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**SECTION 02 0486 - 2**

**PART 3 - EXECUTION**

**3.01 APPLICATION**

- A. Lime shall be applied at the rate as shown on the drawings.
- B. Fertilizer shall be applied at the rate as shown per the drawings.

**3.02 INSTALLATION**

- A. The subgrade of all areas to be seeded shall be raked and all rubbish, sticks, roots and stones larger than 2 inches shall be removed.
- B. Lime shall be spread evenly over surface and thoroughly incorporated with loam by heavy raking to at least 2 inches deep.
- C. Fertilizer shall be uniformly spread and immediately mixed with the upper 2 inches of the soil.
- D. Immediately following this presentation the seed shall be uniformly applied and lightly raked into the surface. Lightly roll the surface and water with a fine spray. Seed shall be sown in a favorable season, as approved by the Owner's representative.
- E. The Contractor shall keep all seeded areas watered and in good condition, if and when necessary until a good, healthy, uniform growth is established over the entire area seeded, and shall maintain these areas in an approved condition until final acceptance of the Contract.
- F. On slopes, the Contractor shall provide against washouts. Any washout which occurs shall be re-graded and re-seeded at the Contractor's expense until good sod is established.
- G. The Contractor shall maintain the areas in grass in a neat manner by watering, mowing, raking clippings and leaves, and appurtenances until the project is completed.

END OF SECTION

## BITUMINOUS PAVING AND BASE

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### SECTION 02 0513 - 1

#### PART 1 - GENERAL

##### 1.01 APPLICABLE PUBLICATIONS

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.

A. Military Standards:

MIL-STD-620A(1) Test Methods for Bituminous Materials

B. American Society for Testing and Materials (ASTM) Publications:

C 131-81	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C 136-84	Sieve Analysis of Fine and Coarse Aggregates
D 242-85	Mineral Filler for Bituminous Paving Mixtures
D 421-85	Dry Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants
D 422-63	Particle-Size Analysis of (1972) Soils
D 427-83	Shrinkage Factors of Soils
D 692-85	Coarse Aggregate for Bituminous Paving Mixtures
D 977-86	Emulsified Asphalt
D 1073-81	Fine Aggregate for Bituminous Paving Mixtures
D 1188-83	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens

**BITUMINOUS PAVING AND BASE**

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**SECTION 02 0513 - 2**

D 1556-82	Density of Soil in Place by the Sand-Cone Method
D 1557-78	Moisture-Density Relations of Soils using 10-lb. (4.54KG) Rammer and 16-in. (457mm) Drop
D 1559-82	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
D 1883-73	Bearing Ration of Laboratory-Compacted Soils
D 2027-76	Cutback Asphalt (Medium-(1986) Curing Type)
D 2028-76	Cutback Asphalt (Rapid- (1986) Curing Type)
D 2397-85	Cationic Emulsified Asphalt
D 3381-83	Viscosity-Graded Asphalt Cement for use in Pavement Construction
D 4318-84	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

- C. Georgia Department of Transportation Standard Specifications for Road and Bridge Construction, 2001.

1.02 GENERAL REQUIREMENTS

This work shall consist of an aggregate base course and one or more courses of bituminous plant mixture constructed on a prepared subgrade or on an existing roadway surface in close conformity with the lines, grades, thickness, and typical cross sections shown on the Drawings. Prime and tackcoats applications shall be as specified at the locations shown on the Drawings.

1.03 SUBMITTALS

- A. Bituminous Prime and Tack Coats: A manufacturer's certificate is required for each shipment of both prime and tack coat bituminous materials.

## BITUMINOUS PAVING AND BASE

---

### SECTION 02 0513 - 3

- B. Asphaltic Concrete:
1. Design Analysis: A job-mix formula, prepared by an approved testing laboratory and including data as outlined in paragraph entitled "Asphaltic Concrete Wearing Course," is required for each mix and each change in mix or materials. The job-mix formula shall be submitted for approval and shall include the specific gravities of aggregates and bitumen.
  2. Field Control: Submit certified test results from an approved testing laboratory showing the asphaltic concrete produced daily complies with the approved job-mix formula. Either full time plant inspection or periodic checks shall be acceptable.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS AND CONSTRUCTION PROCEDURES

- A. Subbase: Shall consist of approved (in-place) (selected borrow) material mixed with (limerock) (screenings) (shell) (sand-clay) in the ratio of not less than one part (limerock) (screenings) (shell) (sand-clay) to not more than two parts (in-place) (selected) material. The subbase shall be uniform throughout the compacted thickness and width indicated. The portion of material passing the No. 40 sieve shall have a liquid limit of not more than (25) ( ) and a plasticity index of not more than (5) ( ) determined by ASTM D 4318. The mixture shall have a CBR of at least (30) ( ) at 95 percent of maximum laboratory density determined in accordance with ASTM D 1883. Compact the subbase course through the full depth to not less than (100) (95) percent of maximum laboratory density determined in accordance with ASTM D 1557, Method D. Determine in-place density in accordance with ASTM D 1556.
- B. Aggregate Base Course: Shall be of compacted thickness and at the locations indicated on the drawing. The material retained on the No. 10 sieve shall be designated binder material. The coarse aggregate shall be crushed stone, gravel, or slag from an approved source and shall have a percentage of wear of not more than (50) ( ) as determined by ASTM C 131. The binder material shall consist of local sand, crushed coarse aggregate, soil, or other finely divided mineral matter obtained from an approved source. That portion of binder material passing the No. 40 sieve

WOLF CREEK AMPHITHEATRE  
FULTON COUNTY, GEORGIA  
PEI – 3063-007

## **BITUMINOUS PAVING AND BASE**

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### **SECTION 02 0513 - 4**

shall have a liquid limit of not more than 25 and a plasticity index of not more than 5. Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318. Mixture of coarse aggregate and binder material shall conform to the following gradation:

**BITUMINOUS PAVING AND BASE**

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**SECTION 02 0513 - 5**

<u>SIEVE</u>	<u>PERCENT PASSING</u>
2-inch	
1 1/2-inch	
1-inch	
3/4-inch	
1/2-inch	
3/8-inch	
No. 4	
No. 10	
No. 40	
No. 200	

1. **Compacting and Finishing:** Spread finished mixture uniformly and compact to at least 100 percent of maximum laboratory density as determined in accordance with ASTM D 1557, Method D. Determine in-place density in accordance with ASTM D 1556. After compaction, the finished surface of the base course shall not vary more than 3/8 inch when tested with a 10-foot straightedge. The finished thickness of the base course shall not vary more than one-half inch from the required thickness at any point and the average of all the depth measurements shall be at least that indicated on the drawings. Any areas not meeting any one of the above requirements shall be rejected until corrected by the Contractor.

**\*\*OR\*\***

- B. **Sand Clay Base Course:** Shall consist of either naturally or artificially proportioned and blended soils from approved selected sources. After it has been processed and is in place, ready for compaction, it shall be uniform and homogenous throughout; shall be free from all objectionable materials such as vegetation, roots, and trash; and shall have the following properties:
  1. 100 percent shall pass a 2-inch sieve and 80 to 100 percent shall pass a 1 1/2-inch sieve.

**BITUMINOUS PAVING AND BASE**

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**SECTION 02 0513 - 6**

2. The material passing the No. 10 sieve shall meet the following requirements:

Passing No. 10 sieve	100%
Passing No. 60 sieve	15-60%
Passing No. 200	6-30%
Silt	0-10%
Clay	6-20%

Determine distribution of silt and clay particles by ASTM D 422.

3. The more material passing the No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 6. Determine liquid limit and plasticity index in accordance with ASTM D 4318.
4. CBR value of material: Not less than (60) (80) at 95 percent of maximum laboratory density as determined by ASTM D 1883 and D 1557, respectively.

\*\*\*OR\*\*\*

**B. Sand-Shell Base Course:**

1. Shell: Shall consist of washed reef mollusk shell and shall not contain cannery or live shell. In the production or processing, wash the shell by a screen washer, the mesh of which shall not be smaller than 1/4 inch. The foreign matter content of the shell after washing and drying shall not exceed 3 percent of the dry weight of clean shell. The material shall pass a 2 1/2-inch sieve.
2. Sand: Shall consist of native material suitable for the purpose intended, obtained from an approved source furnished by the Contractor. The sand shall be free from a coating of injurious material, lumps of clay, loam, organic matter, or other deleterious substances.
3. Composition of Mixture: Combine the shell and sand in the proportions by weight, based on a moisture content of 10 percent, of approximately 66 2/3-percent shell and 33 1/3-percent sand. The minimum shell content shall be 65 percent. The Contractor shall make such modifications in materials and methods as are necessary to secure a material that is capable of being compacted

## BITUMINOUS PAVING AND BASE

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### SECTION 02 0513 - 7

- to a dense and well-bonded base course. Material passing the No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 6. Determine liquid limit and plasticity index in accordance with ASTM D 4318.
4. **Mixing and Placing:** The material may be either processed in a central mixing plant, a traveling mixing plant, or in place. Process and combine the shell and sand so that no more than 35 percent of the mixture shall pass the number 4 sieve when ready for compacting.
  5. **Blading, Blending, and Compacting:** When the required amounts of materials have been placed as described, mix and blend the materials thoroughly. Continue mixing until the mixture is uniform throughout and until the majority of shell particles are reduced to a maximum size of one inch by mixing and compacting procedures. Water in the amount necessary shall be uniformly applied prior to and during the mixing operations by means of tanks mounted on trucks, and with spray bars or other approved methods. Immediately following final spreading, roll material until the base has been compacted to not less than 100 percent of maximum laboratory density as determined by ASTM D 1557, Method D. Determine in-place density in accordance with ASTM D 1556.
  6. **Surface Test and Thickness:** Test base course with a 10-foot straightedge, and any deviation in excess of 3/8 inch of the finished grade of the base course shall be corrected by loosening, adding or removing material, and reshaping and re-compacting by sprinkling and rolling.

\*\*\* OR \*\*\*

- B. **(Asphaltic Concrete) (Sand-Asphalt) Base Course:** Shall be hot plant-mixed and hot laid and shall average at least the compacted thickness indicated, not varying from the required amount by more than one-half inch at any point. Construct base in layers not more than (4) (6) inches thick when compacted on the prepared subgrade (or existing pavement), as indicated. (The existing pavement shall be thoroughly cleaned and tack

**BITUMINOUS PAVING AND BASE**

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**SECTION 02 0513 - 8**

coat applied prior to placing the sand-asphalt base.) Protect preceding layers of (sand-asphalt) (asphaltic concrete base from traffic and lightly scarify to make proper bond with succeeding layers or apply tack coat as directed by the Contracting Officer. Materials shall conform to the following:

1. Asphalt ASTM D 3381, viscosity Grade (AC-20) (AC-30) ( ).
- (2. Aggregate: Sand or a blend of sand with silt, mineral filler quarry screenings, or other approved suitable materials.)
- (2. Coarse Aggregate : ASTM D 692.)
- (3. Fine Aggregate: ASTM D 1073.)
- (4. Gradation:

<u>SIEVE</u>	<u>PERCENT PASSING</u>
2-inch	
1 1/2-inch	
1-inch	
3/4-inch	
1/2-inch	
3/8-inch	
No. 4	
No. 10	
No. 40	
No. 80	
No. 200	

Asphalt content shall be between ( ) and ( ) percent by weight and shall be based on an approved job-mix formula. The mixture shall be uniform and homogeneous and shall have a stability of not less than ( ) pounds and a flow of not more than 0.20 inch when tested in accordance with ASTM D 1559, with the following modifications:

1. (Seventy-five) (Fifty blows of the hammer shall be applied to each flat face of the specimen.
2. The temperature of the mixture immediately prior to compaction shall be 250 degrees F plus or minus 10 degrees.
3. The head of the hammer and the molds used in preparing the specimens shall be at a temperature of approximately 250 degrees F.

**BITUMINOUS PAVING AND BASE**

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**SECTION 02 0513 - 9**

4. After compaction, the specimens used for determination of specific gravity shall be air-cooled to approximately the same temperature as the water to be used.
- a. **Mixing and Placing:** All equipment tools, machines, and methods used in mixing, transporting, placing, and compacting the base course shall be subject to approval. Compact each layer of the base course to a density of at least (93) (95) percent of that attained by a laboratory specimen of the same mixture prepared in accordance with ASTM D 1559. Determine the density of in-place material from the bulk specific gravity obtained in accordance with the requirements of ASTM D 1188. Protect the finished surface from all traffic for at least six hours. Finish surface shall not vary more than 1/4 inch when tested with a 10-foot straightedge.

\*\*\* OR \*\*\*

- B. **Caliche Base Course:** Shall consist of processed caliche material in accordance with Texas Department of Transportation Standard Specifications, unless otherwise specified herein. It shall consist of argillaceous limestone, calcareous, or calcareous clay particles with or without stone, conglomerate, gravel, or other granular materials. Crush and screen the caliche in such a manner that uniform product shall be produced. The processed material, when slaked and tested by standard laboratory methods shall met the following requirements.

<u>Retained on</u> <u>Square Sieve</u>	<u>Percent by Weight</u> <u>After Compaction</u>
1 3/4-inch	0
No. 4	45-75
No. 40	50-85

## BITUMINOUS PAVING AND BASE

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### SECTION 02 0513 - 10

The material passing the No. 40 sieve shall be known as "soil binder," and prepared in accordance with ASTM D 421, except as modified herein. Dry the total sample in an oven or air dryer at a temperature not to exceed 140 degrees F. After dry-screening out material that will readily pass the No. 40 sieve, immerse the retained portion of the aggregate sample in a pan of clear water until all binder material has slaked down or disintegrated. (This may require up to 72 hours; a shorter slaking time may be used provided the results are consistent with those obtained in a 72-hour slaking period.) Wash slaked material over a No. 40 sieve, care being taken that all lumps are broken down. After the sample has been wet-screened, set aside the pan containing the soil binder in water and allow the soil binder to settle. Siphon or draw off the clear water and dry the binder sample at a temperature not to exceed 140 degrees F. When dried, that portion of the soil binder which has been obtained in the slaking process shall, if necessary, be re-pulverized in a mortar with a rubber-covered pestle so that all particles will pass the No. 40 sieve. Combined and mix this portion of the soil binder thoroughly with the portion of the soil binder obtained by dry-screening. The soil constants of the composite sample shall conform to the following requirements: The liquid limit shall not exceed 40 and the plasticity index shall not exceed 12 as determined by ASTM D 4318. Except as otherwise permitted by the Contracting Officer, (1 1/2) ( ) percent lime by dry weight shall be added to the caliche material.

1. Construction: The caliche base course shall be of compacted thickness and at the locations indicated on the drawings. Spread base course uniformly and compact to 100 percent of maximum laboratory density as determined in accordance with ASTM D 1557, Method D. Determine in-place density in accordance with ASTM D 1556. When compacted, the finished surface of the base course shall not vary more than 3/8 inch when tested with a ten-foot straightedge. The finished thickness of the base course shall not vary more than one-half inch from the required thickness at any point and the average of all the depth measurements shall be at least the thickness indicated on the drawings. Reject any area not meeting any one of the above requirements until corrected by the Contractor.

**BITUMINOUS PAVING AND BASE**

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**SECTION 02 0513 - 11**

- C. Contractor's Option for Materials Only : At the option of the Contractor, those applicable material sections of the ( ) Department of Transportation Standard Specifications for ( ) shall govern in lieu of this specification for ( ) base course. The selected option shall not be changed during the course of the work.
- D. Bituminous Prime Coat For Limerock Base Course: Shall consist of the application of not more than 0.12-gallon per square yard nor less than 0.08- gallon per square yard of RC-70 or -250, liquid asphalt conforming to ASTM D 2028, or emulsified asphalt Grades SS-1 or SS-1h conforming to ASTM D 977, or cationic emulsified asphalt grades CSS-1 or CSS-1h conforming to ASTM D 977, or cationic emulsified asphalt grades CSS-1 or CSS-1h conforming to ASTM D 2397, to the completed and accepted limerock base course after it has been approved for priming. Emulsified asphalt may be diluted in equal proportion with water. The temperature of application and weather conditions for applying shall be approved. Do not permit traffic on the primed area until the prime coat has cured adequately. Base bids on the application of 0.10-gallon per square yard at 60 degrees F.

\*\*\* OR \*\*\*

- D. Bituminous Prime Coat For (Aggregate Base) (Caliche Base) Course: Shall consist of the application of not more than (0.40) ( )-gallon per square yard, nor less than(0.30) ( )-gallon per square yard of MC-30 liquid asphalt, or -30 or -70 liquid asphalt, conforming to ASTM D 2027 or D 2028, respectively, to the completed and accepted base course after it has been approved for printing. The temperature of application and weather conditions for applying shall be approved. Do not permit traffic on the primed area until the prime coat has cured adequately. Base bids on the application of (0.35)( ) -gallon per square yard at 60 degrees F.

**BITUMINOUS PAVING AND BASE**

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**SECTION 02 0513 - 12**

\*\*\* OR \*\*\*

- D. Bituminous Prime Coat For Sand Clay Base Course: Shall consist of the application of not more than 0.40 gallon per square yard nor less than 0.30 gallon per square yard of MC-30 or MC-70, liquid asphalt, conforming to ASTM D 2027, to the completed and accepted sand clay base course after it has been approved for priming. Do not permit traffic on the primed area until the prime coat has cured adequately. Base bids on application of 0.35 gallon per square yard at 60 degrees F.

\*\*\* OR \*\*\*

- D. Bituminous Prime Coat For Sand-Shell Base Course: Shall consist of the application of not more than 0.20 gallon per square yard nor less than 0.10 gallon per square yard of MC-30 or MC-70, liquid asphalt, conforming to ASTM D 2027, to the completed and accepted sand-shell base after it has been approved for priming. Do not permit traffic on the primed area until the prime coat has cured adequately. Base bids on application of 0.15 gallon per square yard at 60 degrees F.
- E. Bituminous Tack Coat: Shall consist of the application of not more than 0.12 gallon per square yard nor less than 0.08 gallon per square yard of liquid asphalt or asphalt emulsion to the (completed primed base when instructed) (sand asphalt base course) (asphaltic concrete base course). Cutback asphalt shall conform to the requirements of ASTM D 2028, Designation -70 or -250. Asphalt emulsion shall meet the requirements of ASTM D 977, Designation SS-1; if the emulsion is used, it may be diluted with not more than 50 percent water. Base bids on the application of 0.10 gallon per square yard of net bitumen to the entire primed base course.
- F. Asphaltic Concrete Wearing Course: Shall be hot-mixed and hot-laid asphaltic concrete of compacted thickness indicated. The materials when used shall conform to the following specifications:
1. Coarse Aggregate (Maximum Los Angeles Abrasion Loss 40 percent): ASTM D 692, except as modified herein.
  2. Fine Aggregate: ASTM D 1073, except as modified herein.
  3. Mineral Filler: ASTM D 242.
  4. Asphalt Cement: ASTM D 3381, viscosity Grade (AC-20) (AC-30) ( ).

**BITUMINOUS PAVING AND BASE**

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**SECTION 02 0513 - 13**

- a. Mix: Produce mix in an approved plant from an approved job-mix formula based on the following:

(1) Gradation:

<u>SIEVE</u>	<u>PERCENT PASSING</u>		
1-INCH	100	---	---
3/4-INCH	90-100	100	---
1/2-INCH	---	90-100	---
3/8-INCH	56-80	---	90-100
No. 4	35-65	44-74	55-85
No. 8	23-49	28-58	32-67
No. 50	5-19	5-21	7-23
No. 200	2-8	2-10	2-10

(2) Bituminous Content: 5.5 to 8.5 percent (to be based on approved job-mix formula).

- b. Physical Properties: The mixture shall have the following physical properties:

- (1) Stability: Not less than 1000 pounds
- (2) Flow: Not more than 0.20 inch or less than 0.08 inch
- (3) Percent Total Voids: Not less than 3 nor more than 5
- (4) Percent Voids Filled with Asphalt: Not less than 75 nor more than 85

The above physical properties shall be determined in accordance with MIL-STD-620, modified as follows:

- (1) (Seventy-five) (Fifty) blows of the hammer shall be applied to each flat face of the specimen.
- (2) The temperature of the mixture immediately prior to compaction shall be 250 degrees F plus or minus 10 degrees.
- (3) The head of the hammer and the molds used in preparing the specimens shall be at a temperature of approximately 250 degrees F.

## BITUMINOUS PAVING AND BASE

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### SECTION 02 0513 - 14

- (4) After compaction, the specimens used for determination of specific gravity shall be air-cooled to approximately the same temperature as the water to be used.
- c. Spreading and Compacting: Spread wearing course with a bituminous spreader at a temperature of not less than 250 degrees F nor more than 300 degrees F. Roll, while hot, with a steel-wheel roller weighing not less than 10 tons and a pneumatic-tired roller to a density of at least 96 percent of that attained in a laboratory specimen of the same mixture prepared in accordance with MIL-STD-620, Method 100. Determine density of in-place material from the bulk specific gravity obtained in accordance with the requirements of ASTM D 1188. In areas where the use of machine-spreading is impractical, spread the mixture by hand. Dump mixture on approved dump boards or on adjacent approved area outside the area to be paved and distribute into place from the dump boards or from the approved area by means of hot shovels. Spread mixture with hot rakes in a uniformly loose layer of thickness that when compacted will conform to the required grade and thickness. During hand spreading, carefully place each shovel full of mixture by turning the shovel over in a manner that will prevent segregation. In no case shall the mixture be placed by throwing or broadcasting from a shovel. Do not dump the loads any faster than can be properly handled by the shovelers and rakers. The finished surface shall not vary more than 1/8 inch when tested with a 10-foot straightedge. The finished thickness shall not vary more than 1/4 inch from required thickness at any point and the average thickness of all depth measurements shall be at least the thickness indicated. Reject any area not meeting any one of the above requirements until corrected by the Contractor.

## BITUMINOUS PAVING AND BASE

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### SECTION 02 0513 - 15

- d. Contractor's Option for Materials Only: At the option of the Contractor, those applicable material sections of the ( ) Department of Transportation Standard Specifications for (Bituminous Plant Mix,) ( ) Type ( ) shall govern in lieu of this specification for asphaltic concrete wearing course. Do not change the selected option during the course of the work.

### PART 3 - EXECUTION

#### 3.01 FIELD SAMPLING AND TESTING

Where required for testing of density and thickness, cores shall be extracted, tested, and pavement replaced by the Contractor.

- A. Testing: Tests required to provide adequate Quality Control are as follow: (where both subbase and base courses are included in the project, make tests 1 through (7) listed below for each course, unless specified otherwise.)
1. Sieve Analysis: (ASTM C 136) Composite and blend
  2. Particle Size Analysis: (ASTM D 422) Composite and blend
  3. CBR: Composite
  4. Los Angeles Abrasion: ASTM C 131
  5. Maximum Density Determination: Composite
  6. Liquid Limit and Plasticity Index: Composite and each blend
  7. Percentage of each material in blend or stabilization  
Generally, one test of each of items a. through (g.) ( ) from each source and each change in material or blend is required.
  8. Surface Tests: Test completed base and wearing courses for uniformity in grade as specified herein before by using a 10 foot straightedge.
  9. In-place Density and Thickness: Make at least one density and thickness test for each ( ) square yards of (subbase) (base and wearing) courses. ( )Type and number of tests for (sand-asphalt) (asphaltic concrete) base shall be the same as shown for asphaltic concrete)).

END OF SECTION

## ASPHALT PAVEMENT SEALING

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### SECTION 02 0514 - 1

#### PART 1 – GENERAL

##### 1.01 SUMMARY

###### A. Section Includes

1. Refined coal tar emulsion slurry seal coat over existing (aged) asphaltic concrete pavement.

##### 1.02 DESCRIPTION

- A. Provide primer and two coats of refined coal tar emulsion sealer in all areas.

##### 1.03 REFERENCES

###### A. ASTM Standards

- |       |   |
|-------|---|
| C136  | Method of Sieve Analysis of Fine & Coarse Aggregates  |
| D160  | Practice of Sampling Bituminous Materials   |
| D490  | Standard Specification for Road Tar   |
| D2939 | Standard Test Methods For Emulsified Bitumen Used as Protective Coatings  |
| D4866 | Standard Performance Specification for Coal Tar Pitch Emulsion Pavement Sealer Mix Formulations Containing Mineral Aggregates and Optional Polymeric Admixtures |

###### B. Federal Specifications

- RP-355 Pitch, Coal Tar Emulsion (Coating for Bituminous Pavements)

##### 1.04 DEFINITIONS

1. Additive: One or more ingredient that can be added to a specific refined coal tar emulsion, water and/or sand mixture to improve the coatings' durability, fuel resistance, drying time, color uniformity, and/or length of time required before opening the surface to traffic. This material can also be used to modify the wet mixture's viscosity to improve aggregate suspension.
2. Application Rate: The amount of volume of mixed material applied per area of pavement surface, usually expressed in gallons per square yard.
3. Applied Mixture: The combination of all ingredients mixed together and ready for application to the pavement. Also referred to as seal coat or sealer.
4. Asphaltic Concrete Pavements, New: Pavements that have been placed less than 90 days.

## ASPHALT PAVEMENT SEALING

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### SECTION 02 0514 - 2

5. Asphaltic Concrete Pavements, Aged: Pavements that have weathered over at least one summer season and have shown signs of one or more of the following: cracking, raveling, aggregate polishing and/or graying due to oxidation.
6. ASTM: American Society of Testing and Materials; a scientific and technical organization for the development of standards on characteristics and performance of materials, products, systems and services.
7. Brush applicator: A hand type or mechanized brush used to apply pavement sealer.
8. Crackfiller: A material that is placed in a pavement crack or joint to fill but not necessarily seal the void created by the crack or joint.
9. Crack sealant: A material that has adhesive and cohesive properties to seal cracks, joints or other narrow openings (less than 1 1/2" wide) in pavements against the entrance or passage of water or other debris.
10. Crude Coal Tar: Condensed material taken from the coking process (high temperature heating of coal under a vacuum) and containing all the volatile constituents.
11. Cure, final (of the seal coat): The process of evaporation of water and volatiles of the applied sealcoating mixture over a period of days, resulting in the coating reaching its ultimate strength. The duration of this process is dependent upon ambient conditions.
12. Cure, initial (of the seal coat): The condition of an applied sealcoating material that enables it to withstand vehicle traffic without damage to the sealcoat.
13. Drying (of the seal coat): The process of evaporation of water of the applied sealcoating mixture, resulting in the coating being able to sustain light foot traffic.
14. PCTC: The Pavement Coatings Technology Center; a cooperative group of manufacturers, suppliers, contractors, government agencies and professional organizations that develop standards, specifications, test methods and other technical data for the pavement coatings industry.
15. Priming: Application of an initial coat of a material designed to assist the adhesion of the additional coats of sealcoating materials. Primers are always used as under-coatings and are not designed to be used by themselves.
16. Refined Coal Tar: A selectively distilled coal tar meeting the requirements of ASTM D490 grade RT-12.
17. Refined Coal Tar Emulsion: A stable and homogeneous dispersion of refined coal tar, clay, mineral fillers and specialty chemicals in water.
18. Sealcoating: Process of applying a protective coating to a asphaltic concrete pavement.

## ASPHALT PAVEMENT SEALING

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### SECTION 02 0514 - 3

19. Spray Unit: A piece of equipment equipped with a mixing tank and positive displacement pump that can homogeneously mix and apply protective coatings uniformly over the entire width of a spray bar or wand type application device.
20. Squeegee Unit: A piece of equipment equipped with a mixing tank and squeegee that can homogeneously mix and apply protective coatings uniformly over the entire width of a rubber squeegee or brush type application device.
21. Trafficability: The ability of a sealcoating material to withstand vehicle traffic without damage to the sealcoat.
22. Uniform coated surface: A surface that has an even distribution of sealcoating material free of pinholes, streaks and/or other uneven characteristics.

### PART 2 – PRODUCTS

#### 2.01 MATERIALS

- A. Refined Coal Tar Emulsion: A refined coal tar emulsion prepared from a high temperature refined coal tar conforming to the requirements of ASTM specification D490 for RT12. The use of oil and water gas tar is not allowed. Base refined coal tar emulsion must conform to all requirements of Federal Specification RP-355.
- B. Aggregate: Use washed dry silica sand or boiler slag free of dust, trash, clay, organic materials or other contaminants. It is recommended that this aggregate meet the gradation in Table 1, when tested in accordance with ASTM C136.

**ASPHALT PAVEMENT SEALING**

**SECTION 02 0514 - 4**

**TABLE 1. GRADATION OF AGGREGATES\***

Sieve Size		Percent Retained	
		Minimum	Maximum
#20 or coarser	(0.850 mm)	0	2
#30	(0.600 mm)	0	12
#40	(0.425 mm)	2	60
#50	(0.300 mm)	5	60
#70	(0.212 mm)	5	60
#100	(0.150 mm)	5	30
#140	(0.106 mm)	0	10
#200	(0.075 mm)	0	2
Finer than #200		0	0.3

\* Table 1 represents the maximum range of aggregate gradations. In all cases the refined coal tar emulsion supplier is to give written approval of the aggregate used in the mix design.

- C. Water: Use water for mixing that is potable and free of harmful soluble salts. Control water temperature so it is at least 50\_F (10\_C).
- D. Crack Sealant: Must be certified for compatibility with the refined coal tar emulsion by the manufacturer of the refined coal tar emulsion, and approved by the engineer.
- E. Oil Spot Primer: Must be certified for compatibility with the refined coal tar emulsion by the manufacturer of the refined coal tar emulsion, and approved by the engineer.
- F. Pavement Primer: Must be certified for compatibility with the refined coal tar emulsion by the manufacturer of the refined coal tar emulsion, and approved by the engineer.

**2.02 APPLIED MIXTURE**

- A. Composition: The refined coal tar emulsion seal coat is to consist of a mixture of refined coal tar emulsion, water and aggregate, and be proportioned as shown in Table 2. The composition must have written approval of the coal tar emulsion manufacturer.

**ASPHALT PAVEMENT SEALING**

**SECTION 02 0514 - 5**

TABLE 2.  
 COMPOSITION OF MIXTURE PER 100 GAL OF  
 REFINED COAL TAR EMULSION<sup>1</sup>

Application	Refined Coal Tar Emulsion	Water	Aggregate <sup>2</sup>	Formula Rate of Application of Mix per Square Yard	
	Gallons	Gallons	LBS	Minimum Gallons	Maximum Gallons
[Prime Coat (As specified by the coal tar emulsion manufacturer. As required, see 3.01, A 5)]					
1 <sup>st</sup> Seal Coat	100	25-30	300-500	0.12	0.17
2 <sup>nd</sup> Seal Coat	100	25-30	300-500	0.12	0.17
[Additional coats may be specified for greater wearability.]					

<sup>1</sup> The numbers shown in Table 2 represent the maximum recommended range of values. In all cases, the refined coal tar emulsion supplier is to give written approval of specific composition numbers to be used in the mix design.

<sup>2</sup> Some specifications covering this type of coating have allowed sand loadings in excess of 10 pounds per gallon of refined coal tar emulsion. These coatings have not performed well in the field due to poor fuel resistance and loss of adhesion and are not recommended.

- B. Application Rate: Application rates are not to exceed 0.17 gal/yd.2 /coat, and at no time are total coats to exceed 0.51 gal/yd.2

**2.03 PRECAUTIONS**

- A. Sealer should not be applied unless pavement temperature is at least 50\_F (10\_C) and the air temperature is 50\_F (10\_C) and rising.
- B. Sealer should not be applied during rainy or wet weather, or when rain is anticipated within eight hours after application is completed.
- C. Sealer should not be applied to hot surfaces under the summer sun (over 90\_F, ambient) without first cooling the surface with clean water. Water should dampen the surface without leaving puddles.
- D. Since an emulsion may be damaged by freezing, it should be protected at all times when the temperature drops below 40\_F (4\_C).

**2.04 EQUIPMENT**

## ASPHALT PAVEMENT SEALING

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### SECTION 02 0514 - 6

- A. Use application equipment that is capable of applying the required coating rates evenly over the entire width of the application mechanism to provide a uniformly coated surface. To insure this, equip all spray units with a pumping distribution system using positive displacement pumps. Equip all squeegee/brush units with squeegees/brushes that are properly adjusted and in a condition so that the application of seal coat materials is without streaks.
- B. The mixing part of the application equipment must be tank type with a mechanically powered, full sweep mixer capable of homogeneously mixing the entire contents of the tank.
- C. Use of hand squeegee or brush application is to be restricted to places not accessible to the mechanized equipment or to accommodate neat trim work at curbs, etc. Material that is applied by hand is to meet the same standards as that applied by machine.

### PART 3 – EXECUTION

#### 3.01 SURFACE PREPARATION

- A. Preparation Of Aged Asphalt Pavement Surfaces (See Appendix A, #5)
  - 1. Patching: Review with Owner any pavement surfaces which may require patching. Upon Owner's direction, patch bituminous pavement surfaces which have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new bituminous concrete similar to that of the existing pavement. If a solvent containing cold-applied material is used, complete patching a minimum of 90 days prior to the planned application of the sealer to permit solvent to escape before sealing.
  - 2. Crack Sealing: Remove all vegetation and debris from cracks to a minimum depth of 1/2". If extensive vegetation exists treat the specific area with a concentrated solution of a water-based herbicide approved by the engineer. Fill all cracks, ignoring hairline cracks (< 1/4" wide) with a crack sealant. Wider cracks (over 1/2" wide (38.4 mm)), along with soft or sunken spots, indicate that the pavement or the pavement base should be repaired or replaced as in #1 above.
  - 3. Cleaning Existing Surface: Clean pavement surface immediately prior to placing the prime coat or seal coat by sweeping, flushing well with water

## ASPHALT PAVEMENT SEALING

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### SECTION 02 0514 - 7

leaving no standing water, or a combination of both, so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film.

4. Oil Spot Priming: Remove oil or grease that has not penetrated the asphalt pavement by scraping or by scrubbing with a detergent, then wash thoroughly with clean water. After cleaning, treat these areas with the oil spot primer.
5. Pavement Priming: To insure adhesion to sound but oxidized pavements, mix and apply a prime coat of a type and at a rate recommended by the coal tar emulsion manufacturer, after all loose aggregate is removed.

### 3.02 MIXING and APPLICATION OF REFINED COAL TAR EMULSION SLURRY

#### A. Mixing

1. Blend the coal tar emulsion mixture in the equipment described in section 2.04 using the ingredients described in Table 2. The mixing must produce a smooth homogeneous mixture of uniform consistency. (Consult coal tar emulsion supplier for its recommended order of addition of the ingredients.) During the entire mixing and application process, no breaking, segregating or hardening of the emulsion, nor balling or lumping of the sand is to be permitted. Continue to agitate the sealcoating mixture in the mixing tank at all times prior to and during application so that a consistent mix is available for application.
2. Small additional increments of water may be needed to provide a workable consistency, but in no case is the water content to exceed the specified amount.

#### B. Application of Aggregate Filled Sealcoat

1. Prime Coat: As needed, see 3.01-A.5.
2. First Coat: Apply the mixture uniformly to obtain the rates specified in Table 2.
3. Drying and Initial Cure Between Coats (Appendix A, #12 & #13): Allow each coat to dry and initially cure before applying any subsequent coats.
4. Second Coat: Apply the second coat as outlined for the first coat above.
5. Final Look: The finished surface must present a uniform texture.

#### C. Drying and Initial Cure

## ASPHALT PAVEMENT SEALING

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### SECTION 02 0514 - 8

1. The final coat must be allowed to dry a minimum of eight hours of good daylight drying conditions before opening to traffic, and initially cure enough to drive over without damage to the sealcoat.
2. If marginal weather conditions exist during this eight hour drying time, additional time will be required. In some cases this could exceed 24 hours. Check the surface after this for trafficability before opening it to vehicle traffic.

#### D. Striping

1. If striping is required, use a compatible striping paint recommended by the coal tar emulsion manufacturer.

END OF SECTION

**PORTLAND CEMENT CONCRETE PAVING**

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**SECTION 02 0515 - 1**

PART 1 - GENERAL

1.01 APPLICABLE PUBLICATIONS:

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.

A. American Concrete Institute (ACI) Publications:

211.1-81 (R1985)	Selecting Proportions for Normal, Heavyweight, and Mass Concrete
301-84	Structural Concrete for Buildings
305R-77 (R1982)	Hot Weather Concreting

B. American Society for Testing and Materials (ASTM) Publications:

C 31-85	Making and Curing Concrete Test Specimens in the Field
C 33-86	Concrete Aggregate
C 78-84	Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
C 94-86 (REV. B)	Ready-Mixed Concrete
C 143-78	Slump of Portland Cement Concrete
C 150-85 (REV. A)	Portland Cement
C 171-69 (R1986)	Sheet Materials for Curing Concrete
C 172-82	Sampling Freshly Mixed Concrete

## PORTLAND CEMENT CONCRETE PAVING

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### SECTION 02 0515 - 2

C 231-82	Air Content of Freshly Mixed Concrete by the Pressure Method
C 260-86	Air-Entraining Admixtures for Concrete
C 309-81	Liquid Membrane-Forming Compounds for Curing Concrete
C 494-86	Chemical Admixtures for Concrete
C 595-86	Blended Hydraulic Cements
C 618-85	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
D 41-85	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D 98-87	Calcium Chloride

#### 1.2 SUBMITTALS:

- A. Contractor Furnished Mix Design: Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Furnish a complete list of materials including type, brand, source and amount of cement, fly ash, pozzolan, admixtures, and applicable reference specifications.
- B. Laboratory Test Reports: Submit results of fly ash and pozzolan testing and shown that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Obtain approval before concrete placement.
- C. Field Test Reports: Submit testing results in accordance with ASTM C 31 and as required in paragraph entitled "SAMPLING AND TESTING."

## PORTLAND CEMENT CONCRETE PAVING

---

### SECTION 02 0515 - 3

D. Certificates of Conformance:

1. Aggregates
2. Admixtures
3. Cement
4. Fly ash
5. Pozzolan
6. Reinforcing

E. Manufacturer's Data

1. Materials for curing concrete
2. Admixtures
3. Bondbreaker
4. Superplasticizer
5. Mooring eyes

1.03 DELIVERY AND STORAGE: ACI 301

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Cement: ASTM C 150, Type I.
- B. Water: Fresh, clean, and potable
- C. Aggregates: Free from any substance which may be deleteriously reactive with the alkalies in the cement.
  1. Fine Aggregates: ASTM C 33.
  2. Coarse Aggregates: ASTM C 33, Size No. 57.

## PORTLAND CEMENT CONCRETE PAVING

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### SECTION 02 0515 - 4

- D. Admixtures. Where not shown or specified, the use of admixtures is subject to written approval of the Contracting Office.
    - 1. Air-Entraining: ASTM C 260.
    - 2. Retarding: ASTM C 494, Type B or D.
    - 3. Accelerating: ASTM D 98.
    - 4. Water Reducing: ASTM C 494, Type A, D, E, F, or G.
    - 5. Fly Ash and Pozzolan: ASTM C 618, type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Type N and F.
  - E. Forms: Wood, plywood, steel, or other suitable material.
  - F. Reinforcement:
    - 1. Dowels steel shall be intermediate grade, steel bars conforming to ASTM Designation A625, Grade 60. Rail-steel bars will not be permitted in the work.
    - 2. Reinforcing steel shall be deformed, intermediate grade, steel bars conforming to ASTM Designation A615, Grade 60. Rail-steel bars will not be permitted in the work.
  - G. Curing Materials
    - 1. Impervious Sheeting: ASTM C 171 with a minimum sheet thickness of 10 mils.
    - 2. Liquid Membrane-forming Compound: STM C 309, white pigmented, Type 2, Class B, free of paraffin or petroleum.
  - H. Joint Filler: ANSI/ASTM D1751 non-extruding type.
  - I. Joint Sealant: Fed. Spec. SS-S-200E sealants, joint, two-component, jet blast resistant, cold applied, for Portland cement concrete pavement.
  - J. Bondbreaker: ASTM D 41.
  - K. Mooring Eyes: Ductile iron, for rop clip and hook type anchors, 9,000 lb. bending load capacity.
- 2.02 CONTRACTOR-FURNISHED MIX DESIGN:

**PORTLAND CEMENT CONCRETE PAVING**

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**SECTION 02 0515 - 5**

Design mix in accordance with ACI 211.1. The concrete shall conform to the following

**FLEXURAL STRENGTH, AGGREGATE SIZE, AND SLUMP**

Minimum Flexural Strength 28 Days (psi)	Maximum Aggregate Size (inches)	Maximum Aggregate Cement Content lbs./yd <sup>3</sup> (by weight)	Min. Water-Cement Ratio	Maximum Water-Cement Ratio	Range Slump (In.)
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700	1"	658	0.46	1-3	
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- A. Allowable air content: 5 percent plus or minus 1.5 percent by volume.
- B. The minimum cement content is required for durable concrete with local aggregates by may be insufficient to obtain the specified strength, in which case, increase the cement content as necessary, with out additional compensation under the contract.
- C. Do not include fly ash content when calculating the cement content.

**PART 3 - EXECUTION**

**3.01 FORMS:**

- A. **General:** Construct forms to be removable without damaging the concrete. In lieu of setting forms, the edge of an existing pavement section may be used as a form.
- B. **Coating:** Before placing the concrete, coat the contact surfaces of forms with a non-staining mineral oil, non-staining form coating compound, or two coats of nitro-cellulose lacquer. When using existing pavement as a form, clean existing concrete and then coat with a bondbreaker before concrete is placed.
- C. **Grade and Alignment:** Check and correct grade elevations and alignment of the forms immediately before placing the concrete.

## PORTLAND CEMENT CONCRETE PAVING

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### SECTION 02 0515 - 6

#### 3.02 REINFORCEMENT:

- A. Reinforcement shall be newly rolled, of domestic manufacture, free from rust, scale, dirt, grease, and injurious contaminants and shall be of intermediate grade billet steel conforming to ASTM Specification A615, Grade 60.
- B. Reinforcement, where required, shall be accurately placed in exact positions shown, shall be secured against displacement with annealed iron wire ties or suitable clips at intersections, and shall have a clear space of 2 inches between the steel and face of forms for the purpose of holding the steel in proper position. Concrete blocks with wire ties cast therein may be used whereas approved by the Engineer for the purpose of maintaining and clearance between reinforcement and forms.
- C. Reinforcement shall be accurately fabricated to the dimensions indicated on the Drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than two times the minimum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than six times the minimum thickness except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8-bar diameters. All bars shall be bent cold.
- D. Rail-steel will not be allowed in the work.
- E. Metal chairs shall not be used for support unit reinforcing in slabs. Instead, all reinforcing shall be supported on concrete cubes of the correct height. Cubes shall have a minimum compressive strength of 3,500 psi at the time of use. Supporting steel by means of cinder blocks or concrete building blocks will not be permitted.
- F. Reinforcement shall be shipped to the work with bars of the same size and shape fastened in bundles with metal identification tags giving size and mark securely wired on. The identification tags shall be labeled with the same designation as shown on submitted bar schedules and shop drawings.

## PORTLAND CEMENT CONCRETE PAVING

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### SECTION 02 0515 - 7

- G. All bars shall be stored off the ground and shall be protected from moisture and be kept free from dirt, oil, or injurious coatings.
- H. Unless otherwise shown, splices in reinforcement shall be lapped not less than 24 diameters. All bar splices shall be staggered wherever possible. When splicing bars of different diameters, the length of lap is based on the larger bar.
- I. Before being placed in position, reinforcement shall be thoroughly cleaned of loose mill and rust, scale, dirt, and other coatings, including ice, that reduce or destroy bond. Where there is delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.
- J. Reinforcement which is to be exposed for a considerable length of time after being placed shall be painted with a heavy coat of cement grout, if required.

### 3.03 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE

- A. Measuring: ASTM C 94.
- B. Mixing: ASTM C 94, except as modified herein. Begin mixing within 30 minutes after the cement has been added to the aggregates. If the air temperature is greater than 84 degrees, F, reduce mixing time and place concrete within 60 minutes. Additional water may be added to bring the slump within required limits as specified in Section 11.7 may be added of ASTM C 94, provided that the specified water-cement ratio is not exceeded.
- C. Transporting: ACI 301
- D. Placing: ACI 301, except as modified herein. Do not exceed a free vertical drop of 3 feet from the point of discharge. When placing reinforced concrete in two courses, place second course within 30 minutes of striking off first course.
- E. Vibration: Immediately after spreading concrete, consolidate the concrete adjacent to forms and joints regardless of slab thickness, and concrete slabs 6 inches or more in thickness using internal vibrating equipment. For reinforced pavement laid in two courses, vibrate only the top course. Vibrate concrete for full depth adjacent to edge forms and joints. Limit the duration of vibration to that necessary to produce consolidation of the concrete. Excessive vibration will not be permitted. Vibrators shall not be operated in the concrete at one location for more than 15 seconds. At the option of the Contractor, vibrating equipment

## PORTLAND CEMENT CONCRETE PAVING

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### SECTION 02 0515 - 8

of a type approved by the Contracting Officer may be used to compact the concrete in unreinforced pavement slabs less than 6 inches thick.

1. **Vibrating Equipment:** Operate equipment, except hand-manipulated equipment, ahead of the finishing machine. Select the number of vibrating units and power of each unit to properly consolidate the concrete. Mount the units on a frame that is capable of vertical movement and, when necessary, radial movement, so the vibrators may be operated at any desired depth within the slab or be completely withdrawn from the concrete. The clear distance between frame-mounted vibrating units that have spuds that extend into the slab at intervals across the paving lane shall not exceed 30 inches. The distance between the end of the vibrating tube and the side form shall not exceed 2 inches. For pavements less than 10 inches thick, operate the vibrators at mid-depth parallel with or at a slight angle to the subbase. For thicker pavements, angle the vibrators toward the vertical, with the vibrator tip preferably about 2 inches from the subbase, and the top of the vibrator a few inches below the pavement surface. The vibrators may be pneumatic, gas driven, or the electric type, and shall be operated at frequencies within the concrete of not less than 8,000 vibrations per minute. The amplitude of vibration shall be such that noticeable vibrations occur at 1.5-foot radius when the vibrator is inserted in the concrete to the depth specified.
  
- F. **Hot Weather:** Maintain required concrete temperature in accordance with Figure 2:1.5 in ACI 305 to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. After placement, use fog spray, spread and remove polyethylene sheeting between finishing operations, apply monomolecular film, or use other suitable means to reduce the evaporation rate. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Cool underlying material by sprinkling lightly with water before placing concrete. Recommended practices may be found in ACI 305.

## PORTLAND CEMENT CONCRETE PAVING

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### SECTION 02 0515 - 9

#### 3.04 FINISHING CONCRETE

- A. General Requirements: Start finishing operations immediately after placement of concrete. Use finishing machine, except hand finishing may be used in emergencies and for concrete slabs in inaccessible locations or of such shapes or sizes that machine finishing is impracticable. Finish the surface of the pavement on both sides of a joint to the same grade. Finish formed joints from a securely supported transverse bridge. Provide hand finishing equipment for use at all times. Transverse and longitudinal surface tolerances shall be 1/4 inch in 10 feet.
  
- B. Side Form Finishing: Strike off and screed the concrete to the required crown and cross-section by a power-driven transverse finishing machine. Transverse rotating tube or pipe shall not be permitted unless approved by the Contracting Officer. The elevation of the concrete shall be such that, when consolidated and finished, the surface of the pavement will be adequately consolidated and at the required grade. Equip the finishing machine with two screeds which are readily and accurately adjustable for changes in pavement crown and compensation for wear and other causes. Make as many passes over each area of pavement and at such intervals as necessary to give the proper compaction, retention of the coarse aggregate near the finished surface, and a surface of uniform texture, true to grade and crown. Do not permit excessive operation over an area, which will result in an excess of mortar and water being brought to the surface.
  - 1. Equipment Operation: Maintain the travel of machine on the forms without lifting, wobbling, or other variation of the machine which tend to affect the precision of concrete finish. Keep the tops of the forms clean by a device attached to the machine. During the first pass of the finishing machine, maintain a uniform ridge of concrete ahead of the front screed for its entire length.

## PORTLAND CEMENT CONCRETE PAVING

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### SECTION 02 0515 - 10

2. Joint Finish: Before the concrete is hardened, correct any edge slump of pavement, exclusive of edge rounding, in excess of 0.02 foot. Finish the concrete surface on each side of the construction joints to the same plane, and correct all deviations before the newly placed concrete has hardened.
  3. Hand Finishing: Strike-off and screed the surface of the concrete to elevations slightly above finish grade so that when the concrete is consolidated and finished the surface of pavement is at the indicated elevation. Vibrate the entire surface until the required compaction and reduction of surface voids is secured with a strike-off template.
  4. Longitudinal Floating: After the initial finishing, further smooth and consolidate the concrete by means of hand-operated longitudinal floats. Use floats that are not less than 12 feet long and 6 inches wide and stiffened to prevent flexing and warping.
- C. Surface Finish: Surface finish of new pavement shall match existing.
1. Plastic Grooving: After surface irregularities have been removed, give the concrete surface a uniformly roughened finish by use of a wire comb or other approved texturing device similar to a wire comb. Prior to plastic grooving, make one pass with burlap drag in the longitudinal direction. Complete the grooving while the concrete surface is in such condition that it will not be torn or unduly roughened, and before the surface has obtained its initial set. Texture small or irregular areas, or areas not suitable for machine texturing, with hand operated device producing a textured surface equivalent to that required for machine combing.
  2. Edging: At the time the concrete has attained a degree of hardness suitable for edging, carefully finish all slab edges, including the edges at formed joints, with an edge having a maximum radius of one-eighth inch. Clean by removing all loose fragments and soupy mortar from corners or edges of slabs which have crumbled and areas which lack sufficient mortar for proper finishing. Refill the voids solidly with a mixture of suitable proportions and consistency and refinish. Remove all unnecessary tool marks and edges. All remaining edges shall be smooth and true to line.
  3. Repair and Surface Defects: ACI 301.

## PORTLAND CEMENT CONCRETE PAVING

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### SECTION 02 0515 - 11

#### 3.05 CURING AND PROTECTION

- A. **General Requirements:** Protect concrete adequately from injurious action by sun, rain, flowing water, mechanical injury, tire marks and oil stains, and do not allow it to dry out from the time it is placed until the expiration of the minimum curing periods specified herein. Use impervious-sheeting curing, or liquid membrane-forming compound, except as specified otherwise herein. Do not use membrane-forming compound on surfaces where its appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. Maintain the temperature of the air next to the concrete above 40 degrees F for the full curing periods.
- B. **Impervious-Sheeting Curing:** Wet the entire exposed surface thoroughly with a fine spray of water and then cover with impervious sheeting. Lay sheets directly on the concrete surface and overlap 12 inches. Make sheeting not less than 18 inches wider than the concrete surface to be cured, and weight down on the edges and over the transverse laps to form closed joints. Repair or replace sheets if torn or otherwise damaged during curing. Leave the sheeting on the concrete surface to be cured for at least 7 days.
- C. **Liquid Membrane-Forming Compound Curing:** Seal or cover all joint openings to application of the curing compound to prevent the curing compound from entering the joint. Compound shall remain on the concrete for 7 days before sealer or covering is removed and joint sealing material is placed in the joints.
  1. **Application:** Apply the compound immediately after the surface loses its water sheen and has a dull appearance and before joints are sawed. Agitate curing compound thoroughly by mechanical means during use and apply uniformly in a two-coat continuous operation by suitable power-spraying equipment. The total coverage for the two coats shall be at least one gallon of undiluted compound per 200 square feet. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. Apply an additional coat of the compound immediately to areas where the film is defective. Respray concrete surfaces that are subject to heavy rainfall within 3 hours after the curing compound has been applied in the same manner.
  2. **Protection of Treated Surfaces:** Keep concrete surfaces to which liquid membrane-forming compounds have been applied free from vehicular

## PORTLAND CEMENT CONCRETE PAVING

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### SECTION 02 0515 - 12

traffic and other sources of abrasion for not less than 72 hours. Foot traffic is allowed after 24 hours for inspection purposes. Maintain continuity of the coating for the entire curing period and repair damage to the coating immediately.

#### 3.06 SAMPLING AND TESTING:

- A. Sampling: Collect samples of fresh concrete in accordance with ASTM C 172 during each working day as required to perform all tests specified herein. Make test specimens in accordance with ASTM C 31.
- B. Testing
  1. Consistency Tests: Determine slump in accordance with ASTM C 143. Take samples for slump determination from the concrete while it is being placed. Perform tests at the beginning of a concrete placement operation and at subsequent intervals to ensure that the specification requirements are met. In addition, perform tests each time test beams cylinders are made.
  2. Flexural Tests: Determine flexural strength in accordance with ASTM C 78. Make four test specimens for each set of tests. Test two specimens at 7 days, and the other two at 28 days. The strength of the concrete will be considered satisfactory if the average of the 28-day test results equals or exceeds the specified 28-day flexural strength, and no individual strength test is less than 700 pounds per square inch. Frequency of flexural tests on concrete beams shall not be less than four test beams for each 50 cubic yards of concrete, or fraction thereof, placed. Concrete which is determined to be defective, based on the strength acceptance criteria therein, shall be removed and replaced with acceptable concrete.
  3. Air content: Test air-entrained concrete for air content at the same frequency as specified for slump tests. Determine percentage of air in accordance with ASTM C 231 on samples taken during placing of the concrete in the forms.

END OF SECTION

**SECTION 02 0542 - 1**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The work covered by this Section consists of furnishing all materials, equipment, and labor and performing all operations in connection with the construction of the Silt Fence System in accordance with the Contract Documents.
- B. The surfaces to be protected shall be prepared and graded to the extent that they are normally stable in the absence of erosion forces. All stones, roots, and other waste material exposed on the slopes which could disturb the finished mat profile shall be removed. The fabric shall be positioned over these surfaces.

**1.02 RELATED WORK**

- A. Site Work; Division 2.

**1.03 QUALIFICATIONS**

- A. Installation shall be by an experienced applicator approved by the manufacturer of the material supplied.
- B. Applicator shall have a minimum of one year experience.
- C. Submit written proof of qualifications to the Engineer.
- D. The woven fiber filter and appurtenances specified under this Section shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the manufacture of the fabric furnished. The woven fiber filter and all related appurtenances shall be designed, constructed and installed with the best practices and methods.
- E. The woven fiber filter and appurtenances shall be as manufactured by Carthage Mills, Cincinnati, Ohio, Staff Industries, Inc., Upper Montclair, or approved equal.

**1.04 SUBMITTALS**

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**SECTION 02 0542 - 2**

- A. Final acceptance of fabric shall be contingent upon approval of samples.
- B. Furnish an affidavit that all materials comply with these Specification requirements.

**1.05 DELIVERY AND STORAGE**

- A. Prevent damage during delivery and handling.
- B. Store all fabric in undamaged condition as packaged by the manufacturer, with manufacturer's seals and labels intact.
- C. Store all materials in a clean, dry storage area.
- D. Do not store fabric in an upright position.
- E. Storage area temperature shall be maintained above 40 degrees F. with normal humidity.

**PART 2 - PRODUCTS**

**2.01 FABRIC**

- A. The filter fabric shall be designed to control water seepage of the fine particle and or soil without clogging under varying water flow conditions, thereby serving as a soil stabilizer.
- B. The filter fabric shall be chemically resistant to prolonged exposure to fresh water, and either alkaline or acidic soil conditions.

C. Physical Properties:	<u>TEST METHOD</u>
1. Color	Black ----
2. Weight, oz./sq. ft.	0.8 ASTM D-1910
3. Equivalent opening size	70-100 CE-1310
4. % open area	4-10 CE-1310
5. Tensile Strength, #	400 x 280 ASTM D-1682
6. Elongation, %	34 x 32 ASTM D-1682
7. Trapezoidal tear strength, #	92x 40 ASTM D-2263
8. Mullen burst, psi	510 ASTM D-751

**SILT FENCE**

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**SECTION 02 0542 - 3**

9.	Puncture Strength, #	150 ASTM D-751-M
10.	Abrasion resistance Abraded strength, #	ASTM D-01175-71 80 ASTM D-1682
11.	Weather-Ometer strength retention, %	90 ASTM E-42-69
12.	Water permeability, water flow rates*, milliliters/min. 6" head 8" head 36" head	460-520 Canvas Products 620-760 Assn.Intern'l 2510-2790 Test Method (for canvas)

\*Water flow perpendicular to fabric

- D. The upper level of the fabric form work edges shall be structured so as to accommodate the type of anchorage to be utilized at that point.
- E. Individual mill-width panels shall be cut to suitable lengths, and the two layers of fabric separately jointed, edge-to-edge, by means of heavy, double-stitched nylon thread. The tensile strength of stitched joints shall not be less than 100 lbs/inch.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Installation instructions shall be supplied by the manufacturer. The fabric shall be applied in accordance with the manufacturer's recommendations.

**END OF SECTION**

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 1

#### PART 1 - GENERAL

##### 1.01 APPLICABLE PUBLICATIONS

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.

A. Federal Specifications (Fed. Spec.):

SS-S-200D	Sealing Compound, Two Component, Elas- & Am-3 tometric, Polymer Type, Jet-Fuel resistant, Cold Applied
SS-S-1401B	Sealing Compound, Hot-Applied, for Concrete and Asphalt Pavements
SS-S-1614	Sealing Compound, Jet Fuel Resistant, & Am-1 Hot-Applied, One Component, For Portland Cement and Tar Concrete Pavements

##### 1.02 SAMPLING AND TESTING JOINT SEALERS

Submit a 5 gallon sample of joint sealer plus primer to the Waterways Experiment Station in Vicksburg, Mississippi for testing. The Contracting Officer will provide details of the submittal requirements. The Contractor is advised that this testing will require approximately 45 days to complete. Joint sealers will be tested by the Government, and no material shall be used prior to receipt by the Contractor of written notice that the material is acceptable. The cost of the first test of samples from each lot of joint sealer will be borne by the Government. If the sample fails to meet specification requirements, the material represented by the sample shall be replaced. Retests of rejected material shall be at the expense of the Contractor.

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 2

#### 1.03 SUBMITTALS

- A. Certified Test Reports: Submit copies of reports for the following materials:
  - 1. Bond Breakers
  - 2. Primers
  - 3. Joint Seals
- B. Equipment: Submit a list and description of the equipment to be used and a statement from the supplier of the joint sealant that the proposed equipment is acceptable for installing the specified sealant.
- C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with recommendations of the manufacturer of sealing compounds, submit catalog data and copies of recommendations, and a Material Safety Data Sheet (Department of Labor Form OSHA-20 or comparable form) to identify toxic components such as asphalt and coal tar products.
- D. Samples: Submit samples of sealant materials and bond breakers.

#### 1.04 DELIVERY AND STORAGE

Inspect materials delivered to the site for visible damage, and unload and store with a minimum of handling. Joint materials shall be delivered in original sealed containers and shall be protected from freezing or overheating. Provide jobsite storage facilities capable of maintaining temperature ranges within manufacturers recommendations.

#### 1.05 WEATHER LIMITATIONS

Do not proceed when weather conditions detrimentally affect the quality of forming joints and applying joint sealants. Apply sealants only if the atmospheric temperature is at least 40 degrees F in the shade and is rising. Surfaces shall be dry and component materials shall be protected from free moisture.

#### PART 2 - PRODUCTS

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 3

#### 2.01 MATERIALS

##### A. Joint Sealant

Fed Spec. SS-S-200, Type [H] [M].

Fed Spec. SS-S-1614.

Fed Spec. SS-S-1401.

##### B. Primer: Select concrete primer recommended by the manufacturer of the proposed liquid joint sealant.

##### C. Bond Breakers:

1. Blocking Media (Roving): Compressible, nonshrink able, nonreactive with joint sealant, such as, upholstery cord, cotton, and jute, or polyethylene foam rod, all free of oils or bitumens. Minimum width shall be 1/8 inch greater than joint width.
2. Separating Tape: Polyethylene or polyester tape, 3 mil minimum thickness, or masking tape, rubber tape, or other barrier sheet, nonreactive, non-absorptive, adhesive-back tape, 1/8-inch wider than the nominal width of the joint. Select type of tape that will not bond to joint sealer.

#### 2.02 EQUIPMENT

- ##### A. General Requirements: Furnish all equipment, tools, and accessories necessary to clean existing joints and install liquid joint sealants. Maintain machines, tools, and other equipment in proper working conditions at all times.

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 4

- B. Joint Cleaning Equipment:
1. Routing Tool: To remove old sealant from joints, select routing tool that is adjustable to varying widths and depths required, but not wider than the existing joint, and of such dimension that will not strike and damage the sides of joints. V-shaped tools, or rotary impact routing devices shall not be permitted. The equipment shall be capable of maintaining accurate cutting depth and width control.
  2. Concrete Saw: Self-propelled power saw with diamond saw blades designed for sawing hardened concrete, to reface, widen, or deepen existing joints as specified without damaging the sides, bottom, or top edge of joints. Blades may be single or gang type with one or more blades mounted in tandem for fast cutting. Select saw adequately powered and sized to cut specified opening with not more than two passes of the saw through the joint.
  3. Sandblasting Equipment: Commercial type capable of removing residual sealer, oil, or other foreign material which may prevent bond of new sealer. Equipment shall include an air compressor, hose and nozzles of proper size, shape, and opening. Attach an adjustable guide to the nozzle or nozzles that will hold the nozzles aligned with the joint to effectively and efficiently clean without damage to concrete edges, except for slight edge chipping of deteriorated concrete edges, inherent in this type of cleaning existing weathered concrete. Adjust the height, angle of inclination, or size of nozzles to sandblast the joint faces and not the bottom of the joint.
  4. Air Compressor: Potable air compressor capable of operating the sandblasting equipment and capable of blowing out sand, water, dust adhering to sidewalls of concrete, and other objectionable materials from the joints. The compressor shall furnish oil free air at a pressure not less than 90 psi and a minimum rate of 150 cubic feet of air per minute at the nozzles, and free of oil.
  5. Jet Waterblasting: High-pressure water jet machine shall include compressor, pressure pumps, hose, water jets, and controls capable of discharging water up to 10,000 psi pressure at 22 gallons per minute. Use adjustable nozzles to control nozzle pressure between 7,000 and 10,000 psi. Select high-pressure hoses with burst pressures from 20,000 psi to 30,000 psi.

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 5

6. Vacuum Sweeper: Self-propelled, vacuum pickup sweeper capable of completely removing all loose sand, water, joint material, and debris from pavement surface.
  7. Hand Tools: When approved, hand tools such as brooms and chisels may be used in small areas for removing old sealant from joints and repairing or cleaning the joint faces.
- C. Joint Sealing Equipment:
1. Hot-Poured Liquid Sealant: Install hot-poured sealant materials with unit applicators which will heat and extrude the sealant. Equip the mobile units with double-wall agitator type kettles with an oil medium in the outer space for heat transfer, a direct-connected pressure-type extruding device with nozzle or nozzles shaped for insertion in the joints to be filled, and positive devices for controlling the temperature of oil and sealer. Design the applicator so that the sealant will circulate through the delivery hose and return to the kettle when not sealing a joint. Insulate the applicator wand from the kettle to the nozzle. Select dimensions of nozzles such that the tip will easily feed sealant into the void space of the joint. Equip the nozzle tip with a metal cross-bar to assure that the top of the sealant fed into the joint is level and within the indicated tolerance below the pavement surface.
  2. Cold-Applied Liquid Sealant: Select equipment designed to mix and install cold-applied joint sealant materials.
    - a. Applicators: The equipment shall deliver two semifluid components to a portable mixer through a hose at a controllable present ratio by positive displacement with an accuracy within 5 percent, plus or minus, for the quantity of each component. Equip the reservoirs for each component with mechanical agitation devices that will maintain the components in uniform condition without entrapping air.

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 6

- Incorporate provisions to permit thermostatically controlled indirect heating of the components when required; however, immediately prior to proportioning and mixing, do not permit the temperature of either component to exceed the temperature recommended by the manufacturer.
- b. Screens: Provide screens with openings not exceeding 1/2-inch square at the top of each reservoir to eliminate any foreign particles or partially polymerized material that would clog fluid lines or otherwise cause misproportioning or improper mixing of the two components. The equipment shall be capable of intimately mixing the two components through a range of application rates of 10 to 60 gallons per hour and through a range of pressures from 50 to 1,500 psi, as required by material, climatic, or operating conditions. Equipment shall deliver a homogeneous product from the mixer to the nozzle without undue elapsed time which tends to tear down the molecular structure of the chemically reacting components while passing through the mixer.
  - c. Equipment Selection: Select supply lines and nozzles for easy removal and cleaning and for readily accommodating nozzles of different types and sizes and as many as may be required for the various operations. Select dimensions of the nozzle such that the tip of the nozzle will easily feed sealant into the void space of the joint. Equip the nozzle tip with a metal cross-bar to assure that the top of the sealant fed into the joint is level and within the indicated tolerance below the pavement surface.

### PART 3 - EXECUTION

#### 3.01 JOINT PREPARATION

- A. General Joint Preparation: Unless otherwise indicated, saw, clean and reseal all joints. Do not proceed with final cleaning operations by more than one working day in advance of sealant. Thoroughly clean the joints by removing existing joint sealing compound, sealants, dirt, and other foreign material with the equipment specified herein, but not limited thereto. Cleaning procedures which damage joints or previously repaired patches by chipping or spalling will not be permitted. Remove existing sealant to

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 7

the required depth. [Range of sizes of existing joint grooves are shown.] Precise shape and size of existing joints vary, and the conditions of the joint walls and edges vary and include but are not limited to rounding, square edges, sloping, chips, voids, depressions, and projections.

- B. Removal of Existing Material: Remove from the joint faces major portion of the existing sealants by using the specified routing tool. After cutting free the existing sealant from both joint faces, remove the sealant to the depth required to accommodate the bond breaking material and to maintain the specified depth for the new sealant to be installed. For expansion joints, remove existing sealant to a depth of not less than [the indicated depth.] [one inch]. If existing preformed expansion-joint material is more than one inch below the surface of the pavement, remove the existing sealant to the top of the preformed joint filler. For joints other than expansion joints, remove in-place sealant to the depth [as shown.] [of grooves, which are \_\_\_ inch, plus or minus 1/4 inch.] At the completion of routing operations clean the pavement surface with vacuum sweeper and clean the joint opening by blowing with compressed air, or water blast. Protect previously cleaned joints from being contaminated by subsequent cleaning operation.
- C. Refacing of Joints: When other cleaning methods are unsatisfactory [and, if required,] to widen the joint space to the width and depth [as shown] [specified herein], reface concrete joint walls. Refacing shall be by use of a power-driven concrete saw specified herein to remove all residual sealant and a minimum of concrete. Removal shall provide exposure of newly clean concrete. Remove all burrs and irregularities from sides of joint faces. Immediately after sawing each joint, thoroughly clean the saw cut and adjacent concrete surface. Flush with water under pressure, simultaneously blowing the water out with compressed air until all debris is removed from the joint. Protect adjacent previously cleaned joint spaces from receiving water and debris during the cleaning operation.
1. [Joint Widening (Except Expansion Joints): Saw joints having grooves less than 3/8-inch wide and less than one inch deep to a minimum width of [3/8] [1/2] [\_\_\_] inch and to the minimum depth, [of] [one inch] [1 1/2-inches] [as shown].]
- D. Final Cleaning of Joints:

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 8

1. Expansion Joints: Following removal of existing sealant, and immediately before resealing, thoroughly clean the joints by sandblasting until all concrete surfaces in the joint space are free of sealing compound, sealants, dust, dirt, water and any other foreign materials which would prevent bonding of new sealants to the concrete. Use sand particles of the proper size and quality for the work. Perform sandblasting with the specified nozzles, air compressor, and other appurtenant equipment. Position nozzles to clean the joint faces and not the bottom of the joint. Make as many passes of the sandblast nozzle along the joint as required for proper cleaning. Immediately prior to sealing the joint, blow out the joint spaces with compressed air until completely free of sand, water, and dust. Joints shall be dry before installation of joint sealant. Replace expansion joint filler material damaged in performing the work with new materials of the same type and dimensions as the existing material, or with appropriate blocking material.
2. Joints (Except Expansion Joints):
  - a. [Waterblast Cleaning: By use of the specified high-pressure water jets, complete the final cleaning of the joints by removing all evidence of the old sealant from the joint faces and from the pavement surface for a distance of one inch from the edges of the joint. Remove the sealant [to the depth shown.] [for the depth of the groove or void space.] In any event, remove the sealant to the depth required to accommodate any bond breaker to be used and to maintain the above depth for the newly installed sealant. Select the specified high-pressure water jet machines and accessories for water blasting the joints. If required, attach an adjustable guide to the nozzle or nozzles that will support and align the nozzle with the joint at the required height above the joint faces. The tip of the nozzle shall be capable of simultaneously fanning the water toward each joint face at approximately 15 degrees with the pavement surface. Operate the water blast equipment in accordance with the manufacturer's printed instruction, and if necessary, adjust the equipment to secure through cleaning. Make as many passes as necessary for proper cleaning. Control the flow of water and prevent any operation that will damage the concrete joints or float the concrete slabs. After water

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 9

blasting, blow out the joints with compressed air using the specified air compressors to remove all debris and moisture and to ensure that the joints are dry and clean at the time of sealing.]

\*\*\* OR \*\*\*

[Sandblast Cleaning: By sandblasting methods, clean the newly exposed concrete joint faces and the pavement surfaces extending one inch each way from the edges of the joint. Continue sandblasting until surfaces are free of any traces of existing sealant and free of saw-cutting fines. Select specified sandblasting equipment to provide a minimum of 150 cubic feet per minute of air at a nozzle pressure of 90 pounds per square inch for final cleaning. After final cleaning and immediately prior to sealing, blow out the joints with compressed air. Use the specified air compressor to remove all sand and water to ensure that the joints are dry, dust free, and clean at the time of sealing.]

- E. Bond Breaker: At the time the joints receive the final cleaning and are dry, install bond breaker material as indicated in the bottom of the joint with a steel wheel or other approved device.
  - 1. Blocking Media (Roving) (Except for Expansion Joints): When the existing sealant has been removed to a depth greater than [one inch] [required], plug or seal off the lower portion of the groove by installing the specified blocking media.
  - 2. Separating Tape: When the existing sealant has been removed to [a depth less than one inch] [the depth indicated] and the bottom of the joint opening has been formed by saw-cuts, or previously installed joint water stops, insert the specified tape to prevent contact of the newly installed sealant with the existing sealant, joint filler, or groove bottom.
- F. Rate of Progress: The final stages of joint preparation, which include placement of bond breakers, if required, shall be limited to only that lineal footage of joint that can be resealed during the same workday.

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 10

- G. Disposal of Debris: Sweep from pavement surface to remove excess joint material, dirt, water, sand, and other debris by vacuum sweepers or hand brooms. Remove the debris immediately [to a point off station.] [to an area designated by the Contracting Officer.] [ in accordance with Section 02050, "Demolition and Removals."]

#### 3.02 PREPARATION OF SEALANT

- A. Hot-Poured Type: Heat hot-poured sealing materials in accordance with safe heating temperature ranges recommended by the manufacturer. Sealant that has been overheated or subjected to heating for over 3 hours or that remain in the applicator at the end of the day's operation shall be withdrawn and wasted. Heat the sealant in the specified equipment.
- B. Cold-Applied: Arrange for the inspection of the sealant components and containers before the materials are installed. Reject materials which contain water, hard caking of any separated constituents, nonreversible jell, or other unsatisfactory conditions such as settlement of constituents into a soft mass that cannot be readily and uniformly remixed in the field with simple tools. In conformance with the manufacturer's recommendations, mix the individual components in the separate shipping containers before transferring the components to the appropriate reservoirs of the application equipment. Thoroughly mix the components to ensure homogeneity of the components and the incorporation of all constituents at the time of transfer. If necessary, for remixing prior to transfer, warm the components to a temperature not exceeding 90 degrees F by placing the components in heated storage or by other approved methods. In no case shall the components be heated by direct flame or in single-walled, non-oil-bath heating kettles. [hand mixing of cold-applied two component sealant may be done at the option of the Contractor for sealants conforming to Fed. Spec. SS-S-200, Type H.]

#### 3.03 INSTALLATION OF SEALANT

- A. Time of Application: Seal the joints immediately following the final cleaning and placing of the bond breakers, if these are required. Commence sealing the joints when the walls of the concrete joint are dust-free and dry, and when both the atmospheric temperature and pavement temperature within the joint opening are above 40 degrees F and rising. If

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 11

the above conditions cannot be met, or if rains interrupt sealing operations, reclean the open joints prior to installing the sealant.

- B. Sealing the Joints: Do not install joint sealant until the joints to be sealed have been inspected and approved. Install bond breaker just prior to pouring sealant. Fill the joints with sealant from the bottom up until the joints are uniformly filled solid from bottom to top using the specified equipment for the type of sealant required. Fill the joints to [1/4] [3/16] inch below the top of the pavement within the tolerances as shown, and without formation of voids or entrapped air. Except as otherwise permitted, tool the sealant immediately after application to provide firm contact with the joint walls and to form the indicated sealant profile below the pavement surface. Remove excess sealant that has been inadvertently spilled on the pavement surface. [When cold-applied sealants are placed, each day check hourly the proportioning capability of the equipment to determine that the present volume output for each component is being maintained. The material used for these checks may be returned to the proper component reservoir. In no case shall cold-applied sealants be installed using gravity methods and pouring spouts, except for approved hand mixing methods. When a primer is supplied or recommended by the manufacturer of a cold-applied sealant, apply the primer evenly to the joints faces in accordance with the manufacturer's recommendations.] Check the sealed joints frequently to assure that the newly installed sealant is cured to a tack-free condition within 3 hours. The new sealant shall be protected from rain during the curing period.
- C. [Trial Joint Installation: For each type of joint, as a preliminary to the resealing of joints for the entire project, the Contractor shall select a length of not less than 600 feet of joint in an approved location and clean and seal the joint with the specified sealant in the manner proposed for resealing joints for the entire project. Following the sealing of the 600-foot trial length, and before any other joint sealed, the trial joint installation shall be inspected to determine That the sealant and installation meet the requirements specified herein. If it is determined that the cleaning method, material, or installation do not meet the requirements, remove the material and again clean and prepare the joint for resealing. After approval of a 600-foot trial joint, clean and seal all other joint grooves in the same manner and subject to approval.]

## RESEALING OF JOINTS IN RIGID PAVEMENT

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### SECTION 02 0562 - 12

- D. Safety Provisions: In accordance with the provisions of the contract respecting "Accident Prevention," the Contractor shall take appropriate measures to control worker exposure to toxic substances during the work. Provide personnel protective equipment as required. Material Safety Data Sheets (Department of Labor Form OSHA-20 or comparable form) shall be available on the site. [Sandblasting operations shall conform to provisions of Section 01560, Environmental Protection.]

#### 3.04 TRAFFIC CONTROL

During the protection, curing, and maintenance periods recommended by the manufacturer, do not permit vehicular or heavy equipment in the area of the joints. At the end of the curing period, light local traffic may be permitted on the pavement if approved.

**RESEALING OF JOINTS IN RIGID PAVEMENT**

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**SECTION 02 0562 - 13**

3.05 ACCEPTANCE

Joint sealer that fails to bond firmly to the joint walls, or is gummy, or fails in cohesion, or shows excessive air voids, blisters, surface defects, swelling, or deficiencies, or is not properly recessed within the indicated tolerances, shall be rejected. Such unacceptable sealer shall be removed and the joint recleaned and resealed in accordance with the specification. This removal and reseal work shall be done promptly by and at the expense of the Contractor.

END OF SECTION

SECTION 02 0563 – 1

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: 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.

1.1.1 American Concrete Institute (ACI) Publications:

211.1-81 and (R1985)	Selecting Proportions for Normal, Heavyweight, Mass Concrete
301-84	Structural Concrete for Buildings
305R-77 (R1982)	Hot Weather Concreting
306R-78 (R1983)	Cold Weather Concreting

1.1.2 American Society for Testing and Materials (ASTM) Publications:

C 31-85	Making and Curing Concrete Test Specimens in the Field
C 33-86	Concrete Aggregate
C 78-84	Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
C 94-86 (REV. B)	Ready-Mixed Concrete
C 143-78	Slump of Portland Cement Concrete
C 150-85 (REV. A)	Portland Cement
C 171-69	Sheet Materials for Curing Concrete

**PAVEMENT, PORTLAND CEMENT  
CONCRETE, AND REPAIRS**

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**SECTION 02 0563 – 2**

(R1986)

C 172-82	Sampling Freshly Mixed Concrete
C 231-82	Air Content of Freshly Mixed Concrete by the Pressure Method
C 260-86	Air-Entraining Admixtures for Concrete
C 309-81	Liquid Membrane-Forming Compounds for Curing Concrete
C 494-86	Chemical Admixtures for Concrete
C 595-86	Blended Hydraulic Cements
C 618-85	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
D 41-85 and	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D 98-87	Calcium Chloride

**1.2 SUBMITTALS:**

- 1.2.1 Contractor Furnished Mix Design: | Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Furnish a complete list of materials including type, brand, source and amount of cement, fly ash, pozzolan, admixtures, and applicable reference specifications.
- 1.2.2 Laboratory Test Reports: | Submit results of fly ash and pozzolan testing and show that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Obtain approval before concrete placement. An identical concrete mix design previously approved within the past 12 months by the \_\_\_\_\_ Division, Naval Facilities Engineering Command, may be used without

**PAVEMENT, PORTLAND CEMENT  
CONCRETE, AND REPAIRS**

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**SECTION 02 0563 – 3**

further approval, provided that copies of the previous approval and fly ash and pozzolan test results performed within 6 months of submittal date are submitted. Obtain acknowledgment of receipt prior to concrete placement. Submit additional data regarding concrete aggregates, if the source of aggregate changes.

1.2.3 Field Test Reports: | Submit testing results in accordance with ASTM C 31 and as required in paragraph entitled “SAMPLING AND TESTING.”

1.2.4 Certificates of Conformance: |

- a. Aggregates |
- b. Admixtures |
- c. Cement |
- d. Fly ash |
- e. Pozzolan |
- f. \_\_\_\_\_ |

1.2.5 Manufacturer’s Data: |

- a. Materials for curing concrete |
- b. Admixtures |
- c. Bondbreaker |
- d. \_\_\_\_\_ |

1.3 DELIVERY AND STORAGE: ACI 301

**PART 2 - PRODUCTS**

2.1 MATERIALS:

2.1.1 Cement: ASTM C 150, Type I or II [III] [or V] [or ASTM C 595, Type IS, IP, or P].

2.1.2 Water: Fresh, clean, and potable.

2.1.3 Aggregates: Free from any substance which may be deleteriously reactive with the alkalies in the cement.

SECTION 02 0563 – 4

- 2.1.3.1 Fine Aggregates: ASTM C 33.
- 2.1.3.2 Coarse Aggregates: ASTM C 33, Size No [ \_\_\_\_\_ ].
- 2.1.4 Admixtures: Where not shown or specified, the use of admixtures is subject to written approval of the Contracting Officer.
  - 2.1.4.1 Air-Entraining: ASTM C 260.
  - 2.1.4.2 Retarding: ASTM C 494, Type B or D.
  - 2.1.4.3 Accelerating: ASTM D. 98.
  - 2.1.4.4 Water Reducing: ASTM C 494, Type A, D, E, F, or G.
  - 2.1.4.5 Fly ash and Pozzolan: ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Type N and F.
- 2.1.5 Forms: Wood, plywood, steel, or other suitable material.
- 2.1.6 Reinforcement: Provide as specified in Section \_\_\_\_\_, “Joints, Reinforcement, and Mooring Eyes in Concrete Pavement.”
- 2.17 Curing Materials:
  - 2.1.7.1 Impervious Sheeting: ASTM C 171 with a minimum sheet thickness of 10 mils.
  - 2.1.7.2 Liquid Membrane-Forming Compound: ASTM C 309, white pigmented, Type 2, Class B, free of paraffin or petroleum
- 2.1.8 Joint Fillers and Sealants: Provide as specified in Section \_\_\_\_\_, “Joints, Reinforcement, and Mooring Eyes in Concrete Pavements.” [All new joints shall match existing alignment.]
- 2.1.9 Bondbreaker: ASTM D 41.
- 2.2 CONTRACTOR-FURNISHED MIX DESIGN: Design mix in accordance with ACI 211.1. The concrete shall conform to the following:

**PAVEMENT, PORTLAND CEMENT  
CONCRETE, AND REPAIRS**

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**SECTION 02 0563 – 5**

**FLEXURAL STRENGTH, AGGREGATE SIZE, AND SLUMP**

Minimum Flexural Strength 28 Days (psi)  (In.)	Maximum Aggregate Size (inches)	Min. Cement Content lbs./yd <sup>3</sup>	Maximum Water-Cement Ratio (by Weight)	Range in Slump
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[650] [ \_\_\_\_ ] [3/4] [1 1/2] [ \_\_\_\_ ] [517] [ \_\_\_\_ ] [0.50] [ \_\_\_\_ ] [1-3] [ \_\_\_\_ ]

- a. Allowable air content: [4.5 plus or minus 1.5] [5 plus or minus 1.5] percent by volume.
- b. The minimum cement content is required for durable concrete with local aggregates but may be insufficient to obtain the specified strength, in which case, increase the cement content as necessary, without additional compensation under the contract.
- [c. Do not include fly ash content when calculating the cement content.]

**PART 3 - EXECUTION**

**3.1 FORMS:**

- 3.1.1 General: Construct forms to be removable without damaging the concrete. [In lieu of setting forms, the edge of an existing pavement section may be used as a form.]
- 3.1.2 Coating: Before placing the concrete, coat the contact surfaces of forms [except existing pavement sections where bonding is required,] with a non-staining mineral oil, non-staining form coating compound, or two coats of nitro-cellulose lacquer. [When using existing pavement as a form, clean existing concrete and then coat with a bondbreaker before concrete is placed.]
- 3.1.3 Grade and Alignment: Check and correct grade elevations and alignment of the forms immediately before placing the concrete.

**PAVEMENT, PORTLAND CEMENT  
CONCRETE, AND REPAIRS**

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**SECTION 02 0563 – 6**

- 3.2 **REINFORCEMENT:** Provide as specified in Section \_\_\_\_\_, “Joints, Reinforcement, and Mooring Eyes in Concrete Pavement.”
- 3.3 **MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE:**
- 3.3.1 **Measuring:** ASTM C 94.
- 3.3.2 **Mixing:** ASTM C 94, except as modified herein. Begin mixing within 30 minutes after the cement has been added to the aggregates. If the air temperature is greater than 85 degrees F, reduce mixing time and place concrete within 60 minutes. Additional water may be added to bring the slump within required limits as specified in Section 11.7 may be added of ASTM C 94, provided that the specified water-cement ratio is not exceeded.
- 3.3.3 **Transporting:** ACI 301.
- 3.3.4 **Placing:** ACI 301, except as modified herein. Do not exceed a free vertical drop of 3 feet from the point of discharge. [When placing reinforced concrete in two courses, place second course within 30 minutes of striking off first course].
- 3.3.5 **Vibration:** Immediately after spreading concrete, consolidate the concrete adjacent to forms and joints regardless of slab thickness, and concrete slabs 6 inches or more in thickness using internal vibrating equipment. [For reinforced pavements laid in tow courses, vibrate only the top course. Vibrate concrete for full depth adjacent to edge forms and joints.] Limit the duration of vibration to that necessary to produce consolidation of the concrete. Excessive vibration will not be permitted. Vibrators shall not be operated in the concrete at one location for more than 15 seconds. At the option on the Contractor, vibrating equipment of a type approved by the Contracting Officer may be used to compact the concrete in unreinforced pavement slabs less than 6 inches thick.
- 3.3.5.1 **Vibrating Equipment:** Operate equipment, except hand-manipulated equipment, ahead of the finishing machine. Select the number of vibrating

**PAVEMENT, PORTLAND CEMENT  
CONCRETE, AND REPAIRS**

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**SECTION 02 0563 – 7**

units and power of each unit to properly consolidate the concrete. Mount the units on a frame that is capable of vertical movement and, when necessary, radial movement, so the vibrators may be operated at any desired depth within the slab or be completely withdrawn from the concrete. The clear distance between frame-mounted vibrating units that have spuds that extend into the slab at interval across the paving lane shall not exceed 30 inches. The distance between the end of the vibrating tube and the side form shall not exceed 2 inches. For pavements less than 10 inches thick, operate the vibrators at mid-depth parallel with or at a slight angle to the subbase. For thicker pavements, angle the vibrators toward the vertical, with the vibrator tip preferably about 2 inches from the subbase, and the top of the vibrator a few inches below the pavement surface. The vibrators may be pneumatic, gas driven, or the electric type, and shall be operated at frequencies within the concrete of not less than 8,000 vibrations per minute. The amplitude of vibration shall be such that noticeable vibrations occur at 1.5-foot radius when the vibrator is inserted in the concrete to the depth specified.

- 3.3.6 Cold weather: Except with authorization, do not place concrete when the ambient temperature is below 40 degrees F or when the concrete is likely to be subjected to freezing temperatures within 24 hours. When authorized, if concrete is likely to be subjected to freezing within 24 hours after placing, heat concrete materials so that the temperature of the concrete when deposited is between 65 and 80 degrees F. Methods of heating materials are subject to approval of the Contracting Officer. Do not heat mixing water above 165 degrees F. Remove lumps frozen material and ice from the aggregates before placing aggregates in the mixer. When specifically approved by the Contracting Officer, the Contractor may add not more than 2 percent dihydrate calcium chloride by weight of cement. Dissolve the admixture in a portion of the mixing water and add to the mix at the drum in a manner that will ensure uniform distribution of the agent throughout the batch. Recommended practices may be found in ACI 306.
- 3.3.7 Hot weather: Maintain required concrete temperature in accordance with Figure 2.1.5 in ACI 305 to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. After

SECTION 02 0563 – 8

placement, use fog spray, spread and remove polyethylene sheeting between finishing operations, apply monomolecular film, or use other suitable means to reduce the evaporation rate. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Cool underlying material by sprinkling lightly with water before placing concrete. Recommended practices may be found in ACI 305.

3.4 FINISHING CONCRETE:

- 3.4.1 General Requirements: Start finishing operations immediately after placement of concrete. Use finishing machine, except hand finishing may be used in emergencies and for concrete slabs in inaccessible locations or of such shapes or sized that machine finishing is impracticable. Finish the surface of the pavement on both sides of a joint to the same grade. Finish formed joints from a securely supported transverse bridge. Provide hand finishing equipment for use at all times. Transverse and longitudinal surface tolerances shall be 1/4 inch in 10 feet.
- 3.4.2 Side Form Finishing: Strike off and screed the concrete to the required crown and cross-section by a power-driven transverse finishing machine. Transverse rotating tube or pipe shall not be permitted unless approved by the Contracting Officer. The elevation of the concrete shall be such that, when consolidated and finished, the surface of the pavement will be adequately consolidated and at the required grade. Equip the finishing machine with two screeds which are readily and accurately adjustable for changes in pavement crown and compensation for wear and other causes. Make as many passes over each area of pavement and at such intervals as necessary to give the proper compaction, retention of the coarse aggregate near the finished surface, and a surface of uniform texture, true to grade and crown. Do not permit excessive operation over an area, which will result in an excess of mortar and water being brought to the surface.
- 3.4.2.1 Equipment Operation: Maintain the travel machine on the forms without lifting, wobbling, or other variation of the machine which tend to affect the precision of concrete finish. Keep the tops of the forms clean by a device attached to the machine. During the first pass of the finishing machine, maintain a uniform ridge of concrete ahead of the front screed for its entire length.

SECTION 02 0563 – 9

3.4.2.2 Joint Finish: Before the concrete is hardened, correct any edge slump of the pavement, exclusive of edge rounding, in excess of 0.02 foot. Finish the concrete surface on each side of the construction joints to the same plane, and correct all deviations before the newly placed concrete has hardened.

3.4.2.3 Hand Finishing: Strike-off and screed the surface of the concrete to elevations slightly above finish grade so that when the concrete is consolidated and finished the surface of the pavement is at the indicated elevation. Vibrate the entire surface until the required compaction and reduction of surface voids is secured with a strike-off template.

3.4.2.4 Longitudinal Floating: After the initial finishing, further smooth and consolidate the concrete by means of hand-operated longitudinal floats. Use floats that are not less than 12 feet long and 6 inches wide and stiffened to prevent flexing and warping.

3.4.3 Surface Finish: [Surface finish of new pavement shall match existing.]

3.4.3.1 Plastic Grooving: After surface irregularities have been removed, give the concrete surface a uniformly roughened finish by use of a wire comb or other approved texturing device similar to a wire comb. Prior to plastic grooving, make one pass with burlap drag in the longitudinal direction. Complete the grooving while the concrete surface is in such condition that it will not be torn or unduly roughened, and before the surface has obtained its initial set. Texture small or irregular areas, or areas not suitable for machine texturing, with a hand operated device producing a textured surface equivalent to that required for machine combing.

**\*\*OR\*\***

3.4.3.1 Burlap Drag Finish: Before the concrete becomes non-plastic, finish the surface of the slab by dragging on the surface a strip of clean, wet burlap measuring from 3 to 10 feet long and 2 feet wider than the width of the pavement. Select the dimension of the burlap drag so that at least 3 feet of the material is in contact with the pavement. Drag the surface so as to produce a finished surface with a fine granular or sandy texture without leaving disfiguring marks.

**PAVEMENT, PORTLAND CEMENT  
CONCRETE, AND REPAIRS**

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**SECTION 02 0563 – 10**

**\*\*OR\*\***

- 3.4.3.1 Brooming: Finish the surface of the slab by brooming the surface with a new wire broom at least 18 inches wide. Gently pull the broom over the surface of the pavement from edge to edge just before the concrete becomes non-plastic. Slightly overlap the adjacent strokes of the broom. Broom perpendicular to the centerline of the pavement so that the corrugations produced will be uniform in character and width, and not more than 1/16 inch in depth. The broomed surface shall be free from porous spots, irregularities, depressions, and small pockets or rough spots such as may be caused by accidentally disturbing particles of coarse aggregate embedded near the surface.
- 3.4.4 Edging: At the time the concrete has attained a degree of hardness suitable for edging, carefully finish all slab edges, including the edges at formed joints, with an edge having a maximum radius of one-eighth inch. [If brooming is specified for the final surface finish, edge all transverse joints before starting the brooming, then operate the broom to obliterate as much as possible the mark left by the edging tool without disturbing the rounded corner left by the edger.] Clean by removing all loose fragments and soupy mortar from corners or edges of slabs which have crumbled and areas which lack sufficient mortar for proper finishing. Refill the voids solidly with a mixture of suitable proportions and consistency and refinish. Remove all unnecessary tool marks and edges. All remaining edges shall be smooth and true to line.
- 3.4.5 Repair of Surface Defects: ACI 301.
- 3.5 CURING AND PROTECTION:
- 3.5.1 General Requirements: Protect concrete adequately from injurious action by sun, rain, flowing water, [frost,] mechanical injury, tire marks and oil stains, and do not allow it to dry out from the time it is placed until the expiration of the minimum curing periods specified herein. Use impervious-sheeting curing, or liquid membrane-forming compound, except as specified otherwise herein. Do not use membrane-forming compound on surfaces where its appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. Maintain

SECTION 02 0563 – 11

the temperature of the air next to the concrete above 40 degrees F for the full curing periods.

- 3.5.2 Impervious-Sheeting Curing: Wet the entire exposed surface thoroughly with a fine spray of water and then cover with impervious sheeting. Lay sheets directly on the concrete surface and overlap 12 inches. Make sheeting not less than 18 inches wider than the concrete surface to be cured, and weight down on the edges and over the transverse laps to form closed joints. Repair or replace sheets if torn or otherwise damaged during curing. Leave the sheeting on the concrete surface to be cured for at least 7 days.
- 3.5.3 Liquid Membrane-Forming Compound Curing: Seal or cover all joint openings prior to application of the curing compound to prevent the curing compound from entering the joint. Compound shall remain on the concrete for 7 days before sealer or covering is removed and joint sealing material is placed in the joints.
  - 3.5.3.1 Application: Apply the compound immediately after the surface loses its water sheen and has a dull appearance and before joints are sawed. Agitate curing compound thoroughly by mechanical means during use and apply uniformly in a two-coat continuous operation by suitable power-spraying equipment. The total coverage for the two coats shall be at least one gallon of undiluted compound per 200 square feet. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. Apply an additional coat of the compound immediately to areas where the film is defective. Respray concrete surfaces that are subject to heavy rainfall within 3 hours after the curing compound has been applied in the same manner.
  - 3.5.3.2 Protection of Treated Surfaces: Keep concrete surfaces to which liquid membrane-forming compounds have been applied free from vehicular traffic and other sources of abrasion for not less than 72 hours. Foot traffic is allowed after 24 hours for inspection purposes. Maintain continuity of the coating for the entire curing period and repair damage to the coating immediately.
- 3.6 SAMPLING AND TESTING:

SECTION 02 0563 – 12

3.6.1 Sampling: Collect samples of fresh concrete in accordance with ASTM C 172 during each working day as required to perform all tests specified herein. Make test specimens in accordance with ASTM C 31.

3.6.2 Testing:

3.6.2.1 Consistency Tests: Determine slump in accordance with ASTM C 143. Take samples for slump determination from the concrete while it is being placed. Perform tests at the beginning of a concrete placement operation and at subsequent intervals to ensure that the specification requirements are met. In addition, perform tests each time test beams cylinders are made.

3.6.2.2 Flexural Tests: Determine flexural strength in accordance with ASTM C 78. Make four test specimens for each set of tests. Test two specimens at 7 days, and the other two at 28 days. The strength of the concrete will be considered satisfactory if the average of the 28-day test results equals or exceeds the specified 28-day flexural strength, and no individual strength test is less than [550] [ \_\_\_\_ ] pounds per square inch. Frequency of flexural tests on concrete beams shall not be less than four test beams for each 50 cubic yards or concrete, or fraction thereof, placed. Concrete which is determined to be defective, based on the strength acceptance criteria therein, shall be removed and replaced with acceptable concrete.

3.6.2.3 Air Content: Test air-entrained concrete for air content at the same frequency as specified for slump tests. Determine percentage of air in accordance with ASTM C 231 on samples taken during placing of the concrete in the forms.

END OF SECTION

## PAVEMENT REPAIR AND RESTORATION

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### SECTION 02 0575 - 1

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

- A. Furnish all labor, materials equipment and incidentals required and remove and replace pavements over trenches excavated for installation of water lines as shown on the Drawings and/or specified herein.

##### 1.02 RELATED WORK

- A. Earth excavation and backfill, Section 02221.
- B. Crushed stone is included under Section 02221.

##### 1.03 GENERAL

- A. All damage, as a result of work under this project, done to existing structures, pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipe lines, conduits, drains, catch basins, flagstones, rocked, graveled or stabilized areas or driveways and including all obstructions not specifically named herein, shall be repaired in a manner to restore the surface to its original condition. The scope of work shall include the furnishing of all labor, materials, equipment and incidentals necessary for the cutting, repair and restoration of the damaged areas.
- B. The Contractor shall keep the surface of the backfilled area of excavation in a safe condition and level with the pavement restored in the manner specified herein. The last 10 inches of the backfill shall be compacted crusher-run gravel to provide a temporary finished surface until the pavement is replaced. All surface irregularities that are dangerous or obstructive to traffic are to be removed.

**PAVEMENT REPAIR AND RESTORATION**

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**SECTION 02 0575 - 2**

- C. All materials and workmanship shall be first class and nothing herein shall be construed as to relieve the Contractor from this responsibility. The Owner reserves the right to require soil bearing or loading tests or materials tests, should the adequacy of the foundation or the quality of materials used be questionable. Costs of these tests shall be borne by the Owner.
- D. All street, road, driveway and highway repair shall be made in accordance with the details indicated on the Drawings.
- E. No permanent pavement shall be placed over a backfilled trench within 90 days after completion of the backfilling, unless permitted to do so in writing by the Owner's Representative.

**PART 2 - PRODUCTS**

**2.01 ASPHALT PAVEMENT SURFACE**

The material shall be Type E, Bituminous Concrete

**2.02 CONCRETE PAVEMENT SURFACE**

The material shall be a 4,000 psi strength mix design.

**2.03 TEMPORARY PAVEMENT**

- A. The material shall be Type B, Bituminous Concrete. Temporary pavement shall be maintained until replaced by permanent pavement.
- B. If points of settlement or holes appear in the temporary pavement, the Contractor shall repair the same within three days of notification by the Owner. Where permanent pavement is to be installed, the Contractor shall remove the temporary pavement and regrade the subbase for installation of permanent pavement.

## PAVEMENT REPAIR AND RESTORATION

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### SECTION 02 0575 - 3

#### PART 3 - EXECUTION

##### 3.01 CUTTING PAVEMENT

- A. The Contractor shall cut and remove pavement as necessary for installing the new pipe lines and appurtenances and for making connections to existing pipe lines.
- B. Before removing pavement, the pavement shall be marked for cuts nearly paralleling pipe lines and existing street lines. Asphalt pavements shall be cut 4 inches deep, along the markings with a jackhammer, rotary saw. Concrete pavement and asphalt pavement on concrete base, shall be scored to a depth of approximately two (2) inches below the surface of the concrete along the marked cuts. Scoring shall be done by use of a rotary saw, after which the pavement may be broken below the scoring with a jackhammer or other suitable equipment.
- C. No pavement shall be machine pulled until completely broken and separated along the marked cuts.
- D. The pavement adjacent to pipe line trenches shall neither be disturbed nor damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, the Contractor shall remove the damaged pavement and shall replace it at his own expense.

##### 3.02 PAVEMENT REPAIR AND REPLACEMENT

- A. All existing pavement cut or damaged by construction under this contract shall be repaired to match the original surface material and original grade unless otherwise specified or shown on the Drawings.
- B. The repair shall include the preparation of the subgrade, the placing and compacting of the base course, the priming of the base, the placing and maintaining of the surface treatment and any special requirements, all as specified herein. All base course to receive an asphaltic concrete surface

## PAVEMENT REPAIR AND RESTORATION

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### SECTION 02 0575 - 4

shall be finished 2 inches compacted thickness of asphaltic concrete. Stabilized roads and drives shall be finished to match the grade of the existing pavement. Dirt roads and drives shall have the final two inches of the backfill material up to the finished surface as crushed stone.

- C. Wherever the water line is run parallel to and within the limits of a paved street under this Contract, the entire width of such street shall be reconstructed and surfaced in accordance with these Specifications. The base shall be 2 feet wider than the street surface, one foot on each side of the surface edge.
- D. The width of all repairs shall extend at least 12 inches beyond the excavation or limits of any damaged section. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

#### 3.03 MISCELLANEOUS RESTORATION

- A. Trenches cut across sidewalks shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb or curb gutter shall be restored to the existing height and cross section in full sections or lengths between joints. Concrete shall be as specified in Division 3. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass of a type matching the existing grass.

#### 3.04 SPECIAL REQUIREMENTS

- A. The restoration of all surfaces, as described herein, disturbed by the installation or repair to underground facilities shall be completed as soon as is reasonable and practical. In no case shall the surface go unfinished for more than five (5) calendar days after backfilling.

**PAVEMENT REPAIR AND RESTORATION**

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**SECTION 02 0575 - 5**

3.05 CLEAN-UP

- A. After all repair and restoration or paving has been completed, all excess asphalt, dirt, rock and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

3.06 MAINTENANCE

- A. All wearing surfaces shall be maintained by the Contractor in good order and be suitable for traffic at all times for a period of one year after completion and acceptance of the work. Approximately at the end of the maintenance period a final inspection will be made of the repaired surface and any settlement or depression shall be adjusted as previously noted herein.

END OF SECTION

**VALVES AND APPURTENANCES  
FOR SITE UTILITIES**

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**SECTION 02 0605 - 1**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment and incidentals and install complete and ready for operation all valves and appurtenances as shown on the drawings and as specified herein.
- B. The equipment shall include, but not be limited to, the following:
  - 1. Gate valves
  - 2. Post indicator

**1.02 RELATED WORK**

Section 02221: Excavation, Backfill, Fill and Grading for pipe.

**1.03 QUALIFICATION**

- A. All of the types of valves and appurtenances shall be the products of firms fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

**1.05 SUBMITTALS**

- A. Submit within thirty (30) days after execution of the contract a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.
- B. Complete shop drawings of all valves and appurtenances shall be submitted for review.

**1.06 TOOLS**

- A. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

**VALVES AND APPURTENANCES  
FOR SITE UTILITIES**

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**SECTION 02 0605 - 2**

**PART 2 - PRODUCTS**

**2.01 MATERIALS AND EQUIPMENT**

**A. General:**

1. All valves and appurtenances shall be of the same size shown on the drawings and as far as possible all equipment of the same type shall be from one manufacturer.
2. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

**B. Gate Valves and Appurtenances:**

1. Gate valves for water shall meet the requirements of AWWA C509. Valve shall be rated for 150 psi working pressure and a minimum 300 psi test pressure. Valves shall be iron body, bronze-mounted, double disc, parallel seat, non-rising stem type fitted with "O-Ring" seals. The operating nuts shall be 2" square. All valves shall open left, or counterclockwise. Stuffing boxed shall be the "O-Ring" type. Gate valves shall be mechanical joint, ANSI Standard 21.11 except where shown otherwise. Flange joint shall be ANSI B16.1 standard. Bell joint shall be AWWA Class 150.
2. All buried valves shall have cast iron three piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and to extend to such elevation at or slightly above the finished grade. The barrel shall be two-piece, sliding type, having 5-1/4" shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling.

- C.** Where shown on the drawings Post Indicators for the gate valves shall be M & H Floor Stand Style, as manufactured by Clow Coperation, Eddy-Iowa Division or approved equal.

**VALVES AND APPURTENANCES  
FOR SITE UTILITIES**

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**SECTION 02 0605 - 3**

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired before they are installed.
- B. After insulation, all valves and appurtenances shall be tested at least 1 hour at the working pressure corresponding the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired.
- C. Buried flanged or mechanical joints shall be made with cadmium plated bolts. All exposed bolts shall be made with cadmium plated bolts. All exposed bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.
- D. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, metal-to-metal, without excessive bolt tension.
- E. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8". Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6" from the end, and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares.

**VALVES AND APPURTENANCES  
FOR SITE UTILITIES**

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**SECTION 02 0605 - 4**

After the bolts have been inserted and all nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferable by use of a torque wrench of the appropriate size and torque for the bolts.

- F. Castings shall be of good quality, strong, tough, even grained, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field. All finished surfaces shown on the drawings and/or specified shall be machined to a true plane surface and shall be true and seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified or shown shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95% of the theoretical weight computed from the dimensions shown. Provide facilities for weighing castings showing true weights, certified by the supplier.
- G. All steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bituminous trowelling mastic applied in accordance with the manufacturer's instructions prior to installation.

**3.02 SHOP PAINTING**

Paint used for coating valves shall comply with the following Fed. Spec. TT-V-51, TT-C-494a, AWWA C-550. The asphalt varnish shall be applied to the ferrous parts of the valves except for finished or seating surfaces. Surfaces shall be clean and dry before painting. Two coats shall be applied to both the inside and outside ferrous metals. A coating conforming to AWWA C-550 may be used on the interior and/or exterior ferrous surfaces.

**VALVES AND APPURTENANCES  
FOR SITE UTILITIES**

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**SECTION 02 0605 - 5**

3.03 INSPECTION AND TESTING

Completed pipe shall be subjected to hydrostatic pressure test for 12 hours at full working pressure. All leaks shall be repaired and lines re-tested. Prior to testing, the gravity pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall supply all labor, equipment, materials and incidentals necessary to install and disinfect all piping and appurtenances located outside the buildings and structures and test as specified herein.
- B. Yard piping shall begin five (5) feet outside face of structures and buildings.
- C. Yard piping shall not include piping below structures.
- D. Furnish all concrete thrust blocks. Also all excavation, backfilling, sheeting, slope protection, drainage, concrete work, rip rap, grading and all other work necessary to complete the construction, installation and testing of the piping.
- E. The water distribution system shall comply with NFPA 24 and shall have the approval of Factory Mutual and local authorities.

1.02 RELATED WORK

- A. Section 02221: Excavation, Backfill, Fill and Grading for Pipe.
- B. Section 02605: Valves and Appurtenances for Site Utilities.

1.03 SUBMITTALS

- A. Submit shop drawings showing a complete laying plan of all pipe, including all fittings, adapters, valves and specials along with the manufacturer's drawings and specifications indicating complete details of all items. The above shall be submitted for approval before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated in the drawings. In most cases, a certain amount of flexibility in positioning of pipes will be allowed, especially where new pipes will connect to existing structures or piping.
- B. Test certificates in accordance with Section 51-13 of AWWA C151 shall be furnished prior to shipment of valves to the job site.

1.04 INSPECTION

All pipe and fittings to be installed under this Contract may be inspected at the site of manufacture for compliance with these Specifications by an independent laboratory selected by the Owner.

1.05 APPROVAL OF MATERIALS

Submit to the Engineer for approval, within thirty (30) days after the Notice to Proceed, a listing, including materials to be furnished, the name of the suppliers, the date of delivery of materials to the job site, and a time schedule for the completion of the project.

1.06 QUALITY ASSURANCE

It is the Contractor's responsibility that all pipe units and all component parts of the line are manufactured and installed such that the maximum infiltration/exfiltration limit will not be exceeded, as determined by AWWA C600-87.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Ductile iron pipe for yard piping shall meet the following requirements:
1. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51-91. A minimum of Class 52 pipe shall be supplied for all sizes of pipe unless specifically called out in the drawings. Thickness of pipe to be supplied shall be one (1) class greater than that required under Table 51.1 AWWA C151 (ANSI 21.51). Type 1 Bedding Conditions shall be used for all diameters.
  2. The pipe shall be supplied in length not in excess of 20 feet. Pipe shall be either the rubber-ring type push-on joints, standard mechanical joint pipe or restrained joint where required. Ball joint pipe and flange joint pipe shall be used where shown on the drawings. Pipe shall be as manufactured by the American Ductile Iron Pipe Company, U.S. Pipe and Foundry Company, Clow Corporation, or McWayne Pipe Foundry.

SECTION 02 0615 - 3

- B. All ductile iron pipe fittings for yard piping shall be cast iron or ductile iron with a minimum pressure rating of 150 psi. Fittings shall meet the requirements of ANSI, NEWWA, and AWWA specifications as applicable. Rubber gasket joints shall conform to ANSI A21.11 for mechanical and push-on type joints. Ball joints shall conform to ANSI A21.51, with a separately cast ductile iron bell conforming to ASTM A536, Grade 70-5-05, and a cast steel retainer ring conforming to ASTM A148, Grade 90-60. Flanged fittings shall be furnished faced and drilled to 125 pounds template and conform to ANSI B16.1. All pipe and fittings shall have a cement mortar lining and bituminous seal coat on the inside and a coal tar enamel coat on the outside in accordance with ANSI A21.51 except that cement mortar lining shall be not less than 1/8" in thickness for pipe 2" to 12" in diameter, 3/16" for 14" to 24" diameter pipe and 1/4" for 30" to 54" pipe with a plus tolerance of 1/8".

PART 3 - EXECUTION

3.01 HANDLING PIPE AND FITTINGS

- A. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe for fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired.
- B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being laid or installed.
- C. If any defective pipe is discovered after it has been laid it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

3.02 DUCTILE IRON PIPE

- A. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm, even bearing throughout the length of the pipe

SECTION 02 0615 - 4

shall be constructed by tamping selected material at the sides of the pipe up to the springline. **BLOCKING WILL NOT BE PERMITTED.**

- B. All pipe shall be sound and clean before laying. When laying is not in progress, including lunch time, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench.
- C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a Tyton bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.
- D. Jointing Ductile-Iron Pipe:
  - 1. Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.
  - 2. Mechanical joints at valves, fittings and where designated on the drawings and/or as specified shall be in accordance with the "Notes On Method of Installation" under ANSI Specification A21.11 and the instructions of the manufacturer. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no condition shall extension wrenches or pipe over handle or ordinary ratchet wrench be used to secure greater leverage.
- E. Ball joints, where designated on the Drawings and/or as specified, shall be installed in strict accordance with the manufacturer's instructions. Where

SECTION 02 0615 - 5

ball joint assemblies occur at the fact of structures or tanks, the socket end shall be at the structure or tank and the ball end assembled to the socket.

- F. All valves, hydrants, fittings and other appurtenances needed upon the pipe lines shall be set and jointed as indicated on the Drawings or as required by the manufacturer.

3.03 HYDRANTS

- A. Hydrants shall be set plumb on firm material, shall be well braced and anchored by depositing concrete between the hydrant and undisturbed material at the end of the trench as shown on the drawings, or it shall be tied to the pipe with suitable rods or clamps, galvanized, painted or otherwise rustproof treated.
- B. A drainage pit shall be excavated below each hydrant as shown on the drawings and filled with free draining granular fill under and around the bowl of the hydrant and to a level of 6" above drain openings.

3.04 VALVES AND VALVE BOXES

Valves and valve boxes shall be installed as shown on the drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe.

3.05 THRUST BLOCKS

- A. Longitudinal thrust along pipe lines of bends, tees, reducers, and caps or plugs shall be counteracted by thrust blocking, as shown on the drawings. Where the bends are in a vertical plane, the thrust shall be counteracted by enough weight of concrete to counterbalance the vertical thrust forces. Where undisturbed trench walls are not available for thrust blocking, the Contractor shall furnish and install suitable pipe harnesses or ties designed and manufactured specifically for this purpose.
- B. Joints shall be protected by felt roofing paper prior to placing concrete.

SECTION 02 0615 - 6

- C. Bearing area of thrust blocks shall be adequate to prevent any movement of the fitting and shall be of the size and dimensions as shown on the drawings.
- D. Concrete for thrust blocking shall be no leaner than 1 part cement, 1-1/2 parts sand and 5-1/2 parts stone. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.
- E. In lieu of thrust blocking and with prior approval, pipe harnesses and/or ties or restrained push-on or restrained mechanical joints may be used.

3.06 TESTING

- A. Furnish all necessary equipment and labor for carrying out a pressure test and leakage test on the pipelines.
- B. Make any traps and furnish all necessary caps, plugs, etc., as required in conjunction with testing a portion of the pipe between valves. Also, furnish a test pump, gauges, and any other equipment required with carrying out the hydrostatic tests.
- C. Domestic water pipelines shall be subjected to a hydrostatic pressure of 50% above the normal working pressure of 150 psi and this pressure maintained for at least 30 minutes. The leakage test shall be conducted at the maximum operating pressure of 150 psi, and this pressure shall be maintained for at least 30 minutes during this test. The amount of leakage which will be permitted shall be in accordance with the Specifications for Installation of Water Mains, AWWA C600.

END OF SECTION

**POLYVINYL CHLORIDE PIPE  
AND FITTINGS FOR FORCE  
MAIN SANITARY SYSTEMS**

---

**SECTION 02 0620 - 1**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

Furnish all labor, materials, equipment and incidentals required and install in the locations as shown on the Drawings,, the plastic piping, fittings and appurtenances an specified herein.

**1.02 RELATED WORK**

A. Excavation, backfill, fill and grading for pipe: Section 02221.

**1.03 DESCRIPTION OF SYSTEM**

A. Plastic pipe shall be used for the following services;

1. Industrial Waste/Sanitary Sewer System

B. Piping shall be installed in the locations as shown on the Drawings.

**1.04 QUALIFICATIONS**

All plastic pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

**1.05 SUBMITTALS**

A. Shop Drawings shall be submitted to the Engineer for approval in accordance with the General Conditions and shall include dimensioning and technical specification for all piping to be furnished.

**1.06 TOOLS**

Special tools, solvents, lubricants, and caulking compounds required for normal installation shall be furnished with the pipe.

**POLYVINYL CHLORIDE PIPE  
AND FITTINGS FOR FORCE  
MAIN SANITARY SYSTEMS**

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**SECTION 02 0620 - 2**

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Plastic pipe shall be rigid, unplasticized, polyvinyl chloride (PVC) pipe and shall be in accordance with ASTM D-1784 and ASTM D-1785, Class PVC 1120 and as manufactured by Celanese Piping Systems, Chemtrol Division; Cabot Company; or equal.
- B. The pipe shall be suitable for field cutting, welding, bending and coupling and shall be Schedule 80 unless otherwise shown on the Drawings and of the sizes as shown on the Drawings.
- C. All pipe shall be bundled or packaged in such a manner as to provide adequate protection for the ends, threaded, or flanged, during transportation from the manufacturer.
- D. Fittings shall be the socket type for solvent welded joints as designated in ASTM D-2467 or D-2466, except where threaded as shown on the Drawings, and as designated in ASTM D-2464 or flanged as shown on the Drawings and shall be compatible with the pipe where installed. Flanges shall be furnished with 1/8-in. thick full-faced gaskets. Flange bolts and nuts shall be ASTM A276, Type 304 or 316 stainless steel.
- E. Plastic tubing shall be clear, flexible, non-cracking with a wall thickness that is adequate for the pressures involved and of the sizes as shown on the Drawings.
- F. Caulking for plastic pipe in wall sleeve shall be by a mechanical, modular, rubber sealing element placed in between the sleeve and pipe and expanded to make a tight fit or other method approved by the Engineer.
- G. Expansion joints shall have integral duck and rubber flanges. They shall have individual solid steel ring reinforcement with a carcass of highest grade woven cotton or acceptable synthetic fiber. Joints shall be constructed of pipeline size and to meet working pressure and corrosive

**POLYVINYL CHLORIDE PIPE  
AND FITTINGS FOR FORCE  
MAIN SANITARY SYSTEMS**

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**SECTION 02 0620 - 3**

conditions similar to the line where installed. They shall be of a filled arch-type construction with a minimum of three arches per joint. All joints must be finish-coated with Hypalon paint to prevent ozone attack. They shall be Style 500 as manufactured by Mercer Rubber Co. of Trenton, New Jersey, or approved equal.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. The installation of plastic pipe shall be strictly in accordance with the manufacturer's technical data and printed instructions.
- B. Joints for plastic pipe shall be solvent welded except flanged or threaded where required. In making solvent welded connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth, if necessary, and apply solvent cement of the proper grade. Expansion joints shall be installed every 50 ft on long runs and in every straight run longer than 15 ft.
- C. Installation of valves and fittings shall be strictly in accordance with manufacturer's instructions. Particular care shall be taken not to over-stress threaded connections at sleeves. In making solvent weld connections, the solvent shall not be spilled on valves or allowed to run from joints.
- D. All piping shall have a sufficient number of unions to allow convenient removal of piping and shall be as approved by the Engineer.
- E. Where plastic pipe passes through wall sleeves, joints shall be sealed with a mechanical sealing element as specified in Section 15100.
- F. All plastic pipe to metal pipe connection shall be made using flanged connections. Metal piping shall not be threaded into plastic fittings, valves, or couplings, nor shall plastic piping be threaded into metal valves, fittings or couplings.

**POLYVINYL CHLORIDE PIPE  
AND FITTINGS FOR FORCE  
MAIN SANITARY SYSTEMS**

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**SECTION 02 0620 - 4**

- G. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and the Contractor shall verify their locations from approved piping layout Drawings and the structural Drawings. Pipe hangers and supports are specified in Section 15094.

3.02 INSPECTION AND TESTING

- A. All pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipelines shall be subjected to a hydrostatic pressure test for 12 hours at full working pressure. All leaks shall be repaired and lines re-tested as approved by the Engineer. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

**PVC GRAVITY SEWER PIPE**

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**SECTION 02 0622 - 1**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. Furnish, install, make the joints, and test PVC gravity sewer pipe and appurtenances as shown on the drawings and as required by these Specifications.

**1.02 RELATED WORK**

- A. Excavation, Backfill, Fill, and Grading; Section 02221.
- B. Precast Concrete Manholes, Frames and Covers; Section 02720.

**1.03 QUALITY CONTROL**

- A. Sanitary sewer piping shall be PVC pipe unless otherwise noted on the drawings.

**1.04 SHOP DRAWINGS**

- A. Submit for review completely detailed working drawings and schedules of all PVC pipe and fittings required.
- B. Exfiltration and/or infiltration testing method.

**PART 2 - PRODUCT**

**2.01 PVC GRAVITY SEWER PIPE**

- A. PVC pipe and fittings shall be solid wall PVC gravity sewer pipe conforming to ASTM D 3034, SDR 26 in sizes 4-inch through 15-inch and ASTM D 2241 for 18-inch. All pipe shall be thoroughly inspected by the Engineer upon delivery, and the pipe that does not conform to the above requirements will be rejected and shall be removed immediately from the site of the work by the Contractor. The Owner's representative will apply all standard tests of the pipe necessary to assure conformity with the specifications. All such tests shall be made in accordance with the

## PVC GRAVITY SEWER PIPE

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### SECTION 02 0622 - 2

methods prescribed by, and the acceptance or rejection of PVC pipe shall be based upon the ASTM Standard Specifications referred to above.

- B. Pipe which is out of round, or defective otherwise will be rejected even though it meets the strength requirements of the specifications. Rejected pipe shall be removed from the site at once.
- C. Attention is called to the proper method of stacking integral bell gasketed joint pipe. To avoid stress in the bell end of the pipe due to a pipe resting thereon, the pipes shall be stacked with bell ends projecting from the stack in opposite directions for alternate rows. The bottom row of pipe shall be supported free of the ground.

#### 2.02 PVC FITTINGS

- A. PVC gravity sewer fittings shall meet the requirements of ASTM D 3034 Type PSM Poly (Vinyl-Chloride) (PVC) Sewer Pipe and Fittings for sizes 4-inch through 15-inch, and ASTM F679 Poly (Vinyl-Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings in sizes 18-inch and larger.
- B. All pipe and fittings shall have integral bell gasketed joints especially engineered for gravity sewer mains and laterals. Rubber gaskets shall be factory installed in a precision formed recessed groove.
- C. Laying instructions of the manufacturer of the pipe and joint shall be followed explicitly. Examine each bell and spigot end to determine whether the preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected.

### PART 3 - EXECUTION

#### 3.01 LAYING PVC PIPE

- A. Gravity sewer lines shall be laid according to the details shown on the drawing or specified herein, and according to the applicable portions of ASTM Designation C12, Installing PVC Gravity Sewer Pipe. The type bedding to be used shall be as shown on the drawings, specified herein, or as directed in writing.

**PVC GRAVITY SEWER PIPE**

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**SECTION 02 0622 - 3**

- B. The trench bottom shall be graded to the proposed elevation of the pipeline and the bottom shaped to fit the lower quadrant of the pipe. Holes shall be excavated at each bell so that pipe is supported along the barrel only. Pipe bedding shall be described in Section 02221.
- C. The storage of pipe on the job site shall be done in accordance with pipe manufacturer's recommendations and with the approval of the Engineer. Pipe shall be protected during handling against impact shocks and free fall. Pipe laying shall not precede backfilling by more than 100 feet.
- D. The laying of the pipe in finished trenches shall be commenced at the lowest point, with the spigot ends pointing in the direction of flow. The interior of the pipe and the jointing seal shall be free from sand, dirt, and trash before installing in the line. Extreme care must be taken to keep the bells of the pipe free from dirt and rocks so joints may be properly assembled without overstressing the bells. The jointing of the pipe shall be done in strict accordance with the pipe manufacturer's instructions and shall be done entirely in the trench.
- E. Each time the work on the sewer is halted for more than one (1) hour, the ends of the pipe shall be sealed to prevent foreign material from entering the pipe.

**3.02 Y-BRANCHES**

- A. PVC Y-branches shall be manufactured with watertight preformed joints suitable for use with PVC gravity sewer pipe. Each Y-branch shall be provided with a PVC plug. The Y-branches shall be installed as detailed on the plans at locations to be indicated by the Engineer in the field.
- B. The manhole drops where indicated on the plans shall be constructed of ductile iron pipe and fittings as detailed on the plans and encased in concrete.
- C. Stubs for future pipe connections shall be installed from the main to the property line (right-of-way) at locations as shown on the drawings. Stubs shall be PVC gravity sewer pipe with a PVC plug.

**PVC GRAVITY SEWER PIPE**

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**SECTION 02 0622 - 4**

**3.03 TESTING AND CLEANING**

- A. Leakage tests by exfiltration or infiltration, as described below, will be made on all PVC gravity sewer pipe. The Engineer shall have the option of determining which test shall be employed. Generally, if the groundwater table is above the top of the pipe, an infiltration test shall be used. If the groundwater table is below the top of the pipe an exfiltration test shall be used.
- B. Exfiltration tests will be made on the pipe before or after backfilling at the discretion of the Engineer. The length of the sewer to be tested shall be such that the head over the crown of the upstream is not less than 2 ft. and the head over the downstream crown is not more than 6 ft. unless directed otherwise by the Engineer. The sewer shall be plugged by pneumatic bags or mechanical plugs in such a manner that the air can be released from the sewer while it is being filled with water. The test shall be continued for one (1) hour and provisions shall be made for measuring the amount of water required to maintain the water at a constant level during this period. If test results are unsatisfactory, the Engineer may direct that additional tests are made on any or all of the pipe.
- C. If any joint shows an appreciable amount of leakage, the jointing material shall be removed and joint remade. If any pipe is defective, it shall be removed and replaced. If the quantity of water required to maintain a constant level in the sewer for one hour does not exceed 100 gals per inch of diameter per day per mile of sewer and all the leakage is not confined to a few joints, the workmanship shall be considered satisfactory. If the amount of leakage indicates defective joints or broken pipes, that shall be corrected by the Contractor.
- D. Pipe shall be tested for infiltration after the backfill has been placed. Infiltration tests shall be made under the supervision of the Engineer, and the length of line to be tested shall be as directed by the Engineer. The allowable infiltration shall be 100 gals per inch of diameter per day per mile of sewer.
- E. Rates of infiltration shall be determined by means of V-notch weirs, pipe spigot or by plugs in the end of the pipe, to be provided and installed by

**PVC GRAVITY SEWER PIPE**

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**SECTION 02 0622 - 5**

the Contractor in an approved manner, and at such times and locations as may be directed by the Engineer.

- F. If an inspection of the completed sewer or any part thereof show any manholes, pipes, or joints which allow the infiltration of water in a noticeable stream or jet, the defective work or material shall be replaced or repaired as directed.

**3.04 AIR TESTING**

- A. The Contractor may use an air test in lieu of the exfiltration test as described above. If he elects to do this, he shall submit his proposed method to the Engineer for approval.
- B. If the results of the air test are unsatisfactory, as determined by the Engineer, the Contractor shall be required to perform the exfiltration test as outlined above.

**3.05 CLEANING**

- A. At the conclusion of the work the Contractor shall thoroughly clean all of the pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest outlet. If, after this outlet cleaning, obstructions remain, they shall be removed. After the pipe is cleaned and if the groundwater level is above the pipe, or following a heavy rain, the Engineer will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired by the Contractor.

END OF SECTION

**PRECAST CONCRETE MANHOLES  
FRAMES AND COVERS**

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**SECTION 02 0720 - 1**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The contractor shall furnish all materials, labor, and equipment and construct manholes consisting of precast section as shown on the drawings and as specified herein.
- B. The manholes shall have an invert channel shaped to correspond with the lower half of the pipe. The top of the shelf shall be at the elevation indicated and shall be sloped to drain toward the flowing-through channel.
- C. The forms, dimensions, concrete, and construction methods shall be approved in advance of construction.
- D. All work shall be as specified herein and conform to the State of Georgia Department of Transportation Standards.

**1.02 RELATED WORK**

- A. Section 02221: Excavation, backfill, fill, and grading for pipe.
- B. Section 02605: Valves and Appurtenances for Site Utilities.

**1.03 SUBMITTALS**

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval representative of the Owner. Such inspection may be made at the place of manufacture, or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once.
- B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified below and these

**PRECAST CONCRETE MANHOLES  
FRAMES AND COVERS**

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**SECTION 02 0720 - 2**

specifications, and with the approved manufacturer's drawing. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness. The surface shall be dense and close-textured.

- C. Imperfections may be repaired, subject to the approval after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of seven days and 5,000 psi at the end of 28 days, when tested in 3" x 6" cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs.

**PART 2 - PRODUCTS**

**2.01 PRECAST CONCRETE SECTIONS**

- A. Precast concrete manhole barrel and eccentric top sections shall conform to the specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C478, except as otherwise specified below. The method of construction shall conform to the detailed drawings appended to these specifications and the following additional requirements:
1. The minimum wall thickness for the various size barrel sections shall be as listed below.

Inside Diameter of Barrel   Minimum Wall Thickness

48"	5"
60"	6"
72"	7"

2. Barrel section shall have tongue and groove joints. Joints shall have round rubber gaskets set in specifically provided indentations. The round rubber "O" ring gasket shall conform to ASTM C443 standard specifications.
3. Type II cement shall be used except as otherwise approved.

## PRECAST CONCRETE MANHOLES FRAMES AND COVERS

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### SECTION 02 0720 - 3

4. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
5. Sections shall be cured by an approved method and shall not be shipped until at least five days after having been fabricated.
6. Top sections shall be eccentric except that precast concrete slabs shall be used where cover over the top of the pipe is less than 4 feet for all manholes.
7. Precast concrete slabs over top section, where required, shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading.
8. The tops of bases shall be suitable shaped to make the precast barrel section.

#### 2.02 FABRICATED ITEMS

##### A. Manhole Frames and Covers:

1. Manhole frames and cover castings shall be good quality, strong, tough, even-grained, cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and subject to hammer inspection. Manhole covers and frame seats shall be machine true to a plane surface. Before shipment from the factory, casting shall be given one coat of coal tar pitch varnish which shall present a coating which is smooth and tough, but not brittle. Sizes shall be as shown on the drawings. Cast iron shall be gray iron casting conforming to the AASHTO Designation M-105 and shall be Class No. 30.
2. Frames and covers shall have a minimum total weight of 460 pounds. Covers shall have a weight not less than 150 pounds.
3. Frames and covers shall be of the "Type W" unless noted otherwise on the drawings. All covers shall have the words "STORM SEWER" in raised 2 inch letters cast into the top. Type "W" shall be the waterproof frame and cover with bolted lid, 1/8 inch neoprene gasket and sufficient counter sunk hexagonal-head cap screws cover to frame to produce a waterproof seal.
4. All manhole frames and covers shall have a minimum of 22 inches clear opening between the innermost ring. The lower flange of the

**PRECAST CONCRETE MANHOLES  
FRAMES AND COVERS**

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**SECTION 02 0720 - 4**

frame shall be at least 6 to 8 inches. The lower flange of the frame shall be at least 6 inches in width. All covers shall be supplied with two concealed watertight pick holes.

- B. Manhole Steps:
  - 1. Manhole steps shall be Clow Corporation F-3650 or approved equal.

**PART 3 - EXECUTION**

**3.01 GENERAL**

- A. Manholes and other precast structures shall be constructed to the dimensions as shown on the drawings and as specified in these specifications.
- B. The base shall be cast-in-place concrete as specified in Division 3 placed on a thoroughly compacted gravel subbase. The tops of the cast-in-place bases shall be shaped to mate with the precast barrel section, and shall be adjusted in grade so that the top of the dome section is at the approximately correct elevation.
- C. Precast bases, conforming to all requirements of ASTM C478 and above listed requirements for precast sections, may be used.
- D. Precast concrete structure sections shall be set so as to be vertical and with sections in true alignment with a 1/4" maximum tolerance to be allowed. The outside and inside joint shall be filled with a comparatively dry mortar (one part cement to two parts sand) and finished flush with the adjoining surfaces. Allow joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If leaks appear in the structures, the inside joints shall be caulked with lead wool. The contractor shall install the precast section in a manner that will result in a watertight joint.

**PRECAST CONCRETE MANHOLES  
FRAMES AND COVERS**

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**SECTION 02 0720 - 5**

- E. Holes in the concrete pipe sections required for handling or other purposes shall be plugged with a non-shrinking grout or by grout in combination with concrete plugs.
- F. Where holes cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.
- G. Cast iron frames shall be placed, shimmed, and set in portland cement mortar to the specified grade.
- H. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color texture and free from defects impairing strength or durability.
- I. All steel or iron surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bituminous trowelling mastic applied in accordance with the manufacturer's instructions prior to installation.

END OF SECTION

## MISCELLANEOUS WORK AND CLEAN-UP

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### SECTION 02 0999 - 1

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

- A. This section includes operations which cannot be specified in detail as separate items but can be sufficiently described as to the kind and extent of work involved. Furnish all labor, materials, equipment and incidentals to complete the work under this Section.
- B. The work of this Section includes, but is not limited to, the following:
  - 1. Restoring easements and rights of way.
  - 2. Concrete encasements.
  - 3. Cleaning up.
  - 4. Incidental work.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

Materials required for this section shall be of the same quality as materials that are to be restored. Where possible, reuse existing materials that are removed and then replaced.

#### PART 3 - EXECUTION

##### 3.01 RESTORING OF SIDEWALKS, DRIVEWAYS, CURBING, FENCING AND GUARD RAILS

- A. Existing public and private sidewalks and driveways disturbed shall be replaced. Paved sidewalks and drives shall be repaved to the limits and thickness existing prior to construction. Gravel sidewalks and drives shall be replaced and regraded.
- B. Existing curbing shall be protected. If necessary, curbing shall be removed and replaced after backfilling. Curbing which is damaged during construction shall be replaced with curbing of equal quality and dimension.

**MISCELLANEOUS WORK AND CLEAN-UP**

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**SECTION 02 0999 - 2**

**3.02 CROSSING UTILITIES**

- A. This item shall include any extra work required in crossing culverts, water courses, drains, water mains, and other utilities, including all sheeting and bracing, extra excavation and backfill, or any other work required for the crossing, whether or not shown on the drawings.
- B. In no case shall there be less than 0.3 feet between any two pipe lines and structures.
- C. Provide a 6" minimum concrete encasement around the new sewer whenever the vertical clearance between an existing water main and if the new sewer is less than 18".
- D. Where new sewers cross over existing water mains, they shall be encased in 6" minimum of concrete. Encasement shall be a minimum 5'-0" in length.

**3.03 RELOCATIONS OF EXISTING GAS LINES**

Notify the proper authority of the utility involved when relocation of gas lines is required. Coordinate all work by the utility so that the progress of construction will not be hampered.

**3.04 RESTORING THE EASEMENTS AND RIGHTS-OF-WAY**

- A. Portions of the Construction may occur in easements through private property. The Contractor shall be responsible for all damage to private property due to his operations. He shall protect from injury all walls, fences, cultivated shrubbery, pavement, underground facilities, such as water pipe, or other utilities which may be encountered along the easement. If removal and replacement are required, it shall be done in a workmanlike manner so that the replacement is equivalent to that which existed prior to construction.

**MISCELLANEOUS WORK AND CLEAN-UP**

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**SECTION 02 0999 - 3**

- B. Existing lawn surfaces damaged by the construction shall be replaced. Cut and replace the sod, or restore the areas with an equivalent depth and quality of loam, seed and fertilizer. These areas shall be maintained and reseeded, if necessary, until all work under this Contract has been completed and accepted.

3.05 CLEANING UP

Remove all construction material, excess excavation, buildings, equipment and other debris remaining on the job as a result of construction operations and shall render the site of the work in a neat and orderly condition.

3.06 INCIDENTAL WORK

Do all incidental work not otherwise specified, but obviously necessary for the proper completion of the contract as specified and as shown on the drawings.

END OF SECTION

**MISCELLANEOUS CONCRETE**

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**SECTION 03 0300 - 1**

PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment, and incidentals necessary to do all concrete work required as shown on the Drawings or specified herein.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Ready-mixed concrete shall conform to ASTM Specification C94 requirements. If ready - mixed concrete is to be used, the manufacturer shall furnish a statement to the Engineer for his review, giving the dry proportions to be used, with evidence that these will produce concrete of the quality specified.
- B. Cement shall be domestic Portland cement conforming to ASTM Designation C150, Type II.
- C. Concrete aggregates shall be free from organic matter, loam, or other injurious material, and shall conform to ASTM Specification C33, provided, however, that aggregates which have been shown by test or actual service to produce concrete of the required strength. The maximum size of coarse aggregate shall be 3/4 inches.
- D. Fine aggregate shall be washed natural sand conforming to ASTM Designation C33. Sand shall be free from organic matter, loam, or other injurious material.
- E. Water shall be potable, clean, and free from deleterious amounts of acids, alkalis, oils, or organic matter.
- F. No admixtures shall be used.
- G. Reinforcing steel shall be deformed, intermediate grade, steel bars conforming to specification Grade 6. Rail-steel bars will not be permitted in the work.

## MISCELLANEOUS CONCRETE

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### SECTION 03 0300 - 2

- H. Grout for setting bearing plates for structural steel, machinery, and other equipment shall be mixed as recommended by the manufacturer to give the necessary consistency for placing and to give a minimum compressive strength of 3,000 psi in 3 days and 6,800 psi in 28 days. Non-shrink grout shall be Masterflow 713 as manufactured by the Master Builders Company, Euco N-S by Euclid Chemical Co., Five Star Grout by U.S. Grout Corp. or equal.

#### 2.02 CONCRETE QUALITY

- A. Unless otherwise specified or directed, concrete shall be designed for a minimum allowable compressive strength of 3,000 psi at 7 days and 4,000 psi at 28 days. Slump shall preferably be between 2 inches and 4 inches and shall not exceed 5 inches. Water shall be kept to a minimum to obtain concrete which is as dense and watertight as possible. The maximum water content shall be 6 gallons per 94 lb. sack, and the minimum cement factor shall be 5.7 (94 lbs) sacks per cubic yard. The above ratios shall be revised for sacks of cements weighing other than 94 lbs per sack.
- B. Concrete for encasements shall have a minimum 28 - day compressive strength of 2,500 psi.

#### 2.03 MIXING CONCRETE

Concrete shall be mixed until there is a uniform distribution of the materials, and shall be discharged completely before the mixer is recharged. The mixer shall be rotated at a speed recommended by the materials, and shall be discharged completely before the mixer is recharged. The mixer shall be rotated at a speed recommended by the mixer manufacturer, and mixing shall be continued for at least 1-1/2 minutes after all the materials are in the mixer.

#### 2.04 FORMS

- A. Forms shall be free from roughness and imperfections, substantially watertight, and adequately braced and tied to prevent motion when concrete is placed. No wooden spreaders will be allowed in the concrete.

**MISCELLANEOUS CONCRETE**

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**SECTION 03 0300 - 3**

- B. Wire ties will not be allowed. Metal ties or anchorages which are required within the forms shall be so constructed that the metal work can be removed for a depth of at least 1 inch from the surface of the concrete without injury to such surface by spalling or otherwise. Forms shall be thoroughly cleaned before using and shall be treated with oil or other approved material.
- C. With average temperature of 50 degrees F or higher, inside forms shall be retained for at least 48 hours and outside forms for at least 24 hours. With lower average temperature, forms shall be retained one day longer.

**PART 3 - EXECUTION**

**3.01 PLACING CONCRETE**

- A. No concrete shall be placed until forms and method of placement have been reviewed by the Engineer. Before depositing concrete, all debris, foreign matter, dirt, and water shall be removed from the forms. The surface of concrete previously placed, such as manhole base or horizontal construction joint, shall be cleaned and brushed with cement paste. Concrete shall not be placed in water or submerged within 24 hours after placing, nor shall running water be permitted to flow over the surface of fresh concrete within four days after its placing.
- B. Higher frequency mechanical vibrations shall be used to the extent necessary to obtain proper consolidation of the concrete. Care shall be taken to avoid segregation of aggregates by excessive vibration. Concrete adjacent to forms, reinforcing rods and around pipe stubs shall be carefully spaded or rodded.
- C. Concrete walls shall be deposited in one continuous operation with concrete brought up evenly on all sides. Chutes shall be of metal, "U" shaped, and provided with a baffle plate at the end, if necessary, to prevent segregation of materials. Chutes shall be placed at an angle of not less than 25 degrees, nor more than 45 degrees, from horizontal, and they shall be kept clean and free from hardened concrete.

## MISCELLANEOUS CONCRETE

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### SECTION 03 0300 - 4

- D. No concrete shall be mixed or placed during freezing weather without explicit permission. When placing concrete when air temperature is below 40 degrees F, the water, sand, and gravel shall be heated so that the temperature of the concrete will be at least 50 degrees F. This temperature shall be maintained for 72 hours after placing. No concrete shall be placed on frozen ground.
- E. At the base of the walls in manholes and structures where construction joints are used, install water stops as shown on the Drawings.

#### 3.02 FINISHING CONCRETE

- A. As soon as forms have been stripped, form ties, if employed, shall be removed, and the recess filled to insure complete water tightness. Any defects in the surface of the walls shall be chipped out and repaired in a workmanlike manner. Defective concrete where it occurs shall be cut to a minimum depth of 1 inch, thoroughly roughened, and neat cement brushed in. The hole shall then be filled with mortar in the proportion of 1 part cement and 2-1/2 parts sand with a minimum of water. Mortar for filling form tie recesses shall be mixed to a slightly damp consistency (just short of "balling"), pressed into the recess until dense, and trowelled smooth. Mortar in large patches shall be applied and allowed to assume a partial set, following which it shall be struck of flush with the adjoining surface. Patches shall be kept moist for several days to assure proper curing.
- B. Except under freezing conditions, keep all masonry wet by sprinkling with water or by covering with wet burlap, cotton quilts, and or approved material. Concrete shall be kept moist for a period of at least 4 days.

#### 3.03 REINFORCING STEEL

- A. Reinforcement shall be newly rolled, or domestic manufacture, free from rust, scale, dirt, grease, and injurious contaminants and shall be of intermediate grade billet steel conforming to ASTM Specification A615, Grade 60.

## MISCELLANEOUS CONCRETE

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### SECTION 03 0300 - 5

- B. Reinforcement, where required, shall be accurately placed in exact positions shown, shall be secured against displacement with annealed iron wire ties or suitable clips at intersections, and shall have a clear space of 2 inches between the steel and face of forms. Concrete blocks with wire ties cast therein may be used whereas approved by the Engineer for the purpose of maintaining and clearance between reinforcement and forms.
- \* C. Reinforcement shall be accurately fabricated to the dimensions indicated on the Drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than two times the minimum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than six times the minimum thickness except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8-bar diameters. All bars shall be bent cold.
- D. Rail-steel will not be allowed in the work.
- E. Coated metal chairs shall be used for support unit reinforcing in slabs. Supporting steel by means of cinder blocks or concrete building blocks will not be permitted.
- F. Drawings and reinforcing schedules showing completed bending and placing details shall be submitted to the Engineer for review. No steel shall be fabricated until the shop drawings have been reviewed.
- G. Reinforcement shall be shipped to the work with bars of the same size and shape fastened in bundles with metal identification tags giving size and mark securely wired on. The identification tags shall be labeled with the same designation as shown on submitted bar schedules and shop drawings.
- H. All bars shall be stored off the ground and shall be protected from moisture and be kept free from dirt, oil, or injurious coatings.
- I. Unless otherwise shown, splices in reinforcement shall be lapped not less than 30 diameters. All bar splices shall be staggered wherever possible. When splicing bars of different diameters, the length of lap is based on the larger bar.

**MISCELLANEOUS CONCRETE**

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**SECTION 03 0300 - 6**

- J. Before being placed in position, reinforcement shall be thoroughly cleaned of loose mill and rust, scale, dirt, and other coatings, including ice, that reduce or destroy bond. Where there is delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.
- K. Reinforcement which is to be exposed for a considerable length of time after being placed shall be painted with a heavy coat of cement grout, if required.

3.04 CONCRETE ENCASEMENTS

- A. Concrete encasements shall be placed as shown on the Contract Drawings.
- B. Control joints shall be incorporated in the concrete as shown on the Drawings.
- C. The pipe shall be securely braced both vertically and horizontally to restrain it against floatation while pouring concrete encasements and cradles. Holes left in the concrete encasements by cross braces during the pouring shall be completely filled with concrete.

END OF SECTION

## PRECAST CONCRETE MANHOLES

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### SECTION 03 0455 - 1

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

- A. The contractor shall furnish all materials, labor, and equipment and construct manholes consisting of precast section as shown on the drawings and as specified herein.
- B. The manholes shall have an invert channel shaped to correspond with the lower half of the pipe. The top of the shelf shall be at the elevation indicated and shall be sloped to drain toward the flowing-through channel.
- C. The forms, dimensions, concrete, and construction methods shall be approved in advance of construction.
- D. All work shall be as specified herein and conform to the State of Georgia Department of Transportation Standards.

##### 1.02 RELATED WORK

- A. Section 02221: Excavation, Backfill, Fill, and Grading for Pipe
- B. Section 02605: Manhole Frames and Covers

##### 1.03 SUBMITTALS

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the representative of the Owner. Such inspection may be made at the place of manufacture, or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once.

**PRECAST CONCRETE MANHOLES**

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**SECTION 03 0455 - 2**

- B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified below and these specifications, and with the approved manufacturer's drawing. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness. The surface shall be dense and close-textured.
  
- C. Imperfections may be repaired, subject to the approval after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of seven days and 5,000 psi at the end of 28 days, when tested in 3" x 6" cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs.

**PART 2 - PRODUCTS**

**2.01 PRECAST CONCRETE SECTIONS**

- A. Precast concrete manhole barrel and eccentric top sections shall conform to the specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C478, except as otherwise specified below. The method of construction shall conform to the detailed drawings appended to these specifications and the following additional requirements:
  - 1. The minimum wall thickness for the various size barrel sections shall be as listed below.

Inside Diameter of Barrel    Minimum Wall Thickness

48"	5"
60"	6"
72"	7"

- 2. Barrel section shall have tongue and groove joints. Joints shall have round rubber gaskets set in specifically provided indentations. The round rubber "O" ring gasket shall conform to ASTM C443 standard specifications.
- 3. Type II cement shall be used except as otherwise approved.

## PRECAST CONCRETE MANHOLES

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### SECTION 03 0455 - 3

4. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
5. Sections shall be cured by an approved method and shall not be shipped until at least five days after having been fabricated.
6. Top sections shall be eccentric except that precast concrete slabs shall be used where cover over the top of the pipe is less than 4 feet for all manholes.
7. Precast concrete slabs over top section, where required, shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading.
8. The tops of bases shall be suitably shaped to make the precast barrel section.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Manholes and other precast structures shall be constructed to the dimensions shown on the drawings and as specified in these specifications.
- B. The base shall be cast-in-place concrete as specified in Division 3 placed on a thoroughly compacted gravel subbase. The tops of the cast-in-place bases shall be shaped to mate with the precast barrel section, and shall be adjusted in grade so that the top of the dome section is at the approximately correct elevation.
- C. Precast bases, conforming to all requirements of ASTM C478 and above listed requirements for precast sections, may be used.
- D. Precast concrete structure sections shall be set so as to be vertical and with sections in true alignment with a 1/4" maximum tolerance to be allowed. The outside and inside joint shall be filled with a comparatively dry mortar (one part cement to two parts sand) and finished flush with the adjoining surfaces. Allow joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If leaks appear in the structures, the inside joints shall be caulked with lead wool. The contractor shall install the precast section in a manner that will result in a watertight joint.

WOLF CREEK AMPHITHEATRE  
FULTON COUNTY, GEORGIA  
PEI – 3063-007

## PRECAST CONCRETE MANHOLES

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### SECTION 03 0455 - 4

- E. Holes in the concrete pipe sections required for handling or other purposes shall be plugged with a non-shrinking grout or by grout in combination with concrete plugs.
- F. Where holes are cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.
- G. Cast iron frames shall be placed, shimmed, and set in portland cement mortar to the specified grade.

END OF SECTION

## **DRAINAGE STRUCTURES**

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### **SECTION 03 0460 – 1**

#### **PART 1 - GENERAL**

##### **1.01 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment and incidentals required and install in the locations as shown on the Drawings, the drainage pipe, catch basins, headwalls and appurtenances as specified herein.
- B. All drainage structures shall be manufactured and installed in accordance with details included herein, and as shown on Drawings.

##### **1.02 RELATED WORK NOT INCLUDED**

- A. Excavation and Backfill for pipe; Section 02221.
- B. Reinforced concrete pipe for Storm Drains; Section 02433.
- C. Concrete and Reinforcing Steel; Division 3.

##### **1.03 QUALIFICATIONS**

- A. All precast structures shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of items to be furnished. The structures shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

##### **1.04 SUBMITTALS**

- A. Submit for approval six (6) sets shop drawings showing details of construction, reinforcing, joints and catch basin connections.

## DRAINAGE STRUCTURES

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### SECTION 03 0460 – 2

#### 1.05 INSPECTION

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval or other representative of the Owner. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample section may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to site shall be marked for identification and shall be removed from the site at once. All sections which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.
- B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified below and these Specifications, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, crack, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, when tested in 3" x 6" cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Owner's representative.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS AND DESIGN

- A. Precast structures shall conform to ASTM Designation C478 and meet the following additional requirements:
  - 1. Type II cement shall be used except as otherwise approved.

## DRAINAGE STRUCTURES

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### SECTION 03 0460 – 3

2. Holes to accommodate pipe shall be precast into the section at the foundry.
  3. All sections shall be cured by an approved method and shall not be shipped nor manhole rungs subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 6 days after fabrication and/or repair, whichever is the longer.
  4. Precast concrete top slabs shall be designed for an H-20 wheel loading.
  5. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside on each precast unit.
  6. Minimum wall thickness shall be 5".
  7. Minimum inside diameter shall be 48".
  8. The precast reinforced base shall be a minimum of 6" thick and be cast monolithically with the bottom section of manhole walls.
  9. Catch basin sections shall be jointed with either an O-ring type joint or a tongue and groove joint complete with flexible plastic gasket. The O-ring type joints shall be round compression ring of neoprene material set in annular spaces cast into the spigot end of a bellspigot type joint. The ring shall be uniformly compressed between the positioned sections so as to form a watertight joint. After the sections are assembled, the remaining space in the joint shall be point up and filled with a dense cement mortar and finished so as to make a smooth, continuous surface inside and outside the wall sections. The tongue and groove joint shall be sealed with a flexible plastic gasket as manufactured by K.T. Snyder and Sons or approved equal. After the manhole sections have been assembled, the gasket shall completely fill the joint.
  10. If the Owner feels the precast sections do not meet the Specification, the Owner shall require the sections to be tested by a certified testing laboratory. The Owner shall pay for the test if the test shows the Specifications are met and the Contractor shall pay for the tests if the test shows the Specifications are not met.
- B. Base unit, reducer slabs and flat top slabs shall have steel reinforcement as shown in details.

## DRAINAGE STRUCTURES

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### SECTION 03 0460 – 4

- C. Openings for pipes larger than six (6) inches in diameter are to be precast. A minimum of six (6) inches between the circumference is to remain between any two holes.
- D. The Contractor will furnish the fabricator with the angle of alignment and size of all pipes to enter manhole and the height of structure.
- E. Base units shall have sufficient height to allow for minimum of six (6) inches of wall between top of highest opening for pipes and bottom of joint.
- F. Pipes are to be extended into structure wall a minimum of four (4) inches, but should not extend beyond interior wall of structure.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Catch basins shall be constructed to the dimensions shown on the Drawings and as specified in these Specifications.
- B. Precast concrete sections shall be set so as to be vertical and with sections in true alignment with a 1/4" maximum tolerance to be allowed. The outside and inside joint shall be filled with a comparatively dry mortar (one part cement and two parts sand) and finished flush with the adjoining surfaces. Allow joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If any leaks appear in the catch basins, the inside joints shall be caulked with lead wool. The Contractor shall install the precast sections in a manner that will result in a watertight joint.
- C. Holes in the concrete pipe sections required for handling or other purposes shall be plugged with a non-shrinking grout or by grout in combination with concrete plugs.
- D. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.

## **DRAINAGE STRUCTURES**

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### **SECTION 03 0460 – 5**

- E. The precast concrete base shall be placed on a bed of crusher-run gravel as shown on the Drawings to provide even bearing and grade control.
- F. Catch basin pipe connections:
  - 1. A tapered hole filled with non-shrink waterproof grout after the pipe is inserted is acceptable, providing the grout is placed carefully to completely fill all around the pipe. If this method is used, place concrete encasement around the stub.
- G. Cast iron frames specified and furnished under Division 5 shall be placed, shimmed and set in Portland Cement mortar to the required grade.
- H. The catch basin inverts, or channels shall be so constructed as to permit a smooth transition between the up and downstream lines or pipes. The lines or pipes entering the manhole shall be laid to the grade shown on the Drawings. Channels shall be constructed of cement grout and shall be shaped as shown on the Drawings and troweled to render a smooth finish.

END OF SECTION

SECTION 03 1000  
CONCRETE FORMWORK

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.2 RELATED SECTIONS

- A. Section 03 2000 - Concrete Reinforcement.
- B. Section 03 3000 - Cast-in-Place Concrete.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
  - 1. ACI 117-90 Specifications for Tolerances for Concrete Construction and Materials.
  - 2. ACI 301-99 Specification for Structural Concrete for Buildings.
- B. American Plywood Association (APA):
  - 1. APA Plywood Design Specification, Form No. Y510L, August, 1986.
  - 2. APA Design/Construction Guide, Concrete Forming, Form No. V345S, Sept, 1996.
- C. National Forest Products Association (NFPA).
  - 1. National Design Specification for Wood Construction, 2001.
  - 2. Design Values for Wood Construction, 2001.

1.4 CONTRACTOR RESPONSIBILITY

- A. Formwork design and engineering.
- B. Construction of formwork, shoring, removal of forms, and reshoring.
- C. Providing a safe structure at all times and ensuring safety to human life and property.

1.5 DESIGN REQUIREMENTS:

- A. General: In accordance with the references.
- B. Design:
  - 1. Design formwork to withstand applicable hydrostatic pressure of concrete plus dead weight, construction loads and vibrations.
  - 2. Limit deflection of studs and walers to 1/400 of the span for architectural concrete and 1/360 of the span for other concrete. Limit deflection of form facing material exposed to view to 1/240 of the span.
  - 3. Build adequate supports into forms for:
    - a. load concentrations
    - b. external vibrations

1.6 SUBMITTALS

- A. Submit under provisions of Section 01 3300.
- B. Shop Drawings:
  - 1. Show:
    - a. Use the structural member designation system used on the Contract Drawings.
    - b. Joint locations and details.
    - c. Size and locations of sleeves, blockouts, and slab penetrations.
    - d. Shoring and support layout.
  - 2. Indicate:
    - a. Form materials, types, and thickness.
    - b. Form tying system and layout.
    - c. Form accessories.
    - d. Details to be used at sleeves, blockouts, and slab penetrations.
    - e. Type and capacity of shores and supports.
    - f. All shop drawings to be signed, dated and sealed by the formwork designer.
- C. Product Data: Manufacturer's product specifications and installation instructions for manufactured products, including form sealer and release agent.
- D. Concrete Strength Tests: Testing Laboratory's reports for testing required in this Section.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Maintain one copy of ACI 301 on site.

1.8 QUALIFICATIONS

- A. Form Work Designer: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of North Carolina.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle formwork materials and accessories at the site to prevent any damage.
- B. Store formwork materials and accessories off ground in ventilated and protected manner to prevent deterioration from moisture.

1.10 COORDINATION

- A. Coordinate this Section with other Sections of work, which require attachment of components to formwork.
- B. If formwork placed after reinforcement results in concrete cover over reinforcement that is insufficient, request instructions from Architect/Engineer before proceeding.

**PART 2 - PRODUCTS**

2.1 WOOD FORM MATERIALS

- A. Plywood: APA B-B Plyform Class I, Exterior Grade, mill oiled and edge sealed.
- B. Lumber: Southern Pine species; Select Structural No. 2 grade or better with grade stamp clearly visible, and conforming to NFPA design values for visually graded lumber.

2.2 PREFABRICATED FORMS

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

2.3 FORMWORK ACCESSORIES

- A. Form Ties: Removable or Snap-off type, metal, fixed length, plastic cone type, free of defects that could leave holes larger than one inch in concrete surface. Provide ties so that the portion remaining within the concrete after removal of the exterior part is at least 1 1/2 inches from the outer concrete surface.
- B. Form Release Agent: Colorless mineral oil, which will not stain concrete, or absorb moisture.
- C. Corners: Chamfered using wooden strip.
- D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled

release tape sealed slots, and anchors for securing to concrete formwork.

- E. Flashing Reglets: Galvanized steel 22 gage, longest possible lengths, with alignment splines for joints, foam filled release tape sealed slots, and anchors for securing to concrete formwork.
- F. Nails, Spikes, Lag Bolts, Through Bolts, and Anchorages: Sized as required, of strength and character to maintain formwork in place while placing concrete.
- G. Waterstop:
  - 1. Paul Murphy Plastics Co., ribbed, center bulb, 6 inch.
  - 2. Colloid Environmental Technologies Company (CETCO), Waterstop RX, butyl rubber bentonite compound rope, 25% butyl rubber/75% sodium bentonite composition.
  - 3. Synko - Flex Products Inc., Synko-Flex, preformed plastic waterstop.
  - 4. Substitution: Under provisions of Section 01 6300.
- H. Architectural Form Liner:
  - 1. Greenstreak Co. #340 smooth face form liner.
- I. Inserts:
  - 1. Adjustable Wedge Inserts:
    - a. Malleable cast iron.
    - b. Complete with bolts, nuts, and washers.
    - c. 3/4 inch diameter bolt unless noted otherwise.
  - 2. Threaded Inserts:
    - a. Malleable cast iron.
    - b. Complete with full depth bolts.
    - c. 3/4 inch diameter bolt unless noted otherwise.
- J. Sealer for plywood: Colored polyurethane coating of type acceptable to plywood manufacturer, for sealing cut edges of plywood.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions:
  - 1. Examine substrate and conditions under which concrete formwork is to be performed.
  - 2. Have the installer notify the Contractor in writing, with a copy to the Architect, if substrate is unsatisfactory.
  - 3. Do not begin the work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
  - 4. Beginning of work indicates acceptance of the substrate as satisfactory by the installer.

#### 3.2 INSTALLATION

- A. General:

1. In accordance with ACI 301.
2. Design, erect, support, brace and maintain formwork to support vertical and lateral loads which might be applied until such loads can be supported by the concrete structure.
3. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Form Construction:

1. Fabrication:
  - a. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
  - b. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
  - c. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.
  - d. Form exposed corners of beams and columns with beveled chamfer strips.
  - e. Kerf wood inserts for forming keyways, reglets, and recesses to ease removal.
2. Support:
  - a. Provide bracing to ensure stability of formwork.
  - b. Erect and maintain bracing to support vertical, lateral, and asymmetrical loads until such loading can be supported by in-place concrete structures.
  - c. Provide shores and struts with means of adjustment capable of taking up formwork settlement occurring during placement of concrete, using wedges, jacks, or a combination thereof.
3. Form Liner:
  - a. Install Architectural Form Liner for Nosing at stage. See architectural drawings and structural plan S101 and details 1/S301 and 3/S301 for locations and extents.
  - b. Tolerances: Form Liner to be installed so that deviations in dimensions shown in details are no greater than 1/8" per 4'-0" length of nosing.
  - c. Mock-up: Contractor to place 6'-0" long section of wall and nosing at stage for Architect's approval before proceeding with remainder of nosing.
4. Provisions for Other Trades:
  - a. Provide openings in concrete formwork to accommodate work of other trades.
  - b. Accurately place and securely support items to be built into forms.
5. Temporary Openings:
  - a. Provide temporary openings in formwork where interior area is inaccessible for:
    - 1) Clean out.
    - 2) Inspection before concrete placement.
    - 3) Concrete placement.
  - b. Provide temporary openings at the base of column and wall forms.
  - c. Position temporary openings in an inconspicuous

- location.
- d. Brace closures of temporary openings and set tightly to forms to prevent loss of concrete mortar.
- 6. Preparation and Tightening:
  - a. Thoroughly clean forms and adjacent surfaces to receive concrete.
  - b. Form Surface Treatment:
    - 1) Before placing reinforcing steel or concrete, coat the form surfaces with a material that will effectively prevent absorption of moisture, prevent bond with concrete, and not stain concrete.
    - 2) A field applied form release agent or factory applied non-absorptive liner may be used.
    - 3) Do not allow form release agent to stand in puddles, come into contact with reinforcing steel or hardened concrete against which fresh concrete is to be placed.
  - c. Remove loose metal, wood chips, sawdust, dirt, trash, and other debris just prior to concrete placement.
  - d. Re-tighten forms during and immediately after concrete placement to eliminate mortar leaks.
- 7. Earthcuts:
  - a. Do not use earthcuts for formed vertical surfaces unless approved by the Architect.
  - b. Where allowed, hand trim side and bottom of earth form. Remove loose soil prior to placing concrete.
- C. Installation Tolerances:
  - 1. Construct formwork in accordance with tolerances specified in ACI 117.
  - 2. Regardless of specified tolerances construct building so that no part extends beyond the legal boundaries of the project.
- D. Installation of Embedded Items:
  - 1. General:
    - a. Set and build into the work anchorage devices, inserts, and other embedded items required for material attached to or supported by cast-in-place concrete.
    - b. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached.
    - c. Do not place embedded items in any manner that will displace or interfere with the reinforcing steel.
  - 2. Conduit: Do not displace reinforcement or increase or decrease concrete cover of reinforcement with conduit.
    - a. Conduit parallel to reinforcement:
      - 1) Do not attach conduit to reinforcement.
      - 2) Minimum spacing between conduit and reinforcement: 4 inches.
    - b. Conduit perpendicular to reinforcement:
      - 1) Place conduit between upper and lower layers of reinforcement only.

3. Waterstops:
  - a. Install in greatest continuous lengths possible.
  - b. Do not displace concrete reinforcement.
  - c. Splice waterstop in accordance with manufacturer's recommendations.
  
4. Junction Boxes:
  - a. Boxes of any depth may be located in slabs.
  
- E. Removal of Forms:
  1. Formwork supporting weight of concrete:
    - a. Including but not limited to beam, girder, and slab forms.
    - b. Remove forms after concrete has attained 70% of its design compressive strength.
    - c. Concrete strength is determined using concrete cylinders.
  2. Formwork not supporting weight of concrete:
    - a. Including but not limited to sides of beams and stem walls.
    - b. Remove forms after concrete has been in place and curing at not less than 50 degrees (F) for 24 hours and providing concrete is sufficiently hard so as not to be damaged by form removal.
  3. Form Ties: Break back snap ties and remove pull ties.
  
- F. Temporary Wall Supports:
  1. Walls to support backfill must be braced to resist lateral loads until:
    - a. All framed floors and slabs-on-grade providing lateral support to the wall are in place.
    - b. The concrete in the floors and slabs has attained 75% of its design compressive strength.
    - c. Concrete strength is determined using concrete specimens.
  
- G. Re-use of Forms:
  1. Re-use forms only when properly maintained and in condition to produce the formed finish required.
  2. Do not re-use forms that can not be tightly butted and made watertight.
  3. Repair forms between uses.
    - a. Align and tighten to provide secure and watertight joints and avoid offsets.
    - b. Do not plug old tie holes that will not be reused.
    - c. Replace materials containing unused tie holes.
    - d. Split, frayed, delaminated or otherwise damaged form facing material is not acceptable.
    - e. Do not use patched forms for exposed concrete surfaces unless approved by the Architect.

### 3.3 FIELD QUALITY CONTROL

- A. Removal based on strength of concrete specimens: The concrete shall be presumed to have reached its 28 day strength or specified percentage thereof when concrete tests made using either of the following indicates the strength has been achieved.
1. Testing based on field cured test cylinders.
    - a. Except for field curing and age at test, mold and test specimens as specified in Section 03 3000, Cast-In-Place Concrete.
    - b. Field cure specimens under the most unfavorable conditions prevailing for any portion of the concrete represented.
  2. Testing based on laboratory cured test cylinders.
    - a. Except for age at test, mould, cure, and test specimens as specified in Section 03 3000, Cast-In-Place Concrete.
    - b. Test specimens at an age that is equal to the length of time that the in-place formed concrete has been cured as specified in Section 03 3000, Cast-In-Place Concrete.
    - c. Determine the length of time the in-place formed concrete has cured by the cumulative number of days or fractions thereof, not necessarily consecutive, during which:
      - 1) The temperature of the air in contact with the concrete is above 50 degrees (F).
      - 2) The concrete has been damp or sealed from evaporation and moisture loss by a membrane forming curing compound or in place formwork.
  3. The result of a test is based on the average compressive strength of two specimens.
  4. Obtaining, curing, and testing of concrete cylinders, other than those required for field quality control in Section 03 3000, is at the Contractor's option and expense.

End Of Section

SECTION 03 2000

CONCRETE REINFORCEMENT

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2 RELATED SECTIONS

- A. Section 03 1000 - Concrete Formwork.
- B. Section 03 3000 - Cast-in-Place Concrete.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
  - 1. ACI 301-99 Specification for Structural Concrete for Buildings.
  - 2. ACI SP-66 (04) Detailing Manual
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A108-99 - Steel Bars, Carbon, Cold Finished, Structural Quality.
  - 2. ANSI/ASTM A185-02 Welded Steel Wire Fabric for Concrete Reinforcement.
  - 3. ASTM A496-02 Steel Wire, Deformed, for Concrete Reinforcement.
  - 4. ASTM A615-04a - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
  - 5. ASTM A706-04a Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
  - 6. ASTM C1116-02 - Fiber Reinforced Concrete and Shotcrete.
  - 7. ASTM D1751-99 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
- C. American Welding Society (AWS):
  - 1. ANSI/AWS D1.1-04 - Structural Welding Code-Steel.
  - 2. ANSI/AWS D1.4-98 - Structural Welding Code-Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute (CRSI):
  - 1. CRSI- Manual of Standard Practice, 27th Edition.
  - 2. CRSI Reinforcement Anchorage and Splices, 4th Edition, 1997.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 3300.
- B. Shop Drawings:
  - 1. Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric.
  - 2. Bending and cutting schedules.
  - 3. Supporting and spacing devices.
  - 4. Use the same designation numbers for slabs, beams, columns, and footings as used on the Drawings.
  - 5. Detail beams and walls in elevation.
  - 6. Do not make shop drawings using reproductions of or making reference to Contract Drawings.
- C. Submit manufacturer's data and installation instructions for:
  - 1. Mechanical splice device.
  - 2. Headed concrete anchor.
  - 3. Deformed bar anchor.
- D. Welder's qualification certificates.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI Manual of Practice ACI 301 and ACI SP-66.
- B. Submit certified copies of mill test report of reinforcement materials analysis.
- C. Employ welders on the Work that have successfully qualified for the welding positions required in accordance with Chapter 6, Qualification, AWS D1.4 within the last 12 months. Welders are required to carry proof of their qualification on their person.

#### 1.6 COORDINATION

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

### PART 2 - PRODUCTS

#### 2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615-04a, 60-ksi yield grade; deformed billet steel bars.
- B. Weldable Reinforcing Steel: ASTM A706-04a, 60 ksi yield grade; deformed low-alloy steel bars.
- C. Welded Steel Wire Fabric: ASTM A185-02 Plain Type; flat sheets.

- D. Fiber Reinforcement: ASTM C-1116-02 type III.
1. Use only 100 per cent virgin polypropylene, fibrillated fibers specifically manufactured for use as concrete secondary reinforcement.
  2. Do not use fibers containing reprocessed olefin materials.
  3. Minimum volume per cubic yard of concrete: 0.1 percent (1.5 pounds).
  4. Fiber length: 1/2 or 3/4 inch.
- E. Headed Concrete Anchors:
1. Flux filled.
  2. Made from cold drawn steel in accordance with ASTM A108, grades C-1010 through C-1020, yield strength, 50 ksi.
- F. Deformed Bar Anchors:
1. Flux filled.
  2. Made from cold drawn steel in accordance with ASTM A108, yield strength, 70 ksi.
  3. Deformed in accordance with ASTM A496-02.

## 2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Bar Support: Includes spacers, chairs, bolsters, ties and other devices for spacing, supporting and fastening reinforcement in place.
1. General: In accordance with CRSI Manual of Standard Practice.
  2. Factory made.
  3. Use bar support heights that produce the concrete cover called for on the Drawings.
  4. Use bar supports capable of supporting construction loads without permanent deflection.
  5. Spacing: At 4 feet maximum with first support 2 feet from end of bar supported.
  6. Exposed Concrete: Provide supports in contact with formwork that are:
    - a. High density all plastic (CRSI Class 1).
    - b. Stainless steel protected (CRSI Class 2).
  7. Typical support types and minimum configurations.
    - a. Beam and slab bolsters: continuous, type 7-ga. wire or cementitious fiber reinforced.
    - b. Individual high chairs:
      - 1) Legs 5 inch and under: 2-ga. wire, or high density all plastic.
      - 2) Legs 5 to 12 inches: 0-ga. wire.
      - 3) Do not use individual high chairs with legs over 12 inches.

- c. Vertical reinforcement: wheel type, high density all plastic.
  - d. Supports bearing on earth.
    - 1) Precast concrete blocks.
    - 2) Support specifically designed for this purpose, e.g. with sand plates.
- C. Mechanical Splices: Install in strict accordance to manufacturer's recommendations.
- 1. Coupler Splice Devices: Use one of the following complying with requirements of ACI 318, Section 12.14.3.1. Submit for approval.
    - a. Erico Products, Inc., Cadweld
    - b. Erico Products, Inc., Lenton taper threaded connector.
    - c. Splice Sleeve Japan, Ltd., NMB Splice Sleeve.
    - d. Substitutions: Under provisions of Section 01 6300.
- D. Slab-On-Grade Expansion Joint Filler: Non-extruded bituminous type conforming to ASTM D1751.
- E. Slab-On-Grade Construction Joint: Minimum 24 ga. galvanized steel with formed tongue and groove keyed joint, full depth of slab. Furnish complete with stake pins.
- F. Expansion Bolts:
- 1. Install in strict accordance with manufacturer's recommendations.
  - 2. Acceptable manufacturers:
    - a. Hilti Fastening Systems Inc., Hilti Kwik Bolt III, Carbon Steel.
    - b. ITW Ramset/Red Head, Trubolt, Carbon Steel.
    - c. Simpson Strong-Tie Company, Inc., Wedge-All.
    - d. Substitutions: Under provisions of Section 01 6300.
- G. Adhesive Anchor:
- 1. Install in strict accordance with manufacturer's recommendations.
  - 2. Acceptable manufacturers:
    - a. Hilti Fastening Systems Inc., HIT HY 150 Injection Adhesive Anchor.
    - b. ITW Ramset/Red Head, EPCON Ceramic 6 Epoxy Anchoring System.
    - c. Simpson Strong-Tie Company, Inc., Acrylic-Tie Adhesive System.
    - d. Substitutions: Under provisions of Section 01 6300.

### 2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Standard Practice.

- B. Locate reinforcing splices where indicated on Drawings.

### **PART 3 - EXECUTION**

#### **3.1 PLACEMENT**

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor retarder.
- C. Accommodate placement of formed openings.
- D. See drawings for concrete cover over reinforcement.
- E. Conduit: Do not displace reinforcement or increase or decrease concrete cover of reinforcement with conduit.
  - 1. Conduit parallel to reinforcement:
    - a. Do not attach conduit to reinforcement.
    - b. Minimum spacing between conduit and reinforcement: 4 inches.
  - 2. Conduit perpendicular to reinforcement:
    - a. Tie conduit to perpendicular reinforcement.

#### **3.2 WELDING**

- A. Reinforcing Bars:
  - 1. General: Welding of reinforcing bars is only permitted at locations expressly detailed or permitted in writing by the Structural Engineer.
  - 2. Execute all welding in accordance with AWS D1.4.
  - 3. Provide reinforcing bars conforming to ASTM A706 for welding unless permitted in writing by the Structural Engineer.
  - 4. Welding of crossing bars (tack welding) is prohibited.
- B. Headed concrete anchors and deformed bar anchors:
  - 1. Install in strict accordance to manufacturer's recommendations, and in accordance with Chapter 7, Stud Welding, AWS D1.1.

#### **3.3 FIELD QUALITY CONTROL**

- A. Notify the Architect and Engineer 72 hours, minimum, prior to concrete placement to allow time for review of installation of all concrete reinforcement.
- B. The Engineer or his representative will review installation of concrete reinforcement.

- C. Correction of reinforcement not installed in accordance with the Contract Documents is the Contractor's responsibility.
- D. Inspect installation of headed concrete anchors and deformed bar anchors in accordance with Chapter 7, Stud Welding, AWS D1.1.

End of Section

## SECTION 03 3000

## CAST-IN-PLACE CONCRETE

**PART 1 - GENERAL**

## 1.1 SECTION INCLUDES

- A. Cast-in-place Concrete.
- B. Floors.
- C. Foundation walls.
- D. Slabs on grade.
- E. Control and expansion joint devices associated with concrete work.

## 1.2 RELATED SECTIONS

- A. Section 03 1000 - Concrete Formwork.
- B. Section 03 2000 - Concrete Reinforcement.

## 1.3 REFERENCES

- A. American Concrete Institute (ACI):
  - 1. ACI 117-90 Specifications for Tolerances for Concrete Construction and Materials.
  - 2. ACI 301-99 Specification for Structural Concrete for Buildings.
  - 3. ACI 305R-99 Standard Specification for Hot Weather Concreting.
  - 4. ACI 306.0-90 Standard Specification for Cold Weather Concreting.
  - 5. SP-15 (95), field reference manual, specifications for structural concrete buildings, ACI 301-99 with selected ACI and ASTM references.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C31-98 Method of Making and Curing Concrete Test Specimens in the Field.
  - 2. ASTM C33-03 Concrete Aggregates.
  - 3. ASTM C94-04 Ready-Mixed Concrete.
  - 4. ASTM C143-00 Test Method for Slump of Portland Cement Concrete.
  - 5. ASTM C150-04 Portland Cement.
  - 6. ASTM C171-97a (1986) Specification for Sheet Materials for Curing Concrete.

7. ASTM C173-01e1 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
8. ASTM C230-98e1 Flow Table for Use in Tests of Hydraulic Cements.
9. ASTM C231-97e1 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
10. ASTM C260-01 Air Entraining Admixtures for Concrete.
11. ASTM C330-04 Lightweight Aggregates For Structural Concrete.
12. ASTM C494-99ae1 Chemical Admixtures for Concrete.
13. ASTM C939-02 Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
14. ASTM C1107-02 Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrinkable).
15. ASTM C618-03 Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
16. ASTM E 1155-96(2001) Standard test method for determining floor flatness and levelness using the F-number system.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01 3300.
- B. Product Data
  1. Mix design for each class of concrete.
  2. Fully document proposed materials and mix designs per ACI 318-05, Chapter 5.
  3. Submit mix design for review by testing laboratory.
    - a. Submit mix design and documentation 56 days, minimum, prior to use in field.
      - 1) Manufacturer's recommendations for use of admixtures and curing compound.
- C. Quality Control Submittals: Submit two copies plus the number the contractor wants returned.
  1. Mill test of Portland cement.
  2. Aggregate tests.
  3. Field cast cylinders. See Field Quality Control.
  4. Floor finish tolerance:
    - a. Report of flatness and levelness test results for each test area.
    - b. Layout of test sections and sample measurement lines with each test area. Provide layout before start of testing operations.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01 7800.
- B. Accurately record actual locations of embedded utilities and components which are concealed from view.

## 1.6 QUALITY ASSURANCE

- A. Field References: Maintain one copy of each reference listed below in Contractor's field office at all times.
  - 1. SP-15, Field Reference Manual.
- B. Perform Work in accordance with ACI 301.
- C. Acquire cement and aggregate from same source for all work.
- D. Conform to ACI 301 when concreting during hot weather.
- E. Conform to ACI 306.1 when concreting during cold weather.

## 1.7 COORDINATION

- A. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

## PART 2 - PRODUCTS

### 2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150-04, Type I or III, natural color, domestic manufacture. One brand should be used throughout the project.
- B. Aggregate:
  - 1. Normal Weight
    - a. Fine Aggregate: Quartz sand free of sulfates: ASTM C33-03.
    - b. Coarse Aggregate: ASTM C33-03.
- C. Water: clean, potable, and free from deleterious amounts of acids, alkalies, or organic materials.

### 2.2 ADMIXTURES

- A. General: Do not use calcium chloride or admixtures containing more than 0.1% chloride ions.
- B. Air Entraining: ASTM C260.
- C. Water-Reducing ASTM C494, Type A.
- D. Water-Reducing and Retarding: ASTM C494, Type D.
- E. High Range Water-Reducing (Superplasticizer): ASTM C494, Type F or G.
  - 1. The Euclid Chemical Company:

SG-07320WCREEK  
SBA-07199  
PEC-07170

Cast-In-Place Concrete

- a. Type F: Eucon-37.
  - b. Type G: Eucon-537.
  2. Grace Construction Products:
    - a. Type F: Daracem-100.
    - b. Type G: Daracem-100.
  3. Master Builders Technologies:
    - a. Type F: Rheobuild 1000.
    - b. Type G: Rheobuild 716.
  4. Substitutions: Under provisions of Section 01 6300.
- F. Fly Ash: ASTM C618, Type C or F.
1. Use when permitted by Architect.
  2. Limit use to not exceed 25% of cement content by weight.

### 2.3 ACCESSORIES

- A. Bonding Agent: Polymer resin emulsion, polyvinyl acetate, latex emulsion.
- B. Vapor Retarder: See Section 07 2616.
- C. Curing Materials:
1. Moisture retaining sheet: One of the following, complying with ASTM C 171.
    - a. Waterproof paper
    - b. Polyethylene film
    - c. Polyethylene-coated burlap
  2. Liquid membrane forming curing compound:
    - a. Use on a surface to be cured where:
      - 1) A topping material will not be required to bond.
      - 2) A penetrating sealer will not be applied.
    - b. Use one of the following:
      - 1) L & M Chemicals, Inc. Dress & Seal 30.
      - 2) Master Builders, Master Kure
      - 3) Euclid Chemical Co., Super Rez-Seal.
      - 4) Sonneborn Building Products, Kure-n-Seal 30.
      - 5) Substitutions: Under provisions of Section 01 6300.
    - c. To be used where a topping material or penetrating sealer will be required to bond to the surface to which this material is applied. Use the following:
      - 1) Euclid Chemical Company, Kurez DR.
      - 2) Substitutions: Under provisions of Section 01 6300.
- D. Penetrating Sealer: One component silane penetrant for preventing the intrusion of water and water-borne salts. Provide a sealer that exceeds the performance criteria of the National Cooperative Highway Research Program (NCHRP) Report #224. Install in strict accordance with manufacture's recommendations.

### 2.4 NON-SHRINK GROUT

- A. Install in strict accordance to manufacturer's recommendations found in each manufacturer's data publication.
- B. Acceptable Manufacturers:
  - 1. Master Builders, Masterflow 928 Grout
    - a. Application: Fluid installation consistency.
  - 2. Master Builders, Construction Grout
    - a. Application: Stiff or plastic installation consistency.
  - 3. The Euclid Chemical Company, Hi-Flow Grout
    - a. Application: Fluid installation.
  - 4. The Euclid Chemical Company, EUCO N-S Grout
    - a. Application: Stiff or plastic installation consistency.
  - 5. Burke, Non-ferrous, Non-shrink Grout
    - a. Application: Fluid installation consistency.
  - 6. Burke, Damp Pack Grout
    - a. Application: Stiff of plastic installation consistency.
  - 7. Substitutions: Under provisions of Section 01 2513.
- C. Installation Consistency Criteria:
  - 1. Fluid:
    - a. Requires forming for installation.
    - b. To 30 seconds flow by CRD-C611. Flow Cone Method.
  - 2. Plastic or Stiff:
    - a. Does not require forming.
    - b. Plastic: 100% flow by ASTM C230.
    - c. Stiff: 40% flow by ASTM C230.

## 2.5 CONCRETE MIX

- A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94-04.
- B. Concrete Mix Designs:
  - 1. Established concrete mix proportions on the basis of field experience or laboratory trial batches as specified in ACI 301 in Section 3.9, "Proportioning on the basis of previous field experience or trial mixtures," with the following exceptions:
    - a. The standard deviation is determined from tests of mixes that:
      - 1) Contain the same materials as mix designs for the proposed work.
      - 2) Represent concrete produced to meet the same design strength as that specified for the proposed work.
    - b. When acceptable field-test records or trial mixture data is not available, and, if approved by the Architect, the concrete mix proportions may be established as specified in ACI 301, Section 3.10, "Proportioning based on empirical data."

- c. Retain an independent testing laboratory to conduct tests made on trial mixes used in proportioning concrete mixes for the proposed work.

- 1) Produce trial mixes within 12 months of submission of mix design for approval.

- C. The following classes of concrete are required:

Class	Minimum Compressive Strength	Acceptance Criteria Interval	Slump Range
	f 'c		
	PSI	DAYS	IN
A	3000	28	5 ± 1

- D. Air Content:

1. Provide concrete containing entrained air (between 6% and 8%) and conforming to ACI 301 when concrete will be subject to potentially destructive exposure (other than wear of loading) such as freezing and thawing, severe weathering, or deicing chemicals.
2. Provide concrete containing a maximum air content of 3% when used in interior slabs subject to abrasion.

- E. Water - Cement Ratio

1. Provide concrete with a maximum water-cement ratio of 0.45.

- F. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.

- G. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrate and conditions under which concrete work is to be performed.

1. Have installer notify the Contractor in writing, with a copy to the Architect, if substrate is unsatisfactory.
2. Do not begin work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
3. Beginning of work indicates the substrate is acceptable and satisfactory to the installer.

- B. Verify that reinforcement is in place, fastened, supported, protected against displacement, and that no reinforcement is touching formwork.

- C. Verify that conduits, pipes, sleeves, inserts, hangers, steel equipment, grounds, anchors and work that is to be built into the concrete are accurately placed, positioned securely, and will not cause hardship in placing the concrete.

### 3.2 PREPARATION

- A. General: In accordance with ACI 301.
- B. Surface Preparation:
  - 1. Remove debris and foreign matter from forms. Drain water from footing trenches and remove mud film and loose dirt.
  - 2. Soak wood forms with water and coat metal and fiberglass forms with oil.
  - 3. Notify Architect at least 24 hrs. before placing is begun.
  - 4. Do not place concrete on earth until the testing laboratory has verified bearing values.
- C. Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by taping edges and ends.
- D. Install joint fillers, primer, and sealant in accordance with manufacturer's instructions.

### 3.3 PLACING CONCRETE

- A. General:
  - 1. Place concrete in accordance with ACI 301 and as specified in this section.
  - 2. Mix and discharge concrete in such quantities as required for immediate use and place fresh before loss of slump occurs.
  - 3. Completely discharge concrete within 1 1/2 hours or before drum has revolved 300 revolutions, whichever comes first, after introduction of the mixing water to the cement and aggregates or introduction of cement to the aggregates.
- B. Transportation:
  - 1. Transport concrete to point of final deposit by cart, buggy, conveyor, or pump. If concrete is to be transported more than 50 ft. in carts or buggies, equip them with pneumatic tires.
  - 2. Move carts and buggies only on temporary runways built over the floor system. Do not allow runway supports to bear on reinforcement or fresh concrete.
- C. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- D. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

- E. Install joint covers in longest practical length, when adjacent construction activity is complete.
- F. Place concrete continuously between predetermined expansion, control, and construction joints.
- G. Do not interrupt successive placement; do not permit cold joints to occur.
- H. Saw cut joints in slab-on-grade as soon as the concrete has hardened sufficiently to prevent the aggregates from being dislodged by the saw. Complete the joint cutting activity before shrinkage stresses become sufficient to produce cracking.
  - 1. Using 3/16-inch thick blade, cut into 1/4 depth of slab thickness, unless noted otherwise on the drawings.

#### 3.4 SEPARATE FLOOR TOPPINGS

- A. Prior to placing floor topping, remove deleterious material. Broom and vacuum clean.
- B. Place required dividers, edge strips, reinforcing, and other items to be cast in.
- C. Apply bonding agent to substrate in accordance with manufacturer's instructions.
- D. Place concrete floor toppings to required lines and levels.

#### 3.5 FLOOR FINISH TOLERANCE

- A. Interior Slabs on Grade
  - 1. General:
    - a. In accordance with ACI 117 and ASTM E1155.
    - b. Testing laboratory to perform all tests and prepare reports for floor finish tolerance.
    - c. When ambient or slab temperatures are less than 40 degrees (F.) or more than 100 degrees (F.) obtain individual slab elevations manually. Electronic recording of readings outside of this temperature range is not acceptable unless a submittal from the manufacturer of the recording device stating a different accurate operating range is submitted to the engineer for review before using the equipment.
  - 2. Test layout: In accordance with ASTM E1155.
    - a. Test area: Area of concrete placed in a continuous pour.
    - b. Test sections: Area bounded by grid lines, slab edges, or construction joints.
    - c. Sample measurement lines: As defined in ASTM E1155.
  - 3. Flatness and levelness tolerance:

4. Specified overall value (SOV):
  - a. Floor flatness = FF (SOV) = 25.
  - b. Floor levelness = FL (SOV) = 20.
5. Minimum local value (MLV):
  - a. Floor flatness = FF (MLV) = 18.
  - b. Floor levelness = FL (MLV) = 15.
6. Timeliness of tests:
  - a. Obtain floor tolerance measurements within 24 hours after slab installation.
7. Test reports for floor finish tolerance:
  - a. Provide report of test results to Contractor and Architect within 72 hours after slab installation.
  - b. Include in the report a running tabulation of all overall FF and overall FL values of slabs installed to date.
8. Acceptance criteria: Remedial work may be required if either of the following is not met.
  - a. The composite value of the entire test area must be equal or greater than either the entire specified overall F-numbers.
  - b. The values for any test section must be equal or greater than either of the minimum local F-numbers.
9. Remedial work:
  - a. Remedial work may include grinding, planing, skimming, re-topping, or removal and replacement.
  - b. Contractor submit method and materials proposed for remedial work at each location to the Architect for review.
10. Retest is required for all repaired work within two weeks to confirm conformance with floor finish criteria.
11. The Contractor is responsible for correction of floors finished out of tolerance.

B. Exterior slabs

1. Finish exterior slabs to drain freely.
2. Cut out and replace depressions that hold water.

### 3.6 CONCRETE FINISHING

A. Formed Surfaces

1. Formed concrete surfaces to be left exposed to view or to receive an applied finish, provide smooth rubbed finish.
2. Formed surfaces not exposed to view or to receive an applied finish, provide rough form finish.

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

1. Wood Float Finish: Surfaces to receive modified asphalt roof membrane system and surfaces to receive finishes applied with thickset tile or thickset stone.
2. Smooth Troweled Finish: Surfaces to receive membrane waterproofing, EPDM fully adhered roof membrane, and all

other surfaces whether scheduled to receive additional finish materials or not.

3. Broom Finish: Exit stairs and locations noted on finish schedule of the Drawings.

### 3.7 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Cure floor surfaces in accordance with ACI 301.
- D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 4 days.
- E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
- F. Membrane forming curing compound:
  1. Flatwork: Coat with curing compound immediately after final troweling when surface water sheen has disappeared.
  2. Formed vertical surfaces: Apply immediately after form removal.
- G. Apply sealing and curing compound to the following areas at substantial completion.
  1. Mechanical rooms
  2. Electrical rooms
  3. Storerooms
  4. Janitor closets
  5. Any other concrete slab that will not receive a finish material or surface treatment and will remain exposed.
- H. Duration of curing procedures: Conform to paragraph 12.2.3 ACI 301.

### 3.8 FIELD QUALITY CONTROL

- A. Field-testing will be performed in accordance with ACI 301 and under provisions of Section 01 4529.
- B. Provide free access to Work and cooperate with appointed firm.
- C. Sampling of Concrete
  1. General: In accordance with ASTM C31-98.
  2. Frequency: Obtain one set of test specimens for each 100 cu. yds., or fraction thereof, of each mix design placed in one day.

3. Number of specimens in a set.
  - a. Twenty-eight day acceptance criteria (for concrete class A) four 6x12 cylinders.
  
- D. Site testing performed when each set of test specimens are made.
  1. Slump: In accordance with ASTM C143.
  2. Air Content: In accordance with ASTM C231, pressure method for normal weight concrete or ASTM C173, volumetric method for lightweight and normal weight concrete.
  3. Temperature: Determine the ambient temperature and the temperature of the sample.
  
- E. Laboratory Testing
  1. Unit weight.
  2. Compressive strength verification: In accordance with ASTM C31-98.
  3. Frequency of testing for compressive strength verification:
    - a. Twenty-eight day acceptance criteria:
      - 1) One cylinder tested at seven days for information.
      - 2) Two cylinders tested at twenty-eight days for acceptance.
      - 3) One cylinder held in reserve.

### 3.9 REPAIR OF SURFACE DEFECTS

- A. General: Surface defects occur between the surface of the concrete and the first layer of reinforcement below.
- B. Inspect concrete surfaces immediately upon removal of forms.
- C. Excessive honeycombing or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.
- D. After specific instructions by Architect/Engineer, patch imperfections in accordance with Section 5.3.7, Repair of Surface Defects, ACI 301.

### 3.10 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances, specified requirements, or cold joints.
- B. The Architect/Engineer will determine repair or replacement of defective concrete.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

WOLF CREEK AMPHITHEATER

03 3000-12

SG-07320WCREEK

Cast-In-Place Concrete

SBA-07199

PEC-07170

End of Section

SECTION 03 4500

PRECAST ARCHITECTURAL CONCRETE

**PART 1 - GENERAL**

1.1 SUMMARY:

- A. Work of this section includes structural design, manufacture, transportation, erection and cleaning of plant cast, precast architectural concrete.
- B. Related work specified elsewhere:
  - 1. Structural concrete.
  - 2. Structural steel framing.
  - 3. Water-repellent coating.
  - 4. Joint sealants.

1.2 REFERENCES:

- A. Applicable standards; standards of the following, as referenced herein:
  - 1. American Concrete Institute (ACI).
  - 2. American Institute of Steel Construction (AISC).
  - 3. American Welding Society (AWS).
  - 4. Architectural Precast Association (APA).
  - 5. ASTM International (ASTM).
  - 6. Concrete Reinforcing Steel Institute (CRSI).
  - 7. Prestressed Concrete Institute (PCI).
  - 8. Steel Structures Painting Council (SSPC).

1.3 SYSTEM DESCRIPTION:

- A. Performance requirements: Comply with International Building Code, municipal building codes, regulations or other governing agencies having jurisdiction and as follows:
  - 1. Wind loads.
  - 2. Seismic forces.
  - 3. Building dynamics, thermal, live, impact or concentrated loads, structural deflection, and story drift.
- B. Design, fabrication and erection standards:
  - 1. ACI 318.
  - 2. AWS D1.1.
  - 3. PCI "Architectural Precast Concrete", MNL-122, "Manual for Structural Design of Architectural Precast Concrete", MNL-121; and "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products", MNL-117.
  - 4. AISC "Specification for Design, Fabrication and Erection of Structural Steel for Buildings", current edition and supplements.

1.4 SUBMITTALS:

- A. Concrete mix design: Submit mix designs with supporting test results for Architect's approval prior to production of precast units. Submittal shall include the following:
1. Design strength.
  2. Compression strength at time of anticipated form removal, seven days and 28 days.
  3. Air-dry unit weight.
  4. Absorption.
  5. Slump.
  6. Air content.
  7. Water/cement ratio.
  8. Cement source, content and type.
  9. Aggregate identification, gradation supply capacity and content.
  10. Admixture types, trade names, sources and quantities.
- B. Samples:
1. Anchorages: Inserts and all items for temporary anchorage and permanent connections to structure.
  2. Sample units: 2'-0" square. Indicate color and texture of finished work, as well as other specific features as may be requested by Architect. Submit prior to fabrication.
- C. Shop drawings, design data and erection drawings:
1. Indicate design loads used in the design of precast concrete units. Include computations for Architect's information only, prior to manufacture of units. Computation and design shall bear the seal of a professional engineer licensed in State of Georgia.
  2. Indicate sizes, sections, dimensions of units, arrangement of joints, joint sealant detail, reinforcement design, manufacture, fabrication, installation and erection details. Include location of openings, inserts, fasteners and other accessories to be cast or fabricated into units. Indicate devices required in building structure to support precast units.
  3. Identify precast concrete units with mark used on shop drawings. Identifying marks shall be visible on non-exposed surfaces.
  4. Indicate temporary bracing, temporary anchorage and permanent connections to building frame.
  5. Identify welds using appropriate AWS symbols.
  6. Indicate approximate weight of unit.
  7. Relate dimensions to finish floor elevations and structural components.
  8. Indicate primer for anchors and connections.

- D. Submit certified mill reports for Architect's information:
1. Cement: Mill certificate, including source, type, supply capacity and uniformity of characteristics and color.
  2. Aggregate: Plant certificate, including source, type, supply capacity, specific gravity, absorption, alkali reactivity, grading (uniform or gap), uniformity of characteristics and petrographic analysis.
  3. Reinforcement and inserts: Mill certificate indicating compliance with specified standards for each component.
- E. Certifications:
1. Fabricator certification: Submit fabricator's certification from APA or PCI.
  2. Welder certification: Submit welders' qualifications in accord with AWS D1.1, current within the previous 12 months, for Architect's information only.
- F. Quality control procedures: Submit copy of manufacturer's in-plant and erection quality control assurance program, for Architect's information.

1.5 QUALITY ASSURANCE:

- A. Manufacturer's qualifications:
1. Precast manufacturer shall be subject to acceptance by Architect based upon the following criteria:
    - a. Satisfactory manufacture of work of a similar nature and scope as required for this project.
    - b. Adequate financial responsibility.
    - c. In-plant quality control assurance program and testing capabilities, including capacity for performing tests in compliance with ASTM E329-07 and PCI MNL-117.
    - d. Plant certification as provided by APA or PCI, Group A1 or applicable municipal building department. Manufacturer's not certified by APA or PCI shall submit a written Quality Assurance/quality Control program for approval.
    - e. Adequate plant engineering capability for scope of work.
    - f. Location of plant and storage facilities.
    - g. Acceptable sources and type of aggregate, reinforcement, cements and admixtures.
  2. Manufacturer shall have a minimum of five years experience in producing units similar to those required for this project, with production capacity to produce and deliver required units without causing delay in Work.

3. Submit evidence of specified manufacturer's qualifications if requested by Architect. Architect reserves the right to inspect manufacturer's facilities and sample panels in determining qualifications.
- B. Erector qualifications: Erector shall have been regularly engaged in satisfactory erection of precast units of a similar nature and scope as required for this project for at least three years.
- C. Qualifications of welders:
1. Welders employed on the work shall have passed qualification tests within the past 12 months in the position for which employed, using AWS D1.1 test procedures.
  2. Contractor shall require any welder to retake the qualification test when, in the opinion of the Architect, the welder's work creates a reasonable doubt as to the proficiency of the welder. Retests shall be conducted at no additional expense to the Owner. Recertification shall be made to Architect after the welder has passed the test.
- D. Production testing:
1. Testing as described below shall be performed as a part of the work in this section. Testing may be performed by precast manufacturer, or by an independent testing agency retained by the manufacturer, subject to Architect's approval of manufacturer's testing facilities and capacity for performing tests in compliance with ASTM E329-07.
  2. Production testing: During precast unit production, make a set of four 6" by 1'-0" compressive strength test cylinders for each 15 cubic yards of concrete placed.
    - a. Cast and cure cylinders using same methods as for precast units.
    - b. Perform slump tests in accord with ASTM C143-05a for each set of cylinders.
    - c. Perform compressive strength tests for one cylinder at seven days and two at 28 days. If 28-day tests indicate specified strength, discard remaining cylinder. Perform compressive strength testing in accord with ASTM C31-06, ASTM C39-05e1 and ASTM C192-06.
    - d. Furnish copies of all tests, in duplicate, to Architect prior to shipping units. Tests shall be identified by unit designations.
    - e. Precast units not meeting design characteristics shall be rejected.

3. Standards: Except as otherwise required, quality control, inspections and testing shall comply with provisions of PCI MNL-117, Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.
  4. Records: Maintain quality control records for minimum of two years after Date of Substantial Completion.
  5. Tests by Owner: At the Owner's option, he may engage an independent Testing Agency selected and paid by Owner to review manufacturer's quality control program and qualification of welders, monitor manufacturer's testing and make additional tests as deemed necessary during the progress of the work. Precast manufacturer shall provide Testing Agency access to production areas for performing inspections and tests, and shall give timely notification of production schedules to the Testing Agency and Architect.
- E. Allowable fabrication and erection tolerances: Meeting PCI MNL-117.
- F. Mock-ups:
1. Prior to start of production runs, erect full size sample panels of representative precast units at manufacturing facility, for Architect's review.
    - a. Notify Architect in writing of time when sample panels will be ready for Architect's review.
    - b. Begin no precast production until full size samples have been accepted.
  2. Number of sample panels shall be sufficient to indicate the following:
    - a. Color and texture.
    - b. Cross section, including rustications and profiles.
    - c. Cold joints.
    - d. Sealant joints; sealant and backer rod in place.
    - e. Patched areas of concrete.
    - f. Water-repellent coated areas.
  3. Final acceptance of shapes and finishes will be based on appearance of full size sample panel.
  4. If unacceptable to Architect, re-erect panels until approval is obtained.
  5. Acceptable sample units may be incorporated into project.
  6. Units delivered for construction shall have matching appearance of acceptable full size samples.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Delivery and handling: Deliver to project site in such quantities and at such times to ensure continuity of installation.
1. Transport and handle precast concrete units in manner to protect from strain, warping, cracking, chipping or staining.
  2. Do not place units in contact with earth.
  3. Place non-staining resilient spacers of even thickness between units.
  4. Support units during shipment on expanded polystyrene or similar non-staining, shock-absorbing material.
  5. Lift and support only at designated lifting or supporting points as indicated on reviewed shop drawings.
- B. Storage:
1. Store units to protect from straining, warping, cracking, chipping or other physical damage.
  2. Store units in same position as transported with non-staining resilient supports located in same positions as when transported.
  3. Store units on firm, level and smooth surfaces.
  4. Place stored units so that identification marks are discernible.
  5. Damaged units shall be rejected.

1.7 PROJECT CONDITIONS:

- A. Field measurements: Take field measurements prior to preparation of shop drawings and fabrication, to ensure fitting of work.

**PART 2 - PRODUCTS**

2.1 MATERIALS:

- A. Portland cement: Meeting ASTM C150-07, Type IA, white or grey colors as required to achieve desired finish colors. Use only one brand, type and color of cement from the same mill for all precast architectural concrete.
- B. Aggregate:
1. Fine and course aggregate meeting ASTM C33-03, gap graded, each obtained from a single quarry for all precast units; clean, hard, durable, inert and free of staining or deleterious material.
  2. Type, color, size and gradation: Match sample panel in Architect's office.

- C. Water: Clean, potable, clear, free of salts, alkali, acid, oil, organic matter, detergent or other matter that may interfere with color, curing, or strength of concrete.
- D. Admixtures:
1. Air-entraining admixture: Meeting ASTM C260-06, as required by mix design.
  2. Water reducing, retarding, accelerating admixtures: Meeting ASTM C494-05a, Types A, B, C, F or G as required.
  3. Silica fume: Meeting ASTM C1240-05, for cement replacement for high performance concrete.
  4. Coloring agent: ASTM C979-05, compatible with other concrete materials.
- E. Forms:
1. Provide forms with acceptable form facing materials that are non-reactive with concrete or form release agents and that will produce required finish surfaces.
  2. Construct and maintain forms to produce precast concrete units of shapes, lines, and dimensions indicated, within specified tolerances.
- F. Reinforcement:
1. Bars: Meeting ASTM A615-07, Grade 60 for main reinforcement; Grade 40 for ties and stirrups, hot dip galvanized complying with ASTM C767-93(2004).
  2. Steel welded wire fabric: Meeting ASTM A185-06e1, plain, cold drawn, electro-galvanized.
  3. Bar supports: Comply with CRSI Manual of Practice, Class I, plastic protected.
- G. Anchors, connection hardware and inserts:
1. Steel shapes and plates: Meeting ASTM A36-05, hot dip galvanized in accord with ASTM A123-02.
  2. Anchor bolts: Meeting ASTM A307-04e1 or ASTM A1008-07, Grade A, or ASTM A325-06, Type 1 or 3, hot dip galvanized per ASTM A153-05, Class C.
  3. Welded headed studs: Meeting AWS D1.1, Type B.
  4. Deformed steel wire bar anchors: Meeting ASTM A496-05.
- H. Finish for steel connection materials:
1. Steel exposed to weather in final assembly: Hot-dip galvanized in accord with ASTM A123-02 or ASTM A153-05.
  2. Steel protected from weather in final assembly: Shop primed in accord with SSPC-Paint 25.
  3. Anchor bolts, nuts, washers: Cadmium plated in accord with ASTM A563-04a, Grade C.
  4. Setting bolts or projecting steel in masonry applications: Hot-dip galvanized in accord with A153-05.
  5. Welding electrodes: Comply with AWS standards.

- I. Cold galvanizing compound: Pre-mixed, zinc dust and organic binders formulated specifically for use on steel surfaces. Compounds shall have concentrations of zinc dust in the range of 65% to 69% or above 92% in the dried film in accord with ASTM A780-01(2006).
- J. Bearing pads: Elastomeric pads in accord with ASTM D412-06a.

## 2.2 PRECAST UNIT CHARACTERISTICS:

- A. Design mixes for each type of concrete specified may be prepared by independent testing agency or by precast architectural manufacturing plant personnel.
- B. Proportion mixes by either testing agency trial batch or field test data methods in accordance with ACI 211.1 using materials to be used on project, to produce normal weight concrete with properties as follows:
  - 1. Compressive strength: Minimum 5000 psi when tested in accord with ASTM C39-05e1.
  - 2. Maximum water cement ratio 0.40 at point of placement.
  - 3. Air entrainment: Add air-entrainment admixture to result in air content at point of placement complying with ACI 533 requirements.
  - 4. Concrete type: Normal weight, 135 - 160 pcf.
  - 5. Water absorption: Meeting ASTM C642-06, 6% maximum by weight at 28 days.
- C. Joint design: Comply with ACI 504 recommendations or as specifically detailed.
- D. Unexposed surface finish:
  - 1. Formed surfaces shall be as-cast; patch defects, point holes and fill honeycombs.
  - 2. Unformed surfaces shall have wood float or roller finish, true to plane.
- E. Exposed surface finish: Meeting requirements of ACI 301, and matching approved samples for smooth formed rubbed finish.

## 2.3 FABRICATION:

- A. General:
  - 1. Fabricate precast concrete units with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances as specified in ACI 533, unless more stringent requirements are indicated or specified.
  - 2. Fabricate units straight, smooth and true to size and shape, with exposed edges and corners precise and square, unless otherwise indicated.

- B. Precast manufacturer shall design reinforcement and connections for precast units, including additional reinforcement and lifting devices required to withstand loads due to lifting, transporting, handling and erection and related anchorage components. Comply with CRSI "Manual of Standard Practice" and ACI 318 recommendations.
- C. Fabricate precast units to sizes and profiles indicated and matching approved sample panels.
  - 1. Corners, arrises, reveals and similar conspicuous lines shall be sharp and free of irregularities.
  - 2. Cast openings larger than 10" in any dimension according to locations indicated on approved shop drawings. Smaller holes may be field cut when approved by Architect.
  - 3. Form components to radii indicated on drawings.
- D. Provide anchors and similar cast-in items at locations indicated on approved shop drawings. Set in forms prior to placing concrete.
- E. Form, measure, mix, transport, place and consolidate concrete in accord with ACI 533.
  - 1. Place facing mix to thickness of the greater of 1" or 1.5 times the maximum aggregate size. Place back-up concrete to ensure bond with face concrete.
  - 2. Form cure units in accord with ACI 533 until sufficient strength has developed to permit handling units without damage.
- F. Discard units that are warped, cracked, broken, spalled or otherwise defective, unless repairs are approved by Architect and meet specified requirements. Discard panels if repairs do not produce uniform color and texture acceptable to Architect.
- G. Identify each panel with markings as indicated on setting drawings. Imprint casting date and piece mark on a surface to be concealed from view in the finished structure.
- H. Shop priming of exposed anchors and connection hardware:
  - 1. Surface preparation: Clean surfaces after fabrication and immediately prior to shop painting in accord with SSPC-SP 10, Near White Blast Cleaning.
  - 2. Shop priming:
    - a. Shop prime all steel components except surfaces to be field welded.
    - b. Shop prime surfaces after completion of fabrication.

- c. Apply specified shop primer in accord with manufacturer's product data and SSPC-PS 12.01, to provide a dry film thickness of 2.5 mils. Apply shop primer within four hours after cleaning and before rust-bloom occurs. Paint only in relative humidity below 85% and surface temperatures of five degrees F. above dew point.
- H. Fabrication tolerances: Fabricate to tolerances listed in ACI 533.

### **PART 3 - EXECUTION**

#### 3.1 EXAMINATION:

- A. Examine substrates and conditions for compliance with requirements for installation, tolerances, true and level bearing surfaces, and other conditions affecting performance of precast architectural concrete units. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Do not install units until supporting structure has been completed and has attained minimum allowable design compressive strength.

#### 3.2 ERECTION:

- A. Set precast concrete units plumb, level and true to line within specified erection tolerances.
  - 1. Dimensional tolerances shall be non-cumulative.
  - 2. Adjustments such as shimming which would place additional stress on units will not be permitted.
  - 3. Adhere to dimensional tolerances in accordance with ACI recommendations.
- B. Lift and handle precast units using lift points and embeds as indicated on approved shop drawings.
- C. Secure precast units in place by bolting or welding, or both, as indicated on approved shop drawings.
  - 1. Provide temporary anchoring as required.
  - 2. Perform welding in accord with AWS D1.1. Remove galvanizing from galvanized anchors in areas to be welded, prior to welding.
  - 3. Conceal connections in finished work.
- D. Set units dry, without mortar, attaining specified joint dimension with lead, plastic or steel spacers. Remove spacers prior to caulking joints.

- E. Repair of galvanized surfaces: After precast unit erection, clean surfaces from which galvanizing was removed during installation in accord with SSPC-SP 3, Power Tool Cleaning. Coat surfaces with cold galvanizing compound, 3.0 mils minimum dry film thickness.
- F. Caulking: Caulk precast unit joints using silicone sealant specified in Joint Sealants section. Application, including joint preparation shall be in accord with applicable portions of that section.
  - 1. Perform caulking operations prior to water-repellent coating application.
- G. Erection tolerances:
  - 1. Erect within tolerances listed in ACI 533.
  - 2. Erect to conform with structural tolerances listed in ACI 533.

### 3.3 REPAIR:

- A. Mix and place patching mixture to match texture of surrounding concrete and to minimize shrinkage.
- B. Adhere patch to hardened concrete with bonding agent.
- C. Replace defective precast units if repairs are not acceptable to Architect.

### 3.4 CLEANING AND PROTECTION:

- A. Finished surfaces shall be cleaned by precast manufacturer prior to shipment.
- B. Clean panels after installation and just prior to application of specified coatings using detergent and water, thoroughly rinsing with clean water. Test cleaning materials and procedures on designated portion of approved mock-up.
- C. Clean stains not cleanable with detergent and water using 3.0% solution of phosphoric acid applied to thoroughly dampened surface and thoroughly rinsed with clean water before solution dries. The use of stronger solutions on stubborn stains shall be avoided except as approved by Architect following similar cleaning of sample panel. When stronger solutions are approved, entire wall areas shall be uniformly treated to avoid blotchy appearances.
- D. Leave precast units in condition for application of water repellents specified in Water-Repellent Coating section.
- E. Protect panels from mud and excessive dust.

- F. Upon completion of project and immediately prior to Date of Substantial Completion, re-clean surfaces of dust, mud and stains. Replace units stained or damaged beyond correction.

End of Section



SECTION 04 0500

MORTAR AND MASONRY GROUT

**PART 1 - GENERAL**

1.1 SUMMARY:

- A. Related work specified elsewhere:
  - 1. Concrete.
  - 2. Cement grout for reinforced masonry.
  - 3. Concrete unit masonry.
  - 4. Brick masonry.
  - 5. Joint sealants.

1.2 SUBMITTALS:

- A. Product data: Submit manufacturer's product specifications, test data and mixing and installation instructions for each manufactured product.
- B. Mix design: Submit mix design, including properties, materials and proportions, for mortar.
- C. Samples: Submit actual mortar samples for colored mortar, 3/8" wide by 8" long, indicating color range of each color selected. Samples shall be made using cement brand and type, proportions and sand source proposed for work on this project.

1.3 QUALITY ASSURANCE:

- A. For each type and color of cement specified, only one brand shall be used throughout project.
- B. Standards of ASTM International (ASTM), as referenced herein.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials, except aggregate, in original unopened containers displaying product name, type, grade and mixing instructions.

**PART 2 - PRODUCTS**

2.1 MATERIALS:

- A. Portland cement: Meeting ASTM C150-07, Type I, maximum 0.6% alkali, natural color, domestic manufacture.
- B. Masonry cement: Meeting ASTM C91-05, non-staining, 22% maximum air content by volume and proportioned to comply with requirements of ASTM C270-07 for Type S mortar.
- C. Hydrated lime: Meeting ASTM C207-06, Type S.

- D. Pre-mixed, colored masonry cement:
  - 1. Acceptable products; pending compliance with specified characteristics and acceptable color range to match specified color:
    - a. Basis of design: Holnam, Inc. (Holcim, Inc.), Rainbow Mortarmix Masonry Cement.
    - b. LaFarge North America Inc., Citadel Custom Color Masonry Cement.
    - c. Giant Cement Company, Giant Masonry.
    - d. Lehigh Portland Cement Co., Custom Color Masonry Cement.
    - e. Riverton Corp., Flamingo Masonry Cement.
  - 2. Characteristics: Meeting ASTM C91-05, Type S non-staining, 22% maximum air content by volume, with inert, alkali-resistant, fade-resistant mineral pigments and complete with water-reducing and plasticizing admixtures, proportioned to comply with requirements of ASTM C270-07 for Type S mortar with minimum 28-day compressive strength of 1800 psi for Type S mortar.
  - 3. Colors: Match Holnam 10-912.
- D. Aggregate for mortar: Clean, hard, natural washed sand meeting ASTM C144-04. Provide aggregate from single source for colored mortar.
- E. Water-reducing and plasticizing admixture; acceptable products:
  - 1. Anti-Hydro Co., A-H AHCO W/R.
  - 2. Chem-Masters Corp., Hydrolox 400.
- F. Non-shrink grout:
  - 1. Acceptable products:
    - a. Anti-Hydro, A-H Aexpandcrete S Hi-Flow.
    - b. BASF Building Products, Masterflow 713 Plus.
    - c. The Burke Company, Non-Ferrous, Non-Shrink Grout.
    - d. Lambert Corporation, Vibropruf #11.
    - e. L&M Construction Chemicals Co., Crystex.
    - f. U. S. Grout Corp., Five Star Grout.
    - g. W. R. Bonsal Co., F-77 Construction Grout.
    - h. W. R. Meadows, Inc., 588 Precision Grout.
  - 2. Characteristics: Flowable, non-metallic, controlled expansive type grout.
- G. Anchoring cement for railings:
  - 1. Acceptable products:
    - a. BASF Building Products, Thorogrip.
    - b. W. R. Bonsal Company, Anchor Cement.
    - c. U. S. Grout Corp., Five Star Grout.
  - 2. Characteristics: Quick-setting, self-leveling, pourable cement base; waterproof, non-shrinking hydraulic compound.
- H. Water: Clean, potable, free from deleterious amounts of alkalies, acids and organic materials.
- I. Water-repellent admixture:
  - 1. Acceptable products:
    - a. BASF Admixtures, Rheopel® Mortar Admixture.

- b. W. R. Grace & Co.-Conn., Dry-Block Integral Water-Repellent Admixture.
2. Product shall be compatible with water-repellent used in architectural concrete masonry units as specified in Concrete Unit Masonry section.
3. Characteristics: Liquid water-repellent, mildew-resistant for mortar joints in exterior architectural concrete masonry units.

## 2.2 PROPORTIONS:

- A. Type S (1800 psi compressive strength) job-mixed or bag-mixed mortar: Proportion materials by volume in accord with ASTM C270-07, as follows:
  1. One part masonry cement to 1/2 part Portland cement to aggregate proportioned at not less than 2-1/4 nor more than three times the volumes of cements used, or;
  2. One part Portland cement and 1/4 to 1/2 part hydrated lime to aggregate proportioned at not less than 2-1/4 nor more than three times the combined volume of cement and lime used, or;
  3. This method is required for pre-mixed colored masonry cement. One part pre-mixed Type S masonry cement to aggregate proportioned not less than 2-1/4 nor more than three times the volume of masonry cement used, and as directed by masonry cement manufacturer's product data to produce Type S mortar.
- B. Non-shrink grout: Mix prepared non-shrink grout product with water as directed by manufacturer's product data to achieve a minimum compressive strength of 7000 psi at 28 days.
- C. Anchoring cement for railings: Mix prepared anchoring cement product with water as directed by manufacturer's product data for immediate use.

## PART 3 - EXECUTION

### 3.1 MIXING:

- A. Mix mortar and cement grout in power-driven, drum type mixers. Operate mixer for 3 to 5 minutes for mortar and minimum of five minutes for grout after addition of all materials.
- B. For job-mixed mortars, add water-reducing and plasticizing admixture in accord with admixture manufacturer's product data.
- C. Addition of other admixtures, including chloride-based admixtures and antifreeze ingredients, will not be permitted.
- D. Measure materials for job-mixed mortars in a one cubic foot container. Do not measure by shovels.

- E. Discard grout not placed within 1-1/2 hours after water is added to mix, or sooner as indicated by grout manufacturer.

3.2 PLACING MORTAR AND GROUT:

- A. Place mortar as specified in Brick Masonry section and Concrete Unit Masonry section.
- B. Re-temper mortar as necessary to keep plastic. Use no mortar after setting has begun or after 2-1/2 hours of initial mixing.
- C. Mortar type requirements:
  - 1. Mortar for concrete unit masonry work shall be Type S.
  - 2. Mortar for brick masonry shall be Type S colored mortar.
  - 3. Mortar for architectural masonry shall be Type S colored mortar with water-repellent admixture.

End of Section

SECTION 04 0516

CEMENT GROUT FOR REINFORCED MASONRY

**PART 1 - GENERAL**

1.1 SUBMITTALS:

- A. Mix designs: Submit mix designs for each type of cement grout.
- B. Mill reports: Submit for cement and fine and coarse aggregate for use in cement grout mixes.
- C. Laboratory tests: Grout test reports.

1.2 QUALITY ASSURANCE:

- A. For each type of cement specified, only one brand shall be used throughout project.
- B. Standards of the following as referenced herein:
  - 1. ASTM International (ASTM).
  - 2. National Concrete Masonry Association (NCMA).

1.3 TESTING:

- A. Testing of grout, as specified hereinafter, will be performed by an independent Testing Agency selected by the Architect and paid by the Owner.
- B. Testing Agency will perform the following services:
  - 1. Sample grout at project site and prepare compressive strength test specimens.
  - 2. Store test specimens in storage box for 48 hours after molding. Storage box shall be furnished by testing agency.
  - 3. Transport test specimens to laboratory and perform specified tests.
  - 4. Notify Architect immediately of any test specimens which do not meet specified compressive strength at 24 hours, three, 7 or 21 days.
  - 5. Report test results to Architect.
- C. Testing Agency will maintain supplies, apparatus, tools and devices at project site to obtain specimens and perform on-site tests.
- D. Contractor's duties relative to testing:
  - 1. Advise Testing Agency sufficiently in advance of operations to allow for completion of quality tests and for assignment of personnel.
  - 2. Provide labor to assist in obtaining and handling samples.
  - 3. Contractor shall provide for storage area for samples for first 48 hours after molding, in a permanent, stable, lockable area of approximately 100 sq. ft. Limit access to Testing Agency personnel and Contractor's designated agent.

4. Pay cost of additional testing beyond scope of that required herein, if desired by Contractor, and for re-testing when initial tests reveal non-conformance with specified requirements.
- E. Frequency and quantity of samples:
  1. Samples will be taken for compressive strength testing for each 30 cu. yds. or portion thereof placed each day.
  2. Each sample shall consist of four molded specimens for compressive strength testing.
  3. Sampling, curing and storing of grout specimens for compressive strength testing shall be in accord with ASTM C1019-05.
- F. Laboratory testing: Laboratory testing for compressive strength of grout will be performed in accord with ASTM C1019-05. Testing of one specimen will be performed at three days, one at seven days and one at 28 days.
- G. Grout test report: Provide information required in ASTM C1019-05.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials, except aggregate, in original unopened containers displaying product name, type, grade and mixing instructions.

**PART 2 - PRODUCTS**

2.1 MATERIALS:

- A. Portland cement: Meeting ASTM C150-07, Type I, domestic manufacture.
- B. Hydrated lime: Meeting ASTM C207-06, Type S.
- C. Aggregate:
  1. Fine grout: Meeting ASTM C404-06, fine aggregate, size #1.
  2. Coarse grout: Meeting ASTM C33-03, size #7, maximum.
- D. Superplasticizing admixture for cement grout:
  1. Acceptable products:
    - a. Anti-Hydro International, Inc., A-H Super P.
    - b. BASF Admixtures, Inc., Rheobuild 1000.
    - c. The Euclid Chemical Co., Melment L10A Super.
    - d. Sika Corp., Sikament 300.
  2. Characteristics: Meeting ASTM C494-05a, Type F; free of chloride ions.
- E. Water: Clean, potable, free from deleterious amounts of alkalies, acids and organic materials.

2.2 PROPORTIONS:

- A. Proportion in accord with ASTM C476-02, except where more stringent requirements are specified herein.

- B. Fine grout: Use for grouting where void to be filled has a minimum dimension of 2" or less. Proportion materials by volume to provide minimum 3000 psi compressive strength at 28 days in accord with ASTM C1019-05.
- C. Coarse grout: Use for grouting where void to be filled has a dimension greater than 2". Proportion by volume to provide minimum 3000 psi compressive strength at 28 days in accord with ASTM C1019-05.
- D. Provide superplasticizer in all cement grout mixes.

### **PART 3 - EXECUTION**

#### 3.1 MIXING:

- A. Control batching procedure to ensure volume proportions of grout materials and achieve grout slump between 8" and 11".
- B. Mix grout in accordance with ASTM C94-07.
- C. Measure grout materials mixed at job site by volume and mix ingredients in mechanical mixer for a minimum of five minutes after additions of materials.
- D. Addition of other admixtures, including chloride-based admixtures and antifreeze ingredients, will not be permitted.
- E. Discard grout not placed within 1-1/2 hour after water is added to mix, or sooner if grout begins to set.

#### 3.2 PLACING GROUT:

- A. Place grout as directed in Concrete Unit Masonry section.

End of Section

SECTION 04 0523  
MASONRY ACCESSORIES

**PART 1 - GENERAL**

1.1 SUMMARY:

- A. Related work specified elsewhere:
  - 1. Concrete.
  - 2. Mortar and masonry grout.
  - 3. Cement grout for reinforced masonry.
  - 4. Concrete unit masonry.
  - 5. Brick masonry.
  - 6. Joint sealants.

1.2 SUBMITTALS:

- A. Product data: Include manufacturer's product literature and installation instructions. Indicate fastener type and length for each installation condition. Indicate corrosion protection for each item including fasteners.
- B. Samples: Submit individual samples of reinforcement, accessories, fasteners and anchors.
- C. Shop drawings: Indicate bar bending details, bar lists and placement drawings for reinforcement.
- D. Mill tests:
  - 1. Submit for each heat of reinforcing steel, certifying mill tests conducted in accord with ASTM requirements.
  - 2. Costs for tests shall be borne by Contractor.
  - 3. Unidentified bundles may be rejected or tested at request of Architect. Cost of tests on unidentified bundles shall be borne by Contractor.
  - 4. Submit three copies of each test report to Architect.

1.3 QUALITY ASSURANCE:

- A. Applicable standards; standards of the following as referenced herein:
  - 1. American Concrete Institute (ACI).
  - 2. ASTM International (ASTM).
  - 3. Steel Structures Painting Council (SSPC).
- B. Design criteria; masonry wall ties: Two-component tie design shall allow maximum clearance dimension between tie component and back-up plate of 0.05", and a maximum of 0.05" deformation in tie assembly when subjected to 100 lbs. load in either tension or compression, while allowing both vertical and horizontal movement in plane parallel to wall.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver reinforcement and accessories in bundles or boxes with waterproof tags. Maintain tags attached until material is incorporated into work.
- B. Deliver and handle materials to prevent damage or weakening.

- C. Prevent accumulation of rust or debris on reinforcement accessories during storing. Store off ground and under cover.

## **PART 2 - PRODUCTS**

### 2.1 MASONRY JOINT REINFORCEMENT:

- A. Acceptable manufacturers; subject to compliance with specified requirements:
  - 1. Dur-O-Wal, Inc., A Dayton-Superior Co.
  - 2. Hohmann & Barnard, Inc.
  - 3. Masonry Reinforcing Corporation of America.
- B. Masonry joint reinforcement:
  - 1. Material: Cold-drawn wire in accord with ASTM A82-05a.
  - 2. Types:
    - a. At single wythe masonry: Truss type.
    - b. At double wythe masonry where veneer coursing lines up with coursing of masonry backup: Truss type with box ties at unreinforced masonry; ladder type with box ties at reinforced masonry; box ties and cross wires spaced at 1'-4" o. c.
    - c. At double wythe masonry where veneer coursing does not align with coursing of masonry backup: Truss type with adjustable box ties at unreinforced masonry; ladder type with adjustable box ties at reinforced masonry; box ties and cross wires spaced at 1'-4" o. c.
  - 3. Longitudinal rods: Nine ga. deformed rods.
  - 4. Cross rods: Nine ga. rods, welded to longitudinal rods.
  - 5. Width of reinforcement shall be 2" less than total wall width, except that for architectural concrete masonry units, width shall be 3" less than total wall width.
  - 6. Provide reinforcement in minimum 10'-0" lengths with prefabricated corners and tees at intersecting walls of same design, and finish as joint reinforcement.
  - 7. Fabricate reinforcement for cavity wall construction with moisture drips in each cross rod.
- C. Finishes:
  - 1. Joint reinforcement at interior construction: Mill galvanized, meeting ASTM A641-03 (0.10 oz. Zinc Coating/Ft<sup>2</sup>).
  - 2. Joint reinforcement, wire ties and anchors in exterior walls and interior walls exposed to mean relative humidity exceeding 75 percent: Hot dip galvanized, complying with ASTM A153-05, Class B-2.

### 2.2 MASONRY VENEER ANCHOR SYSTEM:

- A. Acceptable products; subject to compliance with specified characteristics:
  - 1. Dur-O-Wal, Inc., A Dayton-Superior Co., D/A 213 Assembly with anchor plate and pintle tie.
  - 2. Heckmann Building Products, Inc., No. 213 Wire Veneer Anchor System with No. 282 Double Pintle Wire Tie.

3. Wire-Bond, RJ-711 Adjustable Veneer Anchor.

B. Characteristics:

1. Type: Two-component tie assembly consisting of screw-attached back-up plate encapturing a wire vee tie.
2. Back-up plate: Minimum 16 ga. grooved or punched plate assembly or minimum 14 ga. stiffened plate assembly, punched for attachment to metal stud framing with two screws.
3. Wire tie: Minimum 3/16" wire vee tie.
4. Tie assembly: Size tie assembly to extend within 1" of exterior exposed veneer face.
5. Finish: Hot dip galvanized in accord with ASTM A153-05, Class B-2.

- C. Fasteners: Self-tapping steel screws, corrosion-resistant coated; passing Kesternich test chamber, DIN 50018 standard with no indications of red rust or corrosion after minimum 30 wet and dry acidic atmosphere cycles and minimum 1000 hours salt spray testing in accord with ASTM B117-07.

2.3 "Z" ANCHORS FOR CORNER CONDITIONS:

A. Characteristics:

1. Type: Strap with 2" long 90 degree bends at each end to form a "Z" shape.
2. Material: Steel.
3. Size: Minimum 1/4" by 1-1/2" by 2'-4".
4. Finish: Hot dip galvanized in accord with ASTM A153-05, Class B-2.

2.4 BAR REINFORCEMENT:

- A. Material: Meeting ASTM A615-07, ACI 530 and ACI 530.1.
- B. Bars: Deformed type, Grade 60.
- C. Ties and stirrups: Grade 60.

2.5 VERTICAL REINFORCING BAR POSITIONERS:

A. Acceptable products; subject to compliance with specified requirements:

1. Dur-O-Wal, Inc., A Dayton-Superior Co., D/A 812.
2. Heckmann Building Products, Inc., 377.
3. Wire-Bond, 3401.

B. Characteristics:

1. Type: Spider shaped positioner allowing rebar to be placed at center of wall or on either side of cavity.
2. Material: Minimum 9 gauge steel wire.
3. Finish: Hot dip galvanized in accord with ASTM A153-05, Class B-2.

2.6 PRESSURE RELIEVING PADS:

A. Acceptable products; subject to compliance with specified requirements:

1. Dur-O-Wal, Inc., A Dayton-Superior Co., Rapid Soft-Joint, D/A 2010.

2. Hohmann & Barnard, Inc., #NS.
  3. Wire-Bond, Horizontal/Vertical Expansion Joint.
- B. Type: Self-adhering, closed cell neoprene conforming to ASTM D1056-07, Class RE41, for compression up to 35%.
- C. Sizes:
1. Horizontal joints: 2-3/4" depth by 1/4" width.
  2. Vertical joints: 3" depth by width matching joint width.
- 2.7 RUBBER CONTROL JOINTS:
- A. Acceptable products; subject to compliance with specified requirements:
1. Dur-O-Wal, Inc., A Dayton-Superior Co., Rapid Control Joint.
  2. Hohmann & Barnard, Inc., RS Series, Rubber Control Joint.
  3. Wire-Bond, Control Joint 2900 Series.
- B. Type: Extruded rubber meeting ASTM D2000-06a, Type 2AA, 805, minimum 80 durometer hardness.
- 2.8 MORTAR NET:
- A. Acceptable products; subject to compliance with specified requirements:
1. Advanced Building Products, Inc., Mortar Maze.
  2. Mortar Net USA, Ltd., Mortar Net.
- B. Characteristics:
1. Type: Mesh designed to catch and hold mortar droppings in an irregular pattern. Mesh shall not trap moisture or water. Mesh shall not support mold or fungus.
  2. Material: High density polyethylene or nylon strands woven into a 90% open mesh.
  3. Thickness: Match thickness of cavity.
- 2.9 WIRE MESH HARDWARE CLOTH:
- A. Characteristics:
1. Material: 1/2" by 16 ga. steel mesh.
  2. Size: 2" less than wall width by 1'-4" long minimum.
  3. Finish: Hot dip galvanized in accord with ASTM A153-05, Class B-2.
- 2.10 COLD GALVANIZING COMPOUND:
- A. Cold galvanizing compound: Pre-mixed, zinc dust and organic binders formulated specifically for use on steel surfaces. Compounds shall have concentrations of zinc dust in the range of 65% to 69% or above 92% in the dried film in accord with ASTM A780-01(2006).

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION:**

##### **A. General:**

1. Install reinforcement and accessories in accord with manufacturer's product data. Provide sizes and methods of attachment as required by installation conditions. In addition to installation spacings specified, provide specified reinforcement and accessories at perimeter of windows, doors and other openings.
2. Where galvanized components must be field-welded to supports, remove galvanizing prior to welding.
3. Limit misalignment of bed joints in one wythe to bed joint in second wythe of multi-wythe construction to 1-1/4".

##### **B. Install masonry joint reinforcement in masonry walls at 1'-4" o. c. vertically. Lap side rods 6" minimum at splices; greater as required by product data.**

1. Stop reinforcement 1" back from expansion and control joints and openings in masonry walls.
2. Install reinforcement in first and second bed joint above and under openings, with noncontinuous reinforcement extending 2'-0" beyond jamb, each side.
3. Install ladder type joint reinforcement with cross wires aligned with head joints of concrete masonry units.
4. At splices, cross rods may be removed to facilitate placement.

##### **C. Attach masonry veneer anchor plates through sheathing to studs using specified fasteners.**

1. Install two fasteners per anchor plate assembly.
2. Space anchor plates at 1'-4" o. c., each direction.
3. Install one tie per plate, using specified fasteners.

##### **D. Install vertical reinforcing bar positioners in reinforced masonry walls as specified in Concrete Unit Masonry section.**

##### **E. Bar reinforcement:**

1. Shop fabricate reinforcement to shape and dimensions indicated on approved shop drawings. Bent bars shall be bent cold. Fabricate in accord with ACI 315 and ACI 318.
2. Reinforcement shall, at the time of placing, be free from rust scale, oil and other coatings reducing bond. Use no bar with kinks or bends not shown on shop drawings.
3. Install reinforcement as specified in Concrete Unit Masonry section.

##### **F. Install "Z" anchors in connection of intersecting walls at maximum 4'-0" o. c., vertically.**

##### **G. Install vertical and horizontal pressure relieving pads in masonry construction at locations indicated.**

1. Joint sizes shall match masonry joint widths.
2. Keep joints clean of masonry droppings.

3. Install pressure relieving pads with lengths butted.
  4. Install horizontal pressure relieving pads under shelf angles.
  5. Caulk joints using sealant as specified in Joint Sealants section. Joints shall be watertight and free from voids after caulking.
- H. Install rubber control joints as specified in Concrete Unit Masonry section. Location of control joints in masonry construction shall be as indicated on drawings.
- I. Install mortar net in cavity walls in collar joint or cavity resting on flashing. Position with profiled side up.
- J. Install wire mesh hardware cloth at concrete masonry units to prevent migration of grout from masonry units, where units are indicated to be grouted.
- K. Repair of galvanized surfaces: After installation, clean surfaces from which galvanizing was removed during installation in accord with SSPC-SP 3, "Power Tool Cleaning". Coat surfaces with cold galvanizing compound, 3.0 mils minimum dry film thickness.

End of Section

SECTION 04 2113

BRICK MASONRY

**PART 1 - GENERAL**

1.1 SUMMARY:

- A. Related work specified elsewhere:
  - 1. Precast Architectural Concrete
  - 2. Cold formed metal framing.
  - 3. Rough carpentry.
  - 4. Concrete unit masonry.
  - 5. Joint sealants.
- B. Work installed but furnished under other sections:
  - 1. Mortar and masonry grout.
  - 2. Masonry accessories.
  - 3. Steel lintels.
  - 4. Self-adhering sheet flashing.
- C. Definition: Face brick: Exposed brick beginning two courses below finish grade.

1.2 SUBMITTALS:

- A. Product data: Submit manufacturer's product data, mixing and application procedures for masonry cleaning compound.
- B. Certificates: Indicate that materials supplied comply with specification requirements. Certificates shall be signed by brick manufacturer and shall state quantities and dates shipped.
- C. Samples: Submit five actual bricks indicating range of color, texture and size to be expected in finished work.

1.3 QUALITY ASSURANCE:

- A. Applicable standards; standards of the following, as referenced herein:
  - 1. ASTM International (ASTM).
  - 2. Southern Brick Institute (SBI) and Brick Institute of America (BIA).

1.4 PROJECT/SITE CONDITIONS:

- A. Cold-weather construction: Implement cold weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.8 C, or the following procedures, when either ambient temperature falls below 40F or temperature of masonry units is below 40°F.
  - 1. Preparation:
    - a. Provide temperatures of masonry units not less than 20°F when laid in masonry. Do not lay masonry units containing frozen moisture, visible ice or snow on their surface.

- b. Remove visible ice and snow from top surface of existing foundations and masonry to receive new construction. Heat these surfaces to above freezing, using methods that do not result in damage.
2. Construction: The following requirements shall apply to work in progress and shall be based on ambient temperature.
  - a. Meet the following construction requirements when ambient temperature is between 40°F and 32°F:
    - 1) Do not heat water and aggregates used in mortar and grout above 140°F.
    - 2) Heat mortar sand or mixing water to produce mortar temperatures between 40°F and 120°F at time of mixing. Heat water and aggregates for grout if they are below 32°F.
  - b. Meet requirements of Building Code and the following construction requirements when ambient temperature is between 32°F and 25°F:
    - 1) Maintain mortar temperature above freezing until used in masonry.
    - 2) Heat aggregates and mixing water for grout to produce grout temperature between 70°F and 120°F at time of mixing. Maintain grout temperature above 70°F at time of grout placement.
  - c. Meet requirements of Building Code and the following construction requirements when ambient temperature is between 25°F and 20°F:
    - 1) Heat masonry surfaces under construction to 40°F.
    - 2) Provide