degrees F).
- B. Field Measurements: Verify field conditions affecting traffic marking installation. Show field measurements on Submittal Drawings.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Design paint complying with specified performance:
 - 1. Application: Fed. Spec. TT-P-1952.

2.2 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide each product from one manufacturer and from one production run.

2.3 SANDBLASTING EQUIPMENT

- A. Air compressor, hoses, and nozzles of proper size and capacity as required for cleaning painted surfaces. Compressor to provide minimum 0.08 cu. m/s (150 cfm) of air at pressure of minimum 625 kPa (90 psi) at each nozzle used.

2.4 PAINT APPLICATOR

- A. Apply marking paint with approved mechanical equipment. Provide equipment with constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in case of skip lines. Equipment to have manual control to apply continuous lines of varying length and marking widths as indicated on Drawings. Provide pneumatic spray guns for hand application of paint in areas where mobile paint applicator cannot be used. Use separate piece of equipment when equipment does not have glass bead dispenser. Adjust and synchronize equipment with paint applicator to distribute reflective beads on paint lines uniformly within ten seconds without any waste.

2.5 PAINT

- A. Paint: MPI No. 97. For obliterating existing markings comply with Fed. Spec. TT-P-1952. Provide minimum 18 L (5 gallons) containers.

2.6 REFLECTIVE GLASS BEADS

- A. Beads: Comply with Fed. Spec. TT-B-1325, Type I, Gradation A. In regions of high humidity, coat beads with silicone or other suitable waterproofing material to ensure free flow. Provide glass beads in containers suitable for handling and strong enough to prevent loss during shipment.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
 - 1. Allow new pavement surfaces to cure for period of minimum 14 days before application of marking materials.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or combination of these methods.
2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by Contracting Officer's Representative.
3. As an option, comply with Fed. Spec. TT-P-1952 for removal of existing paint markings on asphalt pavement. Apply black paint in as many coats as necessary to completely obliterate existing markings.
4. Scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application, Where oil or grease are present on old pavements to be marked, .
 - a. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through new paint.
5. Clean and dry surface before pavement marking. Do not begin any marking until Contracting Officer's Representative inspected surface and gives permission to proceed.

3.2 TEMPORARY PAVEMENT MARKING - RESERVED

3.3 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.4 PAINT APPLICATION

- A. Apply uniformly painted and reflective pavement marking of required colors, length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces.
- B. Comply with details as indicated on drawings and established control points.
- C. Apply paint at wet film thickness of 0.4 mm (0.015 inch). Disperse reflective glass beads evenly on wet paint at rate of 720 g/L (6 pounds per gal.) of paint. Apply paint in one coat. When directed by Contracting Officer's Representative, apply additional coats at

markings showing light spots. Comply with paint manufacturer's maximum drying time requirements to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic.

- D. When deficiency in marking drying occurs, discontinue paint operations until cause of slow drying is determined and corrected.
- E. Remove and replace marking applied less than minimum material rates, deviates from true alignment, exceeds stipulated length and width tolerances, or shows light spots, faulty distribution of beads, smears, or other deficiencies or irregularities.
- F. Remove marking by carefully controlled sandblasting, approved grinding equipment, or other approve method to prevent damage on applied surface.

3.5 DETAIL PAVEMENT MARKING APPLICATION

- A. Apply Detail Pavement Markings, exclusive of actual traffic lane marking as follows:
 - 1. At exit and entrance islands and turnouts.
 - 2. On curbs.
 - 3. At crosswalks.
 - 4. At parking bays.
 - 5. Other locations as indicated on drawings.
- B. Apply International Handicapped Symbol at indicated parking spaces. Color as shown on drawings. Apply paint for symbol using suitable template that will provide pavement marking with true, sharp edges and ends.
- C. Install detail pavement markings of colors, widths and lengths, and design pattern at locations indicated on drawings.

3.6 TOLERANCES

- A. Length and Width of Lines: Plus or minus 75 mm (3 inches) and plus or minus 3 mm (1/8 inch), respectively, in case of skip markings.
- B. Length of intervals exceeding line length tolerance are not acceptable.

3.7 CLEANING

- A. Remove excess paint before paint sets.

3.8 PROTECTION

- A. Protect pavement markings from traffic and construction operations.
 - 1. Protect newly painted markings from vehicular traffic until paint is dry and track free.

2. Place warning signs at beginning of wet line, and at points well in advance of marking equipment for alerting approaching traffic from both directions.
 3. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.
- B. Repair damage.

- - - E N D - - -

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain link fence, gates and accessories.

1.2 RELATED REQUIREMENTS

- A. Temporary Construction Fence: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Fence Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. A121-13 - Metallic Coated Carbon Steel Barbed Wire.
2. A392-11a - Zinc-Coated Steel Chain-Link Fence Fabric.
3. A491-11 - Aluminum Coated Steel Chain Link Fence Fabric.
4. A817-12 - Metal-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.
5. B429 - Aluminum-Alloy Extruded Structural Pipe and Tube.
6. F567-14a - Installation of Chain-Link Fence.
7. F626-14 - Fence Fittings.
8. F668-11 - Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain Link Fence Fabric.
9. F900-11 - Industrial and Commercial Swing Gates.
10. F1184-16 - Industrial and Commercial Horizontal Slide Gates.
11. F1664-08(2013) - Polyvinyl Chloride (PVC) and Other Conforming Organic Polymer Coated Steel Tension Wire used with Chain Link Fence.
12. F1665-08(2013) - Polyvinyl Chloride (PVC) and Other Conforming Organic Polymer Coated Steel Barbed Wire used with Chain Link Fence.
13. F2200-14 - Automated Vehicular Gate Construction.
14. F1043-16 - Strength and Protective Coatings on Steel Industrial Fence Framework.
15. F1083-16 - Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

C. Chain Link Fence Manufacturing Institute (CLFMI):

1. Product Manual.

- D. Federal Specifications (Fed. Spec.):
 - 1. FF-P-110J - Padlock, Changeable Combination.
- E. Master Painters Institute (MPI):
 - 1. No. 18 - Primer, Zinc Rich, Organic.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show size, configuration, and fabrication and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Installation instructions.
- D. Certificates: Certify each product complies with specifications.
 - 1. Fence alignment.
 - 2. Zinc-coating.
- E. Qualifications: Substantiate qualifications comply with specifications.
 - 1. Manufacturer with project experience list.
 - 2. Installer with project experience list.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Regularly manufactures specified products.
 - 2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
- B. Installer Qualifications:
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on five similar installations for minimum five years.

1.6 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

- A. Protect products from damage during handling and construction operations.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

- A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Provide fences and gates from one manufacturer.

2.2 CHAIN-LINK FENCING AND GATES

- A. General: Conform to CLFMI Product Manual.
- B. Chain Link Fabric: 50 mm (2 inch) mesh, 3.76 mm(0.15 inches), 1.8 m (72 inches) high, top selvage and bottom selvage.
 - 1. Zinc-Coated Steel Fabric: ASTM A392, hot dipped galvanized before or after weaving.
 - a. Class 1 - 366 g/sq. m (1.2 oz/sq. ft.).
 - b. Class 2 - 610 g/sq. m (2.0 oz/sq. ft.).
 - 2. Aluminum-Coated Steel Fabric (Aluminized): ASTM A491.
 - 3. Polymer Coated Steel Fabric: ASTM F668.
 - a. Class 1 extruded.
 - b. Class 2a extruded and adhered.
 - c. Class 2b fused and adhered.
 - d. Color: Black.
 - 4. Fabric Selvage: K&T, Knuckle finish at one end, twist at other.
 - a. Fabric less than 1.8 m (72 inches) width, knuckle finish top and bottom.
- C. Fence Framework:
 - 1. Round Steel Pipe and Rail: ASTM F1043, Group IA Heavy Industrial Fence Framework, ASTM F1083 schedule 40 galvanized pipe.
 - a. Line post: 60 mm (2.375 inch) diameter.
 - b. End, Corner, Pull post: 60 mm (2.375 inch) diameter.
 - c. Brace rails, top, bottom, and intermediate rails, 42 mm (1.660 inch) diameter, 3.38 kg/m (2.27 lb./ft.).

2.3 TENSION WIRE

- A. Metallic Coated Steel Marcellled Tension Wire: ASTM A817, Type I, II 4.5 mm (0.177 inches) marcellled wire.

2.4 BARBED WIRE

- A. Metallic Coated Steel Barbed Wire: ASTM A121, Type A, Aluminum-coated double 2.5 mm (0.10 inches) twisted strand wire, with 4 point 2.0 mm (0.080 inches) round barbs spaced 125 mm (5 inches) on center.

2.5 FITTINGS

- A. General: ASTM F626.
- B. Tension and Brace Bands: Galvanized pressed steel.
- C. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves: Pressed steel galvanized.
- D. Truss Rod Assembly: Steel truss rod with a pressed steel tightener.
- E. Tension Bars: Galvanized steel one-piece length 50 mm (2 inches) less than the fabric height.
- F. Barbed Wire Arms: Pressed steel galvanized after fabrication Type I - three strand 45 degree arm and Type II - three strand vertical arm and Type III - V shaped six strand arm.

2.6 TIE WIRE and HOG RINGS

- A. Galvanized: Minimum zinc coating 366 g/sq. m (1.20 oz./sq. ft.); 3.76 mm (0.148 inch) diameter steel wire.

2.7 GATES

- A. Swing Gates: ASTM F900, ASTM F2200, double swing type.
 - 1. Galvanized steel:
 - a. Frame: ASTM F1043 and ASTM F1083 Group IA schedule 40 pipe 48.3 mm (1.900 inches) OD. Apply galvanized repair paint on welded joints.
 - 1) Vertical and Horizontal Spacing: Maximum 2400 mm (8 ft.).
 - b. Hardware:
 - 1) Hinges: 180 degree gate hinges per leaf.
 - 2) Positive locking gate latch, 7.9 mm (5/16 inches) thick by 44 mm (1 3/4 inches).
 - 3) Padlocks: Fed. Spec. FF-P-110J.

2.8 CONCRETE

- A. Concrete: As specified in Section 03 30 00, Cast-in-Place Concrete.

2.9 FINISHES

- A. Steel Paint Finish:

1. Powder-Coat Finish: Manufacturer's standard two-coat finish system as follows:
 - a. One coat primer.
 - b. One coat thermosetting topcoat.
 - c. Dry-film Thickness: 0.05 mm (2 mils) minimum.
 - d. Color: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Finish exposed surfaces after fabrication.
- C. Aluminum Anodized Finish: NAAMM AMP 500.
 1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.
 2. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.
 3. Clear Anodized Finish: AA-C22A31; Class II Architectural, 0.01 mm (0.4 mil) thick.
 4. Color Anodized Finish: AA-C22A32 or AA-C22A34; Class II Architectural, 0.01 mm (0.4 mil) thick.

2.10 ACCESSORIES

- A. Primers:
- B. Barrier Coating: ASTM D1187/D1187M.
- C. Welding Materials: AWS D1.1/D1.1M, type to suit application.
- D. Galvanizing Repair Paint: MPI No. 18.
- E. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Remove existing fences and gates to permit new installation.
 1. Dispose of // other // removed materials.

3.2 INSTALLATION

- A. Layout fence and locate position of post.
- B. Installation:
 1. General: Comply with ASTM F567.
 2. Framework:
 - a. Posts: Set plumb in concrete footings with 600 mm (24 inches) minimum depth.

- 1) Minimum Footing Diameter: Four times largest cross section of post, up to 100 mm (4 inches) O.D. and three times largest cross section of post greater than 100 mm (4 inches). O.D.
 - 2) Provide larger footings for gate posts. Top of post concrete footing, at grade crowned to shed water away from the post.
 - 3) Space line posts not exceeding 3 m (10 ft.) on center.
 - b. Top rail: Install 6.4 m (21 ft.) lengths of rail continuous thru line post or barb arm loop top. Splice rail using top rail sleeves minimum 150 mm (6 inches) long.
 - 1) Secure rail to terminal post by brace band and rail end.
 - 2) Field cut and secure bottom rail or intermediate rail to line posts with boulevard bands or rail ends and brace bands.
 - 3) Provide mid rail for fences 3.7 m (12 feet) high or higher.
 - c. Terminal posts: Brace and truss end, corner, pull and gate posts for fence 1.8 m (6 ft.) and higher and for fences 1.5 m (5 ft.) in height without top rail.
 - d. Tension wire: Install tension wire 100 mm (4 inches) up from bottom of fabric. Fences without top rail, install tension wire 100 mm (4 inches) down from the top of the fabric.
 - 1) Stretched taut tension wire independently, between terminal posts and secure with brace band.
 - 2) Secure tension wire to chain link fabric with 3.76 mm (0.15 inch) hog rings 450 mm (18 inches) on center and to each line post with tie wire.
 - 3) Install top tension wire through barb arm loop for fences with barbed wire and no top rail.
- C. Chain Link Fabric:
1. Install fabric inside the framework with ground clearance of 50 mm (2 inches) maximum.
 2. Stretch fabric between terminal posts and secure with tension bar.
 3. Wrap tie wire around the post or rail. Attached to fabric wire picket on both sides. Cut off and bend excess wire to prevent injury.
- D. Gate:
1. Swing Gates: Comply with ASTM F567. Inward, Outward swing. Gates plumb in closed position with 75 mm (3 inches) bottom clearance.

Install electrically operated gates according to manufacturer's instructions.

2. Horizontal Slide Gates: Install according to manufacturer's instructions.

E. Barbed Wire: Stretched taut between terminal posts. Secure in slots provided on the line post barb arms. Attach each strand to the terminal post with a brace band. Indicate type of barb arm, Type I, II or III and direction inward, outward for installation of Type I arm.

F. Nuts and Bolts:

1. Bolts: Install carriage bolts with head on the secure side of the fence. Peened over all bolts shall be to prevent removal of the nut.

G. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.
2. Repair painted surfaces with touch up primer.

3.3 CLEANING

A. Clean exposed fence surfaces. Remove contaminants and stains.

3.4 PROTECTION

- A. Protect fence from traffic and construction operations.
- B. Repair damage.

- - - E N D - - -

SECTION 32 90 00
PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plants, soils, edging, turf, and landscape materials.

1.2 RELATED REQUIREMENTS

- A. Topsoil Testing: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Stripping Topsoil, Stock Piling and Topsoil Materials: Section 31 20 00, EARTH MOVING.

1.3 DEFINITIONS

- A. Pesticide: Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and is specifically labeled for use by U.S. Environmental Protection Agency (EPA). Also, any substance used as plant regulator, defoliant, disinfectant, or biocide.
- B. Planter Bed: An area containing one or combination of following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, excluding turf. Trees may also be found in planter beds.

1.4 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute (ANSI):
 1. Z60.1-2014 - Nursery Stock.
- C. American Society for Testing And Materials (ASTM):
 1. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 2. B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 3. C33/C33M-16-Concrete Aggregates.
 4. C136/C136M-14 - Sieve Analysis of Fine and Coarse Aggregates.
 5. C602-13a - Agricultural Liming Materials.
 6. D977-13e1 - Emulsified Asphalt.
 7. D5268-13 - Topsoil Used for Landscaping Purposes.
- D. Hortus Third: Concise Dictionary of Plants Cultivated in United States and Canada.

- E. Tree Care Industry Association (TCIA):
 - 1. A300P1-2008 - Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance Standard Practices (Pruning).
 - 2. Z133.1-2012 - Arboricultural Operations - Safety Requirements.
- F. Turfgrass Producers International (TPI):
 - 1. 2006 Guideline Specifications to Turfgrass Sodding.
- G. United States Department of Agriculture (USDA):
 - 1. DOA SSIR 42-2014 - Soil Survey Laboratory Methods Manual.
 - 2. Handbook No. 60 - Diagnosis and Improvement of Saline and Alkali Soils.

1.5 PREINSTALLATION MEETINGS

- A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
 - 1. Required Participants:
 - a. Contracting Officer's Representative.
 - b. Contractor.
 - c. Installer.
 - 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Inspection of planting materials.
 - b. Installation schedule.
 - c. Installation sequence.
 - d. Preparatory work.
 - e. Protection before, during, and after installation.
 - f. Installation.
 - g. Inspecting.
 - h. Environmental procedures.
 - 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Photographs: Color photographs of each plant species showing actual size and condition of plants to be provided with measuring device

included for scale. Where more than 20 plants are required of any species, submit minimum three photographs of average, best, and worst quality plant to be provided. Include on each photograph, plant full scientific name, size, and source nursery.

3. Installation instructions.
4. Warranty.
- C. Test reports: Certify products comply with specifications.
- D. Certificates: Certify products comply with specifications.
 1. Plant Materials: Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease.
 2. Seed and Turf Materials: Notarized certificate of product analysis.
- E. Qualifications: Substantiate qualifications comply with specifications.
 1. Installer, including supervisor with project experience list.
- F. Operation and Maintenance Data:
 1. Care instructions for each plant material.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Regularly installs specified products.
 2. Installed specified products with satisfactory service on five similar installations for minimum five years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
 3. Member in good standing of either Professional Landcare Network or American Nursery and Landscape Association.
 4. Field supervisor certified in all of following categories from Professional Landcare Network and submit one copy of certificate to Contracting Officer's Representative:
 - a. Certified Landscape Technician (CLT) - Exterior, with installation, maintenance, irrigation, specialty areas, designated CLT-Exterior.
- B. Licensed Arborist required to submit one copy of license to Contracting Officer's Representative.
- C. Independent or university laboratory, recognized by State Department of Agriculture, with experience and capability to conduct testing indicated and that specializes in types of tests to be performed.

- D. Measure plants according to ANSI Z60.1. Pruning to obtain required sizes will not be permitted.
- E. Contracting Officer's Representative may review plant materials either at place of growth or project site before planting for compliance with requirements. Contracting Officer's Representative retains right to inspect trees and shrubs to determine if any unacceptable conditions exist and to reject any trees or shrubs at any time during Project. All rejected trees and shrubs must be immediately removed from Project site.
 - 1. Submit plant material source information to Contracting Officer's Representative seven days in advance of delivery to Project site.
- F. Material Test Reports: For standardized ASTM D5268 topsoil, existing native surface topsoil, existing in-place surface soil and imported or manufactured topsoil.
 - 1. For each unamended soil type, provide soil analysis and written report by qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of soil.
 - 2. Comply with USDA's Handbook No. 60 testing methods and written recommendations.
 - 3. Soil-testing laboratory to oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Contracting Officer's Representative. Take minimum 3 representative samples from varied locations for each soil to be used or amended for planting purposes.
 - 4. Report suitability of tested soil for plant growth.
 - 5. Based on test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 92.9 sq. m (1000 sq. ft.) or volume per 0.76 cu. m (1 cu. yd.) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - 6. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.8 DELIVERY

- A. Deliver packaged products in manufacturer's original sealed packaging.
- B. Bulk Products:
 - 1. Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.
 - 2. Install erosion control materials to prevent erosion or displacement of bulk products.
- C. Apply antidesiccant to trees and shrubs according to manufacturer's instructions to protect during digging, handling, and transportation.
 - 1. For deciduous trees or shrubs in full leaf, spray with antidesiccant at nursery before transporting and again two weeks after planting.
- D. Wrap trees and shrubs with tree wrap according to manufacturer's instructions to protect from wind and other damage during digging, handling, and transportation.
- E. Deliver bare-root stock plants freshly dug with root system packed in wet straw, hay, or similar material.
- F. Deliver branched plants with branches tied and exposed branches covered with material that allows air circulation. Prevent damage to branches, trunks, root systems, and root balls and desiccation of leaves.
- G. Use of equipment such as "tree spades" is permitted provided plant balls are sized according to ANSI Z60.1 and tops are protected from damage.

1.9 STORAGE AND HANDLING

- A. Store bulbs, corms, and tubers in dry location at 16 to 18 degrees C (60 to 65 degrees F) until planting.
- B. Store seeds and other packaged materials in dry locations away from contaminants.
- C. Plant Storage and Protection: Store and protect plants not planted on day of arrival at Project site as follows:
 - 1. Shade and protect plants in outdoor storage areas from wind and direct sunlight until planted.
 - 2. Heel-in bare root plants.
 - 3. Protect balled and burlapped plants from freezing or drying out by covering balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering that allows air circulation.

4. Keep plants in moist condition until planted by watering with fine mist spray.
 5. Do not store plant materials directly on concrete or bituminous surfaces.
- D. Topsoil: Before stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks before stockpiling existing topsoil.
- E. Root Control Barrier and Weed Control Fabric: Store materials in site in enclosures or under protective covering in dry location out of direct sunlight. Do not store materials directly on ground.
- F. Handling: Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle plants carefully to avoid damaging or breaking earth ball or root structure. Do not handle plants by trunk or stem. Remove damaged plants from Project site.

1.10 FIELD CONDITIONS

- A. Environment:
1. Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.
 2. Restrictions: Do not plant when ground is frozen, snow covered, muddy, or when air temperature exceed 32 degrees C (90 degrees F).
- B. Weather Limitations: Install plantings only during current and forecasted weather conditions that are comply with plant requirements. Apply associated products in compliance with manufacturers' instructions.

1.11 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant plantings and against material defects.
1. Warranty Period: Two years.
 2. Plant and Turf Warranty Periods will begin from date of Government acceptance of project or phase for beneficial use and occupancy.
 3. Contracting Officer's Representative will reinspect plants and turf at end of Warranty Period. Replace any dead, missing, or defective plant material and turf immediately. Warranty Period will end on

date of this inspection provided Contractor has complied with warranty work required by this specification. Comply with following requirements:

- a. Replace any plants more than 25 percent dead, missing or defective plant material before final inspection.
- b. Only one replacement of each plant will be required except when losses or replacements are due to failure to comply with these requirements.
- c. Complete remedial measures directed by Contracting Officer's Representative to ensure plant and turf survival.
- d. Repair damage caused while making plant or turf replacements.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

- A. Provide each product from one source or manufacturer.

2.2 PLANT MATERIALS

- A. Plant Materials: ANSI Z60.1, conforming to varieties specified and be true to scientific name as listed in Hortus Third. Well-branched, well-formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having healthy, normal, and undamaged root system.
 1. Trees-Deciduous and Evergreen: Single trunked with single leader, unless otherwise indicated; symmetrically developed deciduous trees and shrubs of uniform habit of growth; straight boles or stems; free from objectionable disfigurements; evergreen trees and shrubs with well-developed symmetrical tops, with typical spread of branches for each particular species or variety. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk; crossing trunks; cut-off limbs more than 19 mm (3/4 inch) in diameter; or with stem girdling roots will be rejected.
 2. Ground Cover and Vine Plants: Provide number and length of runners for size specified on drawings, together with proper age for grade of plants specified. Provide vines and ground cover plants well established in removable containers, integral containers, or formed homogeneous soil sections. Provide plants grown under climatic conditions similar to those in locality of project. Spray all plants

- budding into leaf or having soft growth with an anti-desiccant at nursery before digging.
3. Provide plants of sizes indicated, measured before pruning with branches in normal position. Plants larger in size than specified is acceptable with approval of Contracting Officer's Representative, with no change in contract price. When larger plants are used, increase ball of earth or spread of roots according to ANSI Z60.1.
 4. Provide nursery grown plant material conforming to requirements and recommendations of ANSI Z60.1. Dig and prepare plants for shipment in manner that will not cause damage to branches, shape, and future development after planting.
 5. Balled and burlapped (B&B) plant ball sizes and ratios will conform to ANSI Z60.1, consisting of firm, natural balls of soil wrapped firmly with burlap or strong cloth and tied.
 6. Bare root (BR) plants to have root system substantially intact, but with earth carefully removed. Cover roots with thick coating of mud by "puddling" after plants are dug.
 7. Container grown plants to have sufficient root growth to hold earth intact when removed from containers, but not be root bound.
 8. Make substitutions only when plant (or alternates as specified) is not obtainable and Contracting Officer's Representative authorizes change order providing for use of nearest equivalent obtainable size or variety of plant with same essential characteristics and an equitable adjustment of contract price.
 9. Existing plants to be relocated: Ball sizes to conform to requirements for collected plants in ANSI Z60.1, and plants dug, handled, and replanted according to applicable articles of this Section.
 10. Only plants grown in nursery are permitted.
- B. Label plants with durable, waterproof labels in weather-resistant ink. Provide labels stating correct botanical and common plant name and variety and size as specified in list of required plants. Groups of plants may be labeled by tagging one plant. Labels to be legible for minimum 60 days after delivery to planting site.

2.3 SOD

- A. Sod: Nursery grown, certified and classified in TPI's "Guideline Specifications to Turfgrass Sodding" as GSS. Machine cut sod at uniform

thickness of 19 mm (3/4 inch) within tolerance of 6 mm (1/4 inch), excluding top growth and thatch. Each individual sod piece to be strong enough to support its own weight when lifted by ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will not be permitted.

- B. Sod Species: Genetically pure, free of weeds, pests, and disease.

2.4 SEED

- A. Grass Seed: State-approved seed of latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weed seed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will not be acceptable. Field mixes will be acceptable when field mix is performed on site in presence of Contracting Officer's Representative.
- B. Seed Mixtures: Proportion seed mixtures by weight.

2.5 TURF SELECTIONS

- A. Grasses for Cool Regions:
 - 1. Bentgrasses: Redtop (*Agrostis alba*) and Colonial (*Agrostis tenuis*).
 - 2. Bluegrasses: Kentucky (*Poa pratensis*), Rough-stalked (*Poa trivialis*) and Canada (*Poa compressa*).
 - 3. Fescue: Red (*Festuca rubra*), Meadow (*Festuca pratensis*) and Tall (*Festuca arundinacea*).
 - 4. Ryegrasses: Perennial (*Lolium perenne*).
- B. Grasses for Warm Regions:
 - 1. Bermuda grass (*Cynodon dactylon*).
 - 2. Carpetgrass (*Axonopus affinis*).
 - 3. Centipedegrass (*Eremochloa phylloides*).
 - 4. St. Augustinegrass (*Stenotaphrum secundatum*).
 - 5. Zoysiagrass (*Zoysia matrella*).

2.6 SPRIGS

- A. Sod Sprigs: Healthy living stems, stolons, or rhizomes and attached roots of locally adapted grass without adhering soil, including two to three nodes and from 100 to 150 mm (4 to 6 inches) long. Obtain from heavy, dense certified sod classified as TPI GSS. Provide sprigs grown under climatic conditions similar to those of project site. Coordinate harvesting and planting to prevent sun exposure for more than 30

minutes before covering and moistening. Sprigs containing weeds or other detrimental material or that are heat damaged will be rejected.

2.7 PLUGS

- A. Plugs: Nursery grown sod, certified and classified in TPI's "Guideline Specifications to Turfgrass Sodding" as GSS.
- B. Square or round sections with deep, mature root system.
 - 1. Species to match adjacent sod.

2.8 PLANTING SOILS

- A. Planting Soil: Evaluate soil for use as topsoil according to ASTM D5268. From 5 to 10 percent organic matter as determined by topsoil composition tests of Organic Carbon, 6A, Chemical Analysis Method described in USDA DOA SSIR 42. Maximum particle size, 19 mm (3/4 inch), with maximum 3 percent retained on 6 mm (1/4 inch) screen. Mix topsoil with following soil amendments // and fertilizers // as recommended by soils analysis.
- B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 1. Supplement with planting soil when quantities are insufficient.
 - 2. Mix existing, native surface topsoil with soil amendments and fertilizers as recommended by soils analysis.
- C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources are acceptable if sufficient topsoil is not available on site to meet specified depth. At least 10 days before topsoil delivery, notify Contracting Officer's Representative of topsoil sources. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil is at least 100 mm (4 inches) deep. Topsoil from agricultural land, bogs, or marshes will be rejected.

2.9 INORGANIC SOIL AMENDMENTS

- A. Lime: Commercial grade containing calcium carbonate equivalent (CCE) specified in ASTM C602 of minimum 80 percent.
- B. Sulfur: 100 percent elemental.
- C. Iron Sulfate: 100 percent elemental.

- D. Aluminum Sulfate: Commercial grade.
- E. Perlite: Horticultural grade.
- F. Agricultural Gypsum: Coarsely ground from recycled scrap gypsum board comprised of calcium sulfate dehydrate 91 percent, calcium 22 percent, sulfur 17 percent, minimum 96 percent passing through 850 micrometers 20 mesh screen, 100 percent passing through 970 micrometers 16 mesh screen.
- G. Coarse Sand: ASTM C33/C33M, clean and free of materials harmful to plants.
- H. Vermiculite: Horticultural grade for planters.
- I. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.10 ORGANIC SOIL AMENDMENTS - RESERVED

2.11 PLANT FERTILIZERS

- A. Soil Test: Evaluate existing soil conditions and requirements before fertilizer selection and application to minimize use of all fertilizers and chemical products. Obtain approval of Contracting Officer's Representative for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions before application. Apply products during favorable weather and site conditions according to manufacturer's instructions and warranty requirements. Fertilizers to be registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer applicable to specific areas as required for Project conditions and application. Provide commercial grade plant and turf fertilizers, free flowing, uniform in composition and conforms to applicable state and federal regulations.
- B. Fertilizer for groundcover, wildflowers, and grasses is not acceptable. Provide fertilizer for trees, plants, and shrubs as recommended by plant supplier, except synthetic chemical fertilizers are not acceptable. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not acceptable.
- C. Granular Fertilizer: Organic, granular controlled release fertilizer containing minimum percentages, by weight, of plant food nutrients.

1. Composition: Nitrogen, phosphorous, potassium, sulfur, and iron in amounts recommended in soil reports from qualified soil-testing laboratory.
- D. Fertilizer Tablets: Organic plant tablets composed of tightly compressed fertilizer chips, insoluble in water, to provide continuous release of nutrients for minimum 24 months and containing following minimum percentages, by weight, of plant food nutrients:
 1. Nutrient Composition: 20 percent available nitrogen, 20 percent available phosphorous, and 5 percent available potassium.

2.12 WEED CONTROL FABRIC

- A. Roll Type Polypropylene or Polyester Mats: Woven, needle punched, or non-woven fabric treated for protection against deterioration due to ultraviolet radiation. Minimum 99 percent opaque to prevent photosynthesis and seed germination, fabric allows air, water, and nutrients to pass through to plant roots.
 1. Minimum weight: 0.11 kg per square meter (5 ounces per square yard).
 2. Minimum thickness: 0.50 mm (20 mils).

2.13 MULCH

- A. Organic Mulch:
 1. Biobased content minimum 100 percent. Wood cellulose fiber processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of application.
 - a. Straw for Lawn Seed Bed Mulch: Stalks from oats, wheat, rye, barley, or rice free of noxious weeds, mold or other objectionable material. Air dried and suitable for placing with blower equipment.
 - b. Wood cellulose fiber for hydraulic application of grass seed and fertilizer: Specially prepared wood cellulose fiber, processed to contain no growth or germination inhibiting factors, and dyed an appropriate color to facilitate visual metering of application of materials. Maximum 12 percent moisture dry weight, plus or minus 3 percent at time of manufacture. pH range from 3.5 to 5.0. Manufacturer wood cellulose fiber for application as follows:

- 1) After addition and agitation in slurry tanks with fertilizers, grass seeds, water, and other approved additives, fibers will become uniformly suspended to form a homogeneous slurry.
- 2) When hydraulically sprayed, material will form blotter-like cover impregnated uniformly with grass seed.
- 3) Cover will allow absorption of moisture and allow rainfall or applied water to percolate to underlying soil.

2. Color: Natural.

- B. Compost Mulch: Decomposed organic matter with low carbon to nitrogen ratio.

2.14 EDGING - RESERVED

2.15 ANTIDESICCANT

- A. Antidesiccant: An emulsion specifically manufactured for agricultural use that will provide protective film over plant surfaces permeable enough to permit transpiration.

2.16 EROSION CONTROL

- A. Erosion Control Blankets: 100 percent agricultural straw stitched with degradable nettings, designed to degrade within 12 months.
- B. Erosion Control Fabric: Knitted construction of polypropylene yarn with uniform mesh openings 19 to 25 mm (3/4 to 1 inch) square with strips of biodegradable paper. Minimum filler paper strip life of six months.
- C. Erosion Control Net: Heavy, twisted jute mesh weighing approximately 605 grams per meter (1.22 pounds per linear yard) and 1200 mm (4 feet) wide with mesh openings approximately 25 mm (1 inch) square.
- D. Erosion Control Material Anchors: As recommended by erosion control material manufacturer.

2.17 ROOT CONTROL BARRIER - RESERVED

2.18 BIOSTIMULANTS

- A. Biostimulants: Formulation containing soil conditioners, VAM fungi, and endomycorrhizal and ectomycorrhizal fungi spores and soil bacteria appropriate for existing soil conditions.

2.19 STAKING AND GUYING MATERIALS

- A. Staking Material:

1. Tree Support Stakes: Rough sawn hardwood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Minimum 50 mm (2 inches) square by 2.4 m (8 feet) long, pointed at one end.
2. Ground Stakes: 50 mm (2 inches) square by 0.91 m (3 feet) long wood or plastic, pointed at one end.
- B. Guying Material:
 1. Guying Wire: ASTM A580/A580M, galvanized steel wire.
 2. Guying Cable: Minimum five-strand, 5 mm (3/16 inch) galvanized steel cable.
- C. Hose Chafing Guards: New or used 2 ply 19 mm (3/4 inch) reinforced rubber or plastic hose, black or dark green, all of same color.
- D. Flags: White surveyor's plastic tape 150 mm (6 inches) long, fastened to guying wires or cables.
- E. Turnbuckles: Galvanized or cadmium-plated steel with minimum 75 mm (3 inch) long openings fitted with screw eyes and galvanized or cadmium-plated steel eye bolts with 25 mm (1 inch) diameter eyes and 38 mm (1-1/2 inches) minimum screw length.

2.20 TREE WRAP

- A. Crinkled Paper Tree Wrap: Two thicknesses of crinkled paper cemented together with layer of bituminous material. Minimum 100 mm (4 inches) wide with stretch factor of 33 1/3 percent. Tie with lightly tarred medium or coarse sisal yarn twine.
- B. Tree Shelters: Extruded, translucent, twin walled polypropylene protection board sheets, 3 mm (1/8 inch) thick, 1800 mm (6 feet) long, utilized for short trunk trees 75 mm (3 inch) caliper or less.
- C. Synthetic Fabric Tree Wrap: White, breathable polypropylene fabric in 75 mm (3 inch) wide rolls.
- D. Tape: Bio-degradable tape suitable for nursery use to secure tree wrap which degrades in sunlight maximum 2 years after installation.

2.21 TACKIFIERS AND ADHESIVES

- A. Nonasphalt Tackifier: Colloidal liquid fixative recommended by fiber mulch manufacturer for hydroseeding.
- B. Asphalt emulsion: ASTM D977, Grade SS-1.

2.22 WATER

- A. Water: Source approved by Contracting Officer's Representative and suitable quality for irrigation, containing no elements toxic to plant life, including acids, alkalis, salts, chemical pollutants, and organic matter. Use collected storm water or graywater when available.

2.23 PESTICIDES

- A. Consider IPM (Integrated Pest Management) practices to minimize use of all pesticides and chemical products. Obtain Contracting Officer's Representative's approval for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions before application. Apply products during favorable weather and site conditions according to manufacturer's instructions and warranty requirements.

2.24 FINISHES

- A. Steel Paint Finish:
 - 1. Powder-Coat Finish: Manufacturer's standard two-coat finish system consisting of following:
 - a. One coat primer.
 - b. One coat thermosetting topcoat.
 - c. Dry-film Thickness: 0.05 mm (2 mils) minimum.
 - d. Color: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Aluminum Anodized Finish: NAAMM AMP 500.
 - 1. Color Anodized Finish: AA-C22A32 or AA-C22A34; Class II Architectural, 0.01 mm (0.4 mil) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 - 1. Verify that no materials that would inhibit plant growth are present in planting area. If such materials are present, remove soil and contaminants as directed by Contracting Officer's Representative and provide new planting soil.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

3. Suspend soil spreading, grading, and tilling operations if soil moisture becomes excessive. Resume soil preparations when moisture content returns to acceptable level.
 4. If soil is excessively dry, not workable, and too dusty, moisten uniformly.
 5. Special conditions may exist that warrant variance in specified planting dates or conditions. Submit written request to Contracting Officer's Representative stating special conditions and proposed variance.
- B. Proceed with planting operations only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect existing and proposed landscape features, elements, and site construction and completed work from damage. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on drawings.
- B. Install erosion control materials at all areas inside or outside limits of construction that are disturbed by planting operations. Provide erosion control and seeding with native plant species to protect slopes.
- C. Stake out approved plant material locations and planter bed outlines on project site before digging plant pits or beds. Contracting Officer's Representative reserves right to adjust plant material locations to meet field conditions. Provide on-site locations for excavated rock, soil, and vegetation.

3.3 PLANT BED PREPARATION

- A. Verify location of underground utilities before excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings. Where planting beds occur in existing turf areas, remove turf to depth that will ensure removal of entire root system. Measure depth of plant pits from finished grade. Provide depth of plant pit excavation and relation of top of root ball and finish grade as indicated on drawings.

Install plant materials as specified in Article 3.8. Do not plant trees within 3 m (10 feet) of any utility lines or building walls.

- B. For newly graded subgrades, loosen subgrade to minimum 100 mm (4 inches) deep. Remove stones larger than 50 mm (2 inches) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Government's property.
 - 1. Apply fertilizer directly to subgrade before loosening, at rates recommended by soils analysis.
 - 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 3. Spread planting soil 100 mm (4 inches) deep but minimum required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately 1/2 thickness of planting soil over loosened subgrade. Mix thoroughly into top 50 mm (2 inches) of subgrade. Spread remainder of planting soil.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Finish grade planting areas to smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 13 mm (1/2 inch) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in immediate future.

3.4 GROUND COVER AND PLANT INSTALLATION

- A. Place ground cover and plants, not including trees, shrubs, and vines, in even rows and with triangular spacing.
- B. Use prepared soil mixture for backfill.
- C. Place so roots are in natural position.
- D. Do not remove plants from flats or containers until immediately before planting. Plant at depth to sufficiently cover all roots. Start watering areas planted as required by temperature and wind conditions. Water plants at sufficient rate to ensure thorough wetting of soil to 150 mm (6 inches) deep without runoff or puddling. Smooth planting areas after planting to provide even, smooth finish.
- E. Plant ground cover in areas to receive erosion control materials through material after erosion control materials are in place.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Move plant materials only by supporting root ball. Set plants on hand compacted layer of prepared backfill soil mixture 150 mm (6 inches) thick and hold plumb in center of pit until soil has been tamped firmly around root ball.
- B. Set plant materials in relation to surrounding finish grade 25 to 50 mm (1 to 2 inches) above depth at which they were grown in nursery, collecting field, or container. Replace plant material whose root balls are cracked or damaged either before or during planting process.
- C. Place backfill soil mixture on previously scarified subsoil to completely surround root balls and bring to smooth and even surface, blending into existing areas.
- D. Balled and Burlapped Stock: Backfill with topsoil to approximately half ball depth then tamp and water. Carefully remove or fold back excess burlap and tying materials from top to minimum 1/3 depth from top of root ball. Tamp and complete backfill, place mulch topdressing, and water. Remove wires and non-biodegradable materials from plant pit before backfilling.

3.6 MECHANIZED TREE SPADE PLANTING

- A. At designated locations and with approved equipment, trees may be planted by mechanized tree spade. Tree spade is not acceptable for moving trees that are larger than maximum size of similar field-grown, balled-and-burlapped root-ball diameter recommended by ANSI Z60.1, or that are larger than manufacturer's recommended maximum size for tree spade to be used, whichever is smaller.
- B. For tree extraction, center trunk in tree spade and move tree and solid root ball.
- C. Cut any exposed roots with sharp instruments.
- D. Excavate planting hole with same tree spade used to extract and move tree.
- E. If possible, place trees with same orientation as at location from which they were extracted.

3.7 TREE WRAP

- A. Wrap deciduous tree trunks immediately after planting. Wrap tree trunks 40 mm (1-1/2 inches) or greater in caliper with specified material beginning at base and extending to lowest branches. Remove tree wrap

after one year. Securely tie crinkled paper wrap with twine at top and bottom and at maximum 450 mm (18 inch) intervals.

3.8 TREE AND SHRUB PRUNING

- A. Pruning: Performed by trained and experience personnel according to TCIA A300P1.
- B. Remove dead and broken branches. Prune only to correct structural defects.
- C. Retain typical growth shape of individual plants with as much height and spread as practical. Do not central leader on trees. Make cuts with sharp instruments. Do not flush cut with trunk or adjacent branches. Collars to remain in place.
- D. Do not apply tree wound dressing to cuts.

3.9 STAKING AND GUYING

- A. Staking: Stake plants with number of stakes indicated on drawings with double strand of guy wire. Attach guy wire at half tree trunk height but maximum 1.5 m (5 feet) high. Drive stakes to depth of 0.80 to 0.91 m (2-1/2 to 3 feet) into the ground outside plant pit. Do not injure root ball. Install hose chafer guards where wire is in contact with tree trunk.
- B. Guying: Guy plants as indicated on drawings. Attach // two strands of guy wire // guying cable // around tree trunk at 0.785 rad (45 degrees) at half tree trunk height. Install hose chafer guards where // wire // cable // is in contact with tree trunk. Anchor guys to ground stakes. Fasten flags to each guying // wire // cable // at 2/3 of the distance above ground level. // Provide turnbuckles as indicated on drawings. //

3.10 ROOT CONTROL BARRIER INSTALLATION

- A. At trees planted within // 1500 mm (60 inches) // 1200 mm (48 inches) // of paving, walls, curbs, and walkways, install root control barrier, unless otherwise shown on Drawings.
- B. Install geotextile fabric in soil for // vertical // horizontal // and // surrounding // application with appropriate holding device to ensure fabric position. For vertical and horizontal application, provide minimum 50 mm (2 inch) soil cover over top // surface // edge //. Extend fabric minimum 450 mm (18 inches) beyond structure area to be protected to prevent root growth around fabric edges.

- C. Install // cylindrical // linear // polypropylene barrier minimum 25 mm (1 inch) above finished grade to prevent root growth over barrier. Backfill outside barrier with 19 to 25 mm (3/4 to 1 inch) of gravel for minimum 50 mm (2 inches). For linear application, use device recommended by barrier manufacturer to connect two pieces.

3.11 MULCH INSTALLATION

- A. Provide specified mulch over entire planting bed surfaces and individual plant surfaces, including earth mount watering basin around plants, to 75 mm (3 inches) depth after plant installation and before watering. Do not place mulch in crowns of shrubs. Place mulch minimum 50 to 75 mm (2 to 3 inches) away from tree or shrub trunks. Place mulch on all weed control fabric.

3.12 EDGING INSTALLATION

- A. Uniformly edge beds of plants to provide clear cut division line between planted area and adjacent lawn. Construct bed shapes as indicated on drawings.
- B. Metal Edging: Install // steel // aluminum // edging material according to manufacturer's instructions. // Install edging material in perfect 1.22 m (4 foot) diameter circle inside 1.37 m (4-1/2 foot) watering basin, around specimen trees and shrubs not planted in close group. // Install edging with minimum 25 mm (1 inch) visible above ground level.
- C. Natural Cut Edging: Provide uniform 'V' cut with one vertical side adjacent to turf areas 125 mm (5 inches) deep and second side angled 250 mm (10 inches) toward center of plant bed for clear cut division line between plant bed and adjacent lawn.

3.13 SODDING

- A. Place sod maximum 36 hours after initial harvesting according to TPI GSS, except as modified herein.
- B. For slopes 2 to 1 and greater, lay sod with long edge perpendicular to contour. For V-ditches and flat bottomed ditches, lay sod with long edge perpendicular to water flow. // Anchor each piece of sod with wood pegs or wire staples maximum 600 mm (24 inches) on center. // On sloped areas, start sodding at bottom of slope.
- C. Finishing: After sodding, blend edges of sodded area smoothly into surrounding area. Eliminate air pockets and provide true and even surface. Trim frayed areas and patch holes and missing areas with sod.

- D. Rolling: Immediately after sodding, firm entire area, except slopes in excess of 3: 1, with roller maximum 134 kg (90 lbs.) for each foot of roller width.
- E. Watering: Start watering sodded areas as required by daily temperature and wind conditions. Water at rate sufficient to ensure thorough wetting of soil to minimum 150 mm (6 inches) deep. Prevent run-off, puddling, and wilting. Do not drive watering trucks over turf areas, unless otherwise directed. Prevent watering of other adjacent areas or plant materials.

3.14 SPRIGGING

- A. Plant sod sprigs after finish grade is properly prepared and thoroughly soaked day in advance. Plant sprigs in rows spaced maximum 300 mm (12 inches) apart with springs placed in rows at maximum 150 mm (6 inches) apart. Firm entire area with roller not exceeding 130 kg/m (90 lb./ft.) of roller width. Do not roll slopes over maximum 3: 1. Water thoroughly and keep soil moist. Weed by hand or hoe. Do not treat sprig area with herbicide.

3.15 PLUGGING

- A. Plant fresh sod plugs after finish grade is properly prepared. Plant plugs in rows, spaced // 300 mm (12 inches) // 450 mm (18 inches) // apart in both directions. On slopes, contour rows to near level. Water thoroughly and keep soil moist. Weed by hand or hoe. Do not treat plug area with herbicide.

3.16 SEEDING

- A. Broadcast and Drop Seeding: Uniformly broadcast seed at rate of // _____ // kilograms per hectare (// _____ // pounds per 1000 square feet). Use broadcast or drop seeders. Sow one-half seed in one direction and sow remainder at right angles to first sowing. Cover seed uniformly to maximum 6 mm (1/4 inch) deep in clay soils and 13 mm (1/2 inch) deep in sandy soils by means of spike-tooth harrow, cultipacker, raking, or other approved device.
- B. Drill Seeding: Drill seed at rate of // _____ // kilograms per hectare (// _____ // pounds per 1000 sq. ft.). Use // cultipacker // grass seed drills //. Drill seed uniformly to 13 mm (1/2 inch) deep.
- C. Rolling: Immediately after seeding, firm entire area, except for slopes in excess of 3 to 1, with roller not exceeding 130 kg/m (90 lb./ft.) of

roller width. // Eliminate rolling if seeding is done with cultipacker type seeder. //

3.17 HYDROSEEDING

- A. Mix water with wood cellulose fiber, paper fiber, or recycled paper at rate of 11.2 kg per 100 square meters (1,000 lb. per acre) dry weight. Add seed and fertilizer to fiber and water and mix to produce homogeneous slurry.
 - 1. Broadcast seed mixture at rate of // _____ // kilograms per hectare (// _____ // pounds per 1000 square feet).
 - 2. Hydraulically spray slurry to form uniformly impregnated grass seed cover. Spread with one application with no second application of mulch.

3.18 TURF RENOVATION

- A. General: Restore to original condition existing turf areas damaged during turf installation and construction operations. Keep at least one paved pedestrian access route and one paved vehicular access route to each building clean at all times. Clean other paving when work in adjacent areas is complete.
- B. Aeration: Eradicate weeds and, with Contracting Officer's Representative's approval to proceed, aerate turf areas with approved device. Core, by pulling soil plugs to minimum // _____ // mm (// _____ // inches) deep. // Leave all soil plugs that are produced, in turf area. // // After aeration operations are complete, topdress entire area // 6.35 mm (1/4 inch) // 12.7 mm (1/2 inch) // deep. Blend all parts of topdressing mixture to uniform consistency. // Clean all soil plugs off of other paving when work is complete.
- C. Vertical Mowing: At completion of aerating and, with Contracting Officer's Representative's approval to proceed, vertical mow turf areas indicated on drawings with approved device to // 6 mm (1/4 inch) // 13 mm (1/2 inch) // deep above existing soil level to reduce thatch build-up, grain, and surface compaction. Remove all debris generated during this operation off site.
- D. Dethatching: At completion of aerating and, with Contracting Officer's Representative's approval to proceed, dethatch turf areas indicated on drawings with approved device to // 6 mm (1/4 inch) // 13 mm (1/2 inch) // deep below existing soil level to reduce thatch build-up,

grain, and surface compaction. Remove all debris generated during this operation off site.

- E. Overseeding: Apply seed according to applicable portions of "Seed Application Method" at rates specified in "Seed Composition."

3.19 PLANT MAINTENANCE

- A. Frequency: Begin maintenance immediately after plants have been installed. Inspect plants at least once week and perform required maintenance promptly.
- B. Promotion of Plant Growth and Vigor: Water, prune, fertilize, mulch, eradicate weeds, and perform other operations necessary to promote plant growth and vigor.
- C. Planter Beds: Weed, fertilize, and irrigate planter beds and keep pest free, pruned, and mulch levels maintained. Do not permit planter beds encroach into turf areas. Maintain edging breaks between turf areas and planter beds. Fertilize plant materials to promote healthy growth without encouraging excessive top foliar growth. Remove noxious weeds common to area from planter beds by mechanical means.
- D. Shrubs: In addition to planter bed maintenance requirements, selectively prune and shape shrubs for health and safety when following conditions exist:
 - 1. Remove growth in front of windows, over entrance ways or walks, and any growth which will obstruct vision at street intersections or of security personnel.
 - 2. Remove dead, damaged, or diseased branches or limbs where shrub growth obstructs pedestrian walkways, where shrub growth is growing against or over structures, and where shrub growth permits concealment of unauthorized persons.
 - 3. Properly dispose of all pruning debris.
- E. Trees: Adjust stakes, ties, guy supports // and turnbuckles // and water, fertilize, control pests, mulch, and prune for health and safety // and provide fall leaf cleanup //.
 - 1. Fertilize trees to promote healthy plant growth without encouraging excessive top foliar growth. Inspect and adjust stakes, ties, guy supports // and turnbuckles // to avoid girdling and promote natural development.
 - 2. Selectively prune all trees within project boundaries, regardless of caliper, for safety and health reasons, including, but not limited

to, removal of dead and broken branches and correction of structural defects. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced.

3. All pruning, including palm tree pruning, must be by or in presence of certified member of International Society of Arboriculture and according to TCIA Z133.1.
4. Properly dispose of all pruning debris.

3.20 SLOPE EROSION CONTROL MAINTENANCE

- A. Provide slope erosion control maintenance to prevent undermining of all slopes in // newly landscaped // and // natural growth // areas.

Maintenance tasks include immediate repairs to weak spots in sloped areas // and maintaining clean, clear culverts // and graded // berms // and // terraces // to intercept and direct water flow to prevent development of large gullies and slope erosion // and securing irrigation systems during periods of extended rainfall //.

1. Fill eroded areas with amended topsoil and replant with same plant species.
2. // Reinstall erosion control materials damaged due to slope erosion. //

3.21 REMOVAL OF DYING OR DEAD PLANTS

- A. Remove dead and dying plants and provide new plants immediately upon commencement of specified planting season and replace // stakes, // guys, // mulch, and eroded earth mound water basins. No additional correction period will be required for replacement plants beyond original warranty period. Plants will be considered dead or dying as follows:

1. Tree: Main leader died back or minimum 20 percent of crown died.
2. Shrub and Ground Cover: Minimum 20 percent of plant died.
3. Determination: Scrape on maximum 2 mm (1/16 inch) square branch area to determine dying plant material cause and provide recommendations for replacement.

3.22 TURF MAINTENANCE

- A. Mow turf to uniform finished height measured from soil. Perform mowing in manner that prevents scalping, rutting, bruising, uneven and rough cutting. Before mowing, remove and dispose of all rubbish, debris,

trash, leaves, rocks, paper, and limbs or branches on turf areas. Sweep or vacuum clean adjacent paved areas.

- B. Apply fertilizer in manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. Determine method of application, fertilizer type and frequencies by results of laboratory soil analysis. // Provide organic fertilizer. If organic fertilizer does not produce desired effect, contact Contracting Officer's Representative for approval before applying synthetic fertilizer. // Apply fertilizer by approved methods and according to manufacturer's instructions.
- C. Watering: Perform irrigation in manner that promotes health, growth, color, and appearance of cultivated vegetation, complying with Federal, State, and local water agency and authority directives. Prevent overwatering, water run-off, erosion, and ponding due to excessive quantities or rate of application.
- D. Aeration: Eradicate weeds and, with Contracting Officer's Representative's approval to proceed, aerate turf areas with approved device. Core, by pulling soil plugs to minimum // _____ // mm (// _____ // inches) deep. // Leave all soil plugs that are produced, in turf area. // // After aeration operations are complete, topdress entire area // 6.35 mm (1/4 inch) // 12.7 mm (1/2 inch) // deep. Blend all parts of topdressing mixture to uniform consistency. // Clean all soil plugs off of other paving when work is complete.

3.23 CLEANING

- A. Remove and legally dispose of all excess soil and planting debris.

3.24 PROTECTION

- A. Protect plants from traffic and construction operations.
- B. Provide temporary fences or enclosures and signage, at planted areas. Maintain fences and enclosures during maintenance period.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

- - - E N D - - -

SECTION 33 40 00

STORM SEWER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTHWORK.
- B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.
- D. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- E. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

1.4 ABBREVIATIONS

- A. HDPE: High-density polyethylene
- B. PE: Polyethylene

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle manholes ,catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.6 COORDINATION

- A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.
- B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.7 QUALITY ASSURANCE:

- A. Products Criteria:
 - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.8 SUBMITTALS

A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

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

A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for
Concrete

A242/A242M-04(2009).....High-Strength Low-Alloy Structural Steel

A536-84(2009).....Ductile Iron Castings

A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement

A760/A760M-10.....Corrugated Steel Pipe, Metallic-Coated for
Sewers and Drains

A798/A798M-07.....Installing Factory-Made Corrugated Steel Pipe
for Sewers and Other Applications

A849-10.....Post-Applied Coatings, Paving, and Linings for
Corrugated Steel Sewer and Drainage Pipe

A929/A929M-01(2007).....Steel Sheet, Metallic-Coated by the Hot-Dip
Process for Corrugated Steel Pipe

B745/B745M-97(2005).....Corrugated Aluminum Pipe for Sewers and Drains

B788/B788M-09.....Installing Factory-Made Corrugated Aluminum
Culverts and Storm Sewer Pipe

C14-07.....Non-reinforced Concrete Sewer, Storm Drain, and
Culvert Pipe

| | |
|---------------------|--|
| C33/C33M-08..... | Concrete Aggregates |
| C76-11..... | Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe |
| C139-10..... | Concrete Masonry Units for Construction of Catch Basins and Manholes |
| C150/C150M-11..... | Portland Cement |
| C443-10..... | Joints for Concrete Pipe and Manholes, Using Rubber Gaskets |
| C478-09..... | Precast Reinforced Concrete Manhole Sections |
| C506-10b..... | Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe |
| C507-10b..... | Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe |
| C655-09..... | Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe |
| C857-07..... | Minimum Structural Design Loading for Underground Precast Concrete Utility Structures |
| C891-09..... | Installation of Underground Precast Concrete Utility Structures |
| C913-08..... | Precast Concrete Water and Wastewater Structures |
| C923-08..... | Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals |
| C924-02(2009)..... | Testing Concrete Pipe Sewer Lines by Low- Pressure Air Test Method |
| C990-09..... | Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants |
| C1103-03(2009)..... | Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines |

- C1173-08.....Flexible Transition Couplings for Underground
Piping Systems
- C1433-10.....Precast Reinforced Concrete Monolithic Box
Sections for Culverts, Storm Drains, and Sewers
- C1479-10.....Installation of Precast Concrete Sewer, Storm
Drain, and Culvert Pipe Using Standard
Installations
- D448-08.....Sizes of Aggregate for Road and Bridge
Construction
- D698-07e1.....Laboratory Compaction Characteristics of Soil
Using Standard Effort (12 400 ft-lbf/ft³ (600
kN-m/m³))
- D1056-07.....Flexible Cellular Materials—Sponge or Expanded
Rubber
- D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe,
Schedules 40, 80, and 120
- D2321-11.....Underground Installation of Thermoplastic Pipe
for Sewers and Other Gravity-Flow Applications
- D2751-05.....Acrylonitrile-Butadiene-Styrene (ABS) Sewer
Pipe and Fittings
- D2774-08.....Underground Installation of Thermoplastic
Pressure Piping
- D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe
and Fittings
- D3350-10.....Polyethylene Plastics Pipe and Fittings
Materials
- D3753-05e1.....Glass-Fiber-Reinforced Polyester Manholes and
Wetwells
- D4101-11.....Polypropylene Injection and Extrusion Materials
- D5926-09.....Poly (Vinyl Chloride) (PVC) Gaskets for Drain,
Waste, and Vent (DWV), Sewer, Sanitary, and
Storm Plumbing Systems

- F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic
Pipe
- F679-08.....Poly(Vinyl Chloride) (PVC) Large-Diameter
Plastic Gravity Sewer Pipe and Fittings
- F714-10.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based
on Outside Diameter
- F794-03(2009).....Poly(Vinyl Chloride) (PVC) Profile Gravity
Sewer Pipe and Fittings Based on Controlled
Inside Diameter
- F891-10.....Coextruded Poly(Vinyl Chloride) (PVC) Plastic
Pipe With a Cellular Core
- F894-07.....Polyethylene (PE) Large Diameter Profile Wall
Sewer and Drain Pipe
- F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer
Pipe With a Smooth Interior and Fittings
- F1417-11.....Installation Acceptance of Plastic Gravity
Sewer Lines Using Low-Pressure Air
- F1668-08.....Construction Procedures for Buried Plastic Pipe
- C. American Association of State Highway and Transportation Officials
(AASHTO):
- M190-04.....Bituminous-Coated Corrugated Metal Culvert Pipe
and Pipe Arches
- M198-10.....Joints for Concrete Pipe, Manholes, and Precast
Box Sections Using Preformed Flexible Joint
Sealants
- M252-09.....Corrugated Polyethylene Drainage Pipe
- M294-10.....Corrugated Polyethylene Pipe, 12 to 60 In. (300
to 1500 mm) Diameter
- D. American Water Works Association(AWWA):
- C105/A21.5-10.....Polyethylene Encasement for Ductile iron Pipe
Systems

C110-08.....Ductile-Iron and Gray-Iron Fittings
C219-11.....Bolted, Sleeve-Type Couplings for Plain-End
Pipe
C600-10.....Installation of Ductile iron Mains and Their
Appurtenances
C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and
Fabricated Fittings, 4 In. Through 12 In. (100
mm Through 300 mm), for Water Transmission and
Distribution
M23-2nd ed.....PVC Pipe "Design And Installation"

E. American Society of Mechanical Engineers (ASME):

A112.6.3-2001.....Floor and Trench Drains
A112.14.1-2003.....Backwater Valves
A112.36.2M-1991.....Cleanouts

F. American Concrete Institute (ACI):

318-05.....Structural Commentary and Commentary
350/350M-06.....Environmental Engineering Concrete Structures
and Commentary

G. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for
Erosion and Sediment Control

1.10 WARRANTY

The Contractor shall remedy any defect due to faulty material or
workmanship and pay for any damage to other work resulting therefrom
within a period of one year from final acceptance. Further, the
Contractor will furnish all manufacturers' and suppliers' written
guarantees and warranties covering materials and equipment furnished
under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part
requirements. The Contractor shall guarantee performance of assemblies

of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.2 STEEL PIPE AND FITTINGS

- A. Steel pipe and fittings shall be as per ASTM A760.
- B. Type of pipe: // I // II // IR // IIR //.
- C. Corrugations: // Annular // Helical // 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
- D. Corrugations: Helical 3/4 by 3/4 by 7-1/2 inch (19 by 19 by 190 mm) corrugations.
- E. Internal Coating: Internal coating shall be // fully bituminous coated (AASHTO M190 Type A) // half bituminous coated, part paved (AASHTO M190 Type B) // fully bituminous coated, part paved (AASHTO M190 Type C) // fully bituminous coated, fully paved (AASHTO M190 Type D) // concrete lined as per ASTM A849 // polymer precoated, part paved (AASHTO M190, Type B modified) // polymer precoated, fully paved (AASHTO M190, Type D modified) //.
- F. Exterior Coating: // Aluminum // Zinc // Polymer // Coated.
- G. Gaskets: ASTM D1056, Type 2, // A1 // B3 //.
- H. Connecting Bands: To be same type and size as the ends of the pipe being connected.

2.3 ALUMINUM PIPE AND FITTINGS

- A. Corrugated aluminum pipe and fittings shall be ASTM B745, Type I with fittings of similar form and construction as pipe.
 - 1. Special-joint bands shall be corrugated steel with O-ring seals.
 - 2. Standard-joint bands shall be corrugated steel.

2.4 ABS PIPE AND FITTINGS

- A. ABS Sewer Pipe and Fittings: Pipe and fittings shall conform to ASTM D2751, with bell-and-spigot ends for gasketed joints.
 - 1. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
 - 2. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.
- B. Gaskets: ASTM F477, elastomeric seals.

2.5 PE PIPE AND FITTINGS

- A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.
 - 1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.

2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.
- B. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500);
// AASHTO M294, Type S // ASTM F714, SDR 21 for pipes 3 to 24 inches
(300 to 600 mm) // with smooth waterway for coupling joints. Pipe shall
be produced from PE certified by the resin producer as meeting the
requirements of ASTM D3350, minimum cell class 335434C.
 1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A,
Grade 2 gasket material that mates with tube and fittings.
 2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and
fittings.
 3. Water tight joints shall be made using a PVC or PE coupling and
rubber gaskets as recommended by the pipe manufacturer. Rubber
gaskets shall conform to ASTM F477. Soil tight joints shall conform
to requirements in AASHTO HB-17, Division II, for soil tightness and
shall be as recommended by the manufacturer.
- C. Profile Wall PE Pipe: Pipe shall comply with ASTM F894, Class 160.
 1. Profile Wall PE Plastic Pipe Joints: Joints shall be as per ASTM
F894, // gasket // or // thermal // weld type with integral bell.
- D. PVC Pipe And Fittings
 1. PVC Cellular-Core Pipe And Fittings: ASTM F891, Sewer and Drain
Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain
ends for solvent-cemented joints.
 2. Fittings: ASTM D3034, // SDR 35 // Insert SDR //, PVC socket-type
fittings.
- E. PVC Corrugated Sewer Piping
 1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for
gasketed joints.
 2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
 3. Gaskets: ASTM F477, elastomeric seals.
- F. PVC Profile Sewer Piping
 1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot
ends.
 2. Fittings: ASTM D3034, PVC with bell ends.
 3. Gaskets: ASTM F477, elastomeric seals.
- G. PVC Type PSM Sewer Piping

1. Pipe: ASTM D3034, // SDR 35 // Insert SDR //, PVC Type PSM sewer pipe with bell-and-spigot ends.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

H. PVC Gravity Sewer Piping

1. Pipe and fittings shall be ASTM F679, // T-1 // T-2 // wall thickness, PVC gravity sewer pipe with bell-and-spigot ends.
2. Gaskets: ASTM F477, elastomeric seals for gasketed joints.

I. PVC Pressure Piping

1. Pipe: AWWA C900, // Class 100 // Class 150 // and // Class 200 // PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, // Class 100 // Class 150 // and // Class 200 // PVC pipe with bell ends
3. Gaskets: ASTM F477, elastomeric seals.

2.6 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete sewer pipe and fittings shall be ASTM C76 or ASTM C655.

1. // Bell-and-spigot // or // tongue-and-groove // ends and // gasketed joints with ASTM C443, rubber gaskets // sealant joints with ASTM C990, bitumen or butyl-rubber sealant //.

SPEC WRITER NOTE: Retain one of subparagraphs below for NPS 12 to NPS 144 (DN 300 to DN 3600).

2. Class I: // Wall A // Wall B //
3. Class II, Wall B
4. Class III: // Wall A // Wall B // Wall C
5. Class IV: // Wall A // Wall B // Wall C //
6. Class V: // Wall B // Wall C //

B. Reinforced arch culvert and storm drain pipe and fittings shall be ASTM C506, Class // A-III // A-IV // and // gasketed joints with ASTM C443, rubber gaskets // sealant joints with ASTM C990, bitumen or butyl-rubber sealant //.

C. Reinforced-Concrete elliptical culvert and storm drain pipe and fittings shall be ASTM C507, Class // HE III // HE IV // VE III // VE IV // VE V // VE VI // and // gasketed joints with ASTM C443, rubber gaskets // sealant joints with ASTM C990, bitumen or butyl-rubber sealant //.

2.7 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials
 - 1. For concrete pipes: ASTM C443, rubber.
 - 2. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
 - 3. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with // stainless-steel shear ring and // corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.8 PRESSURE PIPE COUPLINGS

- A. Couplings: AWWA C219, tubular-sleeve coupling, with center sleeve, gaskets, end rings, and bolt fasteners.
- B. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include // 150-psi (1035-kPa) // 200-psi (1380-kPa) // Insert value // minimum pressure rating and ends sized to match adjoining pipes.
- C. Center-Sleeve Material: // Carbon steel // Stainless steel // Ductile iron // Malleable iron //.
- D. Gasket Material: Natural or synthetic rubber.
- E. Metal Component Finish: Corrosion-resistant coating or material.

2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS

- A. Ductile iron flexible expansion joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psi (1725-kPa) minimum working pressure and for offset and expansion indicated.

- B. Ductile iron expansion joints: Three-piece assemblies of telescoping sleeve with gaskets and restrained-type, // ductile iron // or // steel with protective coating //, bell-and-spigot end sections complying with AWWA C110. Include rating for 250-psi (1725-kPa) minimum working pressure and for expansion indicated.
- C. Ductile iron deflection fittings: Compound-coupling fitting, with ball joint, flexing section, gaskets, and restrained-joint ends, complying with AWWA C110. Include rating for 250-psi (1725-kPa) minimum working pressure and for up to 15 deg of deflection.

2.10 BACKWATER VALVES

- A. Cast-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
- //1. Horizontal type; with swing check valve and hub-and-spigot ends. //
- //2. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends. //
- //3. Terminal type; with bronze seat, swing check valve, and hub inlet. //
- B. Plastic backwater valves: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.11 CLEANOUTS

- A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
1. Top-Loading Classification(s): // Light Duty // Medium Duty // Heavy Duty // and // Extra-Heavy Duty //
2. Pipe fitting and riser to cleanout shall be same material as main pipe line.
- B. Plastic Cleanouts shall have PVC body with PVC threaded plug. Pipe fitting and riser to cleanout shall be of same material as main line pipe.

2.12 DRAINS

- A. Cast-Iron Area Drains: ASME A112.6.3, gray-iron round body with anchor flange and round // secured // grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
1. Top-Loading Classification(s): // Medium Duty // Medium and Heavy Duty // Heavy Duty //

B. Cast-Iron Trench Drains: ASME A112.6.3, 6 inch (150 mm) wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular // secured // grate. Include units of total length indicated and quantity of bottom outlets with inside calk or spigot connections, of sizes indicated.

1. Top-Loading Classification(s): // Medium Duty // Heavy Duty // Extra-Heavy Duty // Medium and Heavy Duty // Medium and Extra-Heavy Duty // Heavy and Extra-Heavy Duty // Medium, Heavy, and Extra-Heavy Duty //

C. Steel Trench Drains: ASTM A242, welded steel plate, to form rectangular body with uniform bottom downward slope of 2 percent toward outlet, anchor flange, and grate.

1. Plate Thicknesses: // 1/8 inch (3.2 mm) // and // 1/4 inch (6.4 mm) //

2. Overall Widths: // 7-1/2 inches (190 mm) // and // 12-1/3 inches (313 mm) //

D. Grate openings shall be // 1/4 inch (6.4 mm) circular // 3/8 inch (9.5 mm) circular // or // 3/8 by 3 inch (9.5 by 76 mm) slots //.

2.13 ENCASEMENT FOR PIPING

A. Material: AWWA C105 // Linear low-density polyethylene film of 0.008 inch (0.20 mm) // or // high-density, cross-laminated polyethylene film of 0.004 inch (0.10 mm) // minimum thickness.

B. Form: // Sheet // or // tube //

C. Color: // Black // or // natural // Insert color //

2.14 MANHOLES AND CATCH BASINS

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.

3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.

4. Base Section: 6 inch (150 mm) minimum thickness for floor slab and 4-inch (102 mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.

5. Riser Sections: 4 inch (102 mm) minimum thickness, and lengths to provide depth indicated.

6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). // Individual FRP steps or FRP ladder // Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP // ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP //, width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.
10. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C913; designed for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
5. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). // Individual FRP steps or FRP ladder // Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP // ASTM A615 deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D 4101, PP //, width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.
6. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Fiberglass Manholes:

1. Description: ASTM D3753.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of concrete base as required to prevent flotation.
4. Base Section: Concrete, 8 inch (203 mm) minimum thickness.
5. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
6. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). // Individual FRP steps or FRP ladder // Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP // ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP //, width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.
7. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

D. Manhole Frames and Covers:

1. Description: Ferrous; 24 inch (610 mm) ID by 7 to 9 inch (175 to 225 mm) riser with 4 inch (102 mm) minimum width flange and 26-inch (600 mm) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: // ASTM A536, Grade 60-40-18 ductile // ASTM A48/A48M, Class 35 gray // iron unless otherwise indicated.

2.15 CONCRETE FOR MANHOLES AND CATCH BASINS

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

B. Concrete Design Mix: 4000 psi (27.6 MPa) minimum, compressive strength in 28 days.

1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Channels shall be the main line pipe material. Include benches in all manholes and catch basins.

1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel. Minimum of 6 inch slope from main line pipe to wall sides.

2.16 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Polymer-Concrete, Channel Drainage Systems:

Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

B. Sloped-Invert, Polymer-Concrete Systems:

1. Channel Sections:

- a. Interlocking-joint, precast, modular units with end caps.
- b. 4-inch (102 mm) inside width and deep, rounded bottom, with built-in invert slope of 0.6 percent and with outlets in quantities, sizes, and locations indicated.
- c. Extension sections necessary for required depth.
- d. Frame: Include gray-iron or steel frame for grate.

2. Grates:

- a. Manufacturer's designation "// Heavy // Medium // Duty," with slots or perforations that fit recesses in channels.
- b. Material: // Fiberglass // Galvanized steel // Gray iron // Stainless steel//.

3. Covers: Solid gray iron if indicated.

4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

C. Narrow-Width, Level-Invert, Polymer-Concrete Systems:

1. Channel Sections:

- a. Interlocking-joint, precast, modular units with end caps.
- b. 5 inch (127 mm) inside width and 9-3/4 inch (248 mm) deep, rounded bottom, with level invert and with NPS 4 (DN 100) outlets in quantities, sizes, and locations indicated.

2. Grates:

- a. Slots or perforations that fit recesses in channels.
 - b. Material: // Fiberglass // Galvanized steel // Gray iron // Stainless steel //.
- 3. Covers: Solid gray iron if indicated.
- 4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- D. Wide-Width, Level-Invert, Polymer-Concrete Systems:
 - 1. Channel Sections:
 - a. Interlocking-joint, precast, modular units with end caps.
 - b. 8 inch (203 mm) inside width and 13-3/4 inch (350 mm) deep, rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.
 - 2. Grates:
 - a. Slots or other openings that fit recesses in channels.
 - b. Material: // Fiberglass // Gray iron //.
 - 3. Covers: Solid gray iron if indicated.
 - 4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- E. Drainage Specialties: Precast, polymer-concrete units.
 - 1. Large Catch Basins:
 - a. 24 by 12 inch (610 by 305-mm) polymer-concrete body, with outlets in quantities and sizes indicated.
 - b. Gray-iron slotted grate.
 - c. Frame: Include gray-iron or steel frame for grate.
 - 2. Small Catch Basins:
 - a. 19 to 24 inch by approximately 6 inch (483 to 610 mm by approximately 150 mm) polymer-concrete body, with outlets in quantities and sizes indicated.
 - b. Gray-iron slotted grate.
 - c. Frame: Include gray-iron or steel frame for grate.
 - 3. Oil Interceptors:
 - a. Polymer-concrete body with interior baffle and four steel support channels and two 1/4 inch (6.4 mm) thick, steel-plate covers.
 - b. Steel-plate covers.
 - c. Capacity: // 140 gal. (530 L) // 200 gal. (757 L) // 260 gal. (984 L) //.
 - d. Inlet and Outlet: // NPS 4 (DN 100) // NPS 6 (DN 150) //.

4. Sediment Interceptors:

a. 27 inch (686 mm) square, polymer-concrete body, with outlets in quantities and sizes indicated.

b. 24 inch (610 mm) square, gray-iron frame and slotted grate.

F. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

G. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.17 PLASTIC, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Plastic, Channel Drainage Systems:

1. Modular system of plastic channel sections, grates, and appurtenances.

2. Designed so grates fit into frames without rocking or rattling.

3. Number of units required to form total lengths indicated.

B. Fiberglass Systems:

1. Channel Sections:

a. Interlocking-joint, fiberglass modular units, with built-in invert slope of approximately 1 percent and with end caps.

b. Rounded or inclined inside bottom surface, with outlets in quantities, sizes, and locations indicated.

c. Width: // 6 inches (150 mm) // 6 or 8 inches (150 or 203 mm) // 8 inches (203 mm) //.

2. Factory- or field-attached frames that fit channel sections and grates.

a. Material: // Galvanized steel // Stainless steel // Manufacturer's standard metal //.

3. Grates with slots or perforations that fit frames.

a. Material: // Fiberglass // Galvanized steel // Gray iron //Stainless steel //.

4. Covers: Solid gray iron if indicated.

5. Drainage Specialties:

a. Large Catch Basins: 24 inch (610 mm) square plastic body, with outlets in quantities and sizes indicated. Include gray-iron frame and slotted grate.

b. Small Catch Basins: 12 by 24 inch (305 by 610 mm) plastic body, with outlets in quantities and sizes indicated. Include gray-iron frame and slotted grate.

C. PE Systems:

1. Channel Sections: Interlocking-joint, PE modular units, 4 inches (102 mm) wide, with end caps. Include rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.
2. Grates: PE, ladder shaped; with stainless-steel screws.
3. Color: Gray unless otherwise indicated.
4. Drainage Specialties: Include the following PE components:
 - a. Drains: 4 inch (102 mm) diameter, round, slotted top; with NPS 4 (DN 100) bottom outlet.
 - b. Drains: 8 inch (203 mm) diameter, round, slotted top; with NPS 6 (DN 150) bottom outlet.
 - c. Drains: 4 inch (102 mm) square, slotted top; with NPS 3 (DN 80) bottom outlet.
 - d. Drains: 8 inch (203 mm) square, slotted top; with NPS 6 (DN 150) bottom outlet.
 - e. Catch Basins: 12 inch (305 mm) square plastic body, with outlets in quantities and sizes indicated. Include PE slotted grate 11-3/4 inches (298 mm) square by 1-1/8 inches (28.6 mm) thick.

D. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

E. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.18 PIPE OUTLETS

A. Head walls: Cast in-place reinforced concrete, with apron and tapered sides.

B. Riprap basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."

SPEC WRITER NOTE: Retain one of three subparagraphs below or insert another grade.

1. Average Size: NSSGA No. R-3, screen opening 2 inches (51 mm).
2. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).
3. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).
4. Average Size: // Insert size //.

SPEC WRITER NOTE: Retain both paragraphs below to require specific stone sizes.

C. Filter Stone: NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

- D. Energy Dissipaters: To be as per NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton (2721-kg) average weight armor stone, unless otherwise indicated.

2.19 DRY WELLS

- A. Concrete Well: ASTM C913, precast, reinforced, perforated concrete rings. Include the following:
1. Concrete Floor: 4000 psi (27.6 MPa) minimum 28 day compressive strength.
 2. Cover: Liftoff-type concrete cover with cast in lift rings
 3. Wall Thickness: 4 inches (102 mm) minimum with 1 inch (25 mm) diameter or 1 by 3 inch (25 by 76 mm) maximum slotted perforations arranged in rows parallel to axis of ring
 4. Total free area of perforations: Approximately 15 percent of ring interior surface
 5. Ring construction: Designed to be self-aligning.
 6. Filtering material: ASTM D448, Size No. 24, 3/4 to 2-1/2 inch (19 to 63 mm) washed, crushed stone or gravel.
- B. Manufacture PE side panels and top cover to assemble into 50 gal. (190 L) storage capacity units.
- C. Constructed-in-place aggregate type well: Include the following:
1. Line with clay or concrete bricks.
 2. Line with concrete blocks or precast concrete rings with notches or weep holes.
 3. Filtering Material: ASTM D448, Size No. 24, 3/4 to 2-1/2 inch (19 to 63 mm) washed, crushed stone or gravel.
 4. Cover: Precast, reinforced-concrete slab, designed for structural loading according to ASTM C890 and made according to ASTM C913. Include slab dimensions that extend 12 inches (300 mm) minimum beyond edge of excavation. Cast cover with opening for manhole in center.
 5. Manhole: 24 inch (610 mm) diameter, reinforced-concrete access lid with steel lift rings. Include bituminous coating over entire surface.

2.20 STORMWATER DISPOSAL SYSTEMS

- A. Chamber Systems:
1. Storage and leaching chambers: Molded PE with perforated sides and open bottom. Include number of chambers, distribution piping, end

plates, and other standard components as required for system total capacity.

2. Filtering material: ASTM D448, Size No. 24, 3/4 to 2-1/2 inch (19 to 63 mm) washed, crushed stone or gravel. Include Geotextile woven or spun filter fabric, in one or more layers, for minimum total unit weight of 4 oz./sq. yd (135 g/sq. m).

B. Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M252 for NPS 10 (DN 250) and smaller, AASHTO M294 for NPS 12 to NPS 60 (DN 300 to DN 1500). Include fittings, couplings, seals, and filter fabric.

2.21 HEADWALLS

A. Headwalls: Cast in-place concrete with a minimum compressive strength of 3000 psi (20 MPa) at 28 days.

2.22 FLARED END SECTIONS

A. Flared End Sections: Sections shall be of standard design fabricated from zinc-coated steel sheets conforming to requirements of ASTM A929.

2.23 PRECAST REINFORCED CONCRETE BOX CULVERT

A. Precast Reinforced Concrete Box Culvert: Designed for highway loadings with 2 feet (600 mm) of cover or more subjected to dead load only, conforming to ASTM C1433. For less than 2 feet (600 mm) of cover, subjected to highway loading, conform to ASTM C1433.

2.24 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS

A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets, and shall conform to ASTM C923.

2.25 WARNING TAPE

A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape // detectable // non-detectable // type, green with black letters, and imprinted with "CAUTION BURIED STORM DRAIN LINE BELOW".

PART 3 - EXECUTION

3.1 PIPE BEDDING

A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular

pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

3.2 PIPING INSTALLATION

- A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping with // 36 inch (915 mm) // 48 inch (1220 mm) // 60 inch (1520 mm) // 72 inch (1830 mm) // Insert dimension // minimum cover as shown on the Drawings.
- C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
 - 2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
 - 3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
 - 4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
 - 5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
 - 6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.

7. Warning tape shall be continuously placed 12 inches (300 mm) above storm sewer piping.
- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- G. Install gravity-flow, nonpressure drainage piping according to the following:
 1. Install piping pitched down in direction of flow.
 2. Install piping // NPS 6 (DN 150) // Insert value // and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
 3. Install // hub-and-spigot // hubless //, cast iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 4. Install ductile iron piping and special fittings according to AWWA C600.
 5. Install corrugated steel piping according to ASTM A798.
 6. Install corrugated aluminum piping according to ASTM B788.
 7. Install ABS sewer piping according to ASTM D2321 and ASTM F1668.
 8. Install PE corrugated sewer piping according to ASTM D2321 with // gasketed joints // gaskets with fused joints //.
 9. Install PVC cellular-core piping, PVC sewer piping, and PVC profile gravity sewer piping, according to ASTM D2321 and ASTM F1668.
 10. Install // non-reinforced-concrete // reinforced concrete // sewer piping according to ASTM C1479.
 11. Install force-main pressure piping according to the following:
 - a. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
 - b. Install ductile iron pressure piping and special fittings according to AWWA C600.

- c. Install PVC pressure piping according to AWWA M23, or ASTM D2774 and ASTM F1668.
- d. Install corrosion-protection piping encasement over the following underground metal piping according to AWWA C105/A21.5.
 - 1) Hub-and-spigot, cast iron soil pipe and fittings.
 - 2) Hubless cast iron soil pipe and fittings.
 - 3) Ductile iron pipe and fittings.
 - 4) Expansion joints and deflection fittings.

3.3 REGRADING

- A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES

- A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

3.5 CONNECTIONS TO EXISTING PUBLIC UTILITY MANHOLES

- A. Comply with all rules and regulations of the public utility.
- B. Backwater Valve Installation
- C. Install // horizontal-type backwater valves // combination horizontal and manual gate-valve // terminal-type backwater valves // in piping where indicated.
- D. Cleanout Installation
 - 1. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast iron soil pipe fittings in sewer pipes at branches for cleanouts and cast iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

- a. Use Light-Duty, top-loading classification cleanouts in // earth or unpaved foot-traffic // Insert other // areas.
 - b. Use Medium-Duty, top-loading classification cleanouts in // paved foot-traffic // Insert other // areas.
 - c. Use Heavy-Duty, top-loading classification cleanouts in // vehicle-traffic service // Insert other // areas.
 - d. Use Extra-Heavy-Duty, top-loading classification cleanouts in // roads // Insert area //.
2. Set cleanout frames and covers in earth in cast in-place concrete block, // 18 by 18 by 12 inches (450 by 450 by 300 mm) // Insert dimensions // deep. Set with tops // 1 inch (25 mm) // Insert dimension // above surrounding earth grade.
- E. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
1. Use Light-Duty, top-loading classification cleanouts in // earth or unpaved foot-traffic // Insert other // areas.
 2. Use Medium-Duty, top-loading classification cleanouts in // paved foot-traffic // Insert other // areas.
 3. Use Heavy-Duty, top-loading classification cleanouts in // vehicle-traffic service // Insert other // areas.
 4. Use Extra-Heavy-Duty, top-loading classification cleanouts in // roads // Insert area //.
- B. Embed drains in 4 inch (102 mm) minimum concrete around bottom and sides.
- C. Set drain frames and covers with tops flush with pavement surface.
- D. Assemble trench sections with flanged joints and embed trench sections in // 4 inch (102 mm) // Insert dimension // minimum concrete around bottom and sides.

3.7 MANHOLE INSTALLATION

- A. Install manholes, complete with appurtenances and accessories indicated. Install precast concrete manhole sections with sealants according to ASTM C891.
- B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops // 3 inches (76 mm) // Insert

dimension // above finished surface elsewhere unless otherwise indicated.

C. Circular Structures:

1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.
3. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

D. Rectangular Structures:

1. Precast concrete structures shall be placed on a 8 inch (200 mm) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section shall be set on an 8 inch (200 mm) thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb. Seal all joints with preform flexible gasket material.
2. Do not build structures when air temperature is 32 deg F (0 deg C), or below.
3. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
 - a. Forming directly in concrete base of structure.
 - b. Building up with brick and mortar.
4. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1 to 12 or more than 1 to 6. Bottom slab and benches shall be concrete.

5. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.
6. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
7. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade. Install an 8 inch (203 mm) thick, by 12 inch (300 mm) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.8 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.9 STORMWATER INLET // AND OUTLET // INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete.
- B. Construct riprap of broken stone.
- C. Install outlets that spill onto grade, anchored with concrete.
- D. Install outlets that spill onto grade, with flared end sections that match pipe.
- E. Construct energy dissipaters at outlets.

3.10 DRY WELL INSTALLATION

- A. Excavate hole to diameter of at least 6 inches (150 mm) greater than outside of dry well. Do not extend excavation into ground-water table.
- B. Install precast, concrete-ring dry wells according to the following:
 1. Assemble rings to depth indicated, and extend rings to height where top of cover will be approximately 8 inches (203 mm) below finished grade.
 2. Backfill bottom-inside of rings with filtering material to level at least 12 inches (300 mm) above bottom.
 3. Extend effluent inlet pipe 12 inches (300 mm) into rings and terminate into side of tee fitting.
 4. Backfill around outside of rings with filtering material to top level of rings and install cover over top of rings.

- C. Install manufactured, PE dry wells according to manufacturer's written instructions and the following:
 - 1. Assemble and install panels and cover.
 - 2. Backfill bottom-inside of rings with filtering material to level at least 12 inches (300 mm) above bottom.
 - 3. Extend effluent inlet pipe 12 inches (300 mm) into unit and terminate into side of tee fitting.
 - 4. Install filter fabric around outside of unit.
 - 5. Install filtering material around outside of unit.
- D. Install constructed-in-place dry wells according to the following:
 - 1. Install brick lining material dry and laid flat, with staggered joints for seepage. Build to diameter and depth indicated.
 - 2. Install block lining material dry, with staggered joints and 20 percent minimum of blocks on side for seepage. Install precast concrete rings with notches or weep holes for seepage. Build to diameter and depth indicated.
 - 3. Extend lining material to height where top of manhole will be approximately // 8 inches (203 mm) // Insert dimension // below finished grade.
 - 4. Backfill bottom of inside of lining with filtering material to level at least 12 inches (300 mm) above bottom.
 - 5. Extend effluent inlet pipe 12 inches (300 mm) into lining and terminate into side of tee fitting.
 - 6. Backfill around outside of lining with filtering material to top level of lining.
 - 7. Install manhole over top of dry well. Support cover on undisturbed soil. Do not support cover on lining.

3.11 CHANNEL DRAINAGE SYSTEM INSTALLATION

- A. Install with top surfaces of components, except piping, flush with finished surface.
- B. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
- C. Embed channel sections and drainage specialties in // 4 inch (102 mm) // Insert dimension // minimum concrete around bottom and sides.
- D. Assemble channel sections with flanged or interlocking joints.

- E. Embed channel sections in // 4 inch (102 mm) // Insert dimension // minimum concrete around bottom and sides.

3.12 STORMWATER DISPOSAL SYSTEM INSTALLATION

- A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill according to chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.
- B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, according to piping manufacturer's written instructions.

3.13 CONNECTIONS

- A. Connect // nonpressure, gravity-flow // force-main // drainage piping in building's storm building drains specified in Division 22 Section FACILITY STORM DRAINAGE PIPING.
- B. Encase entire connection fitting, plus 6 inch (150 mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
- C. Make connections to existing piping and underground manholes.
1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
 2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.
 3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. // Unshielded // Shielded // flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.14 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least // 8 inch (203 mm) // Insert dimension // thick, brick masonry bulkheads.
 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
1. Remove manhole or structure and close open ends of remaining piping.
 2. Remove top of manhole or structure down to at least // 36 inches (915 mm) // Insert dimension // below final grade. Fill to within // 12 inches (300 mm) // Insert dimension // of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Division 31 Section EARTH MOVING.

3.15 IDENTIFICATION

- A. Install green warning tape directly over piping and at outside edge of underground structures.

3.16 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video

record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

3.17 TESTING OF STORM SEWERS:

- A. Submit separate report for each test.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
 4. Submit separate report for each test.
 5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.
 6. Test force-main storm drainage piping. Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than // 150 psi (1035 kPa) // Insert value //.
 - a. Ductile iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.

- b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
- C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.18 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. // Flush with potable water. // Flush with water //.

--- E N D ---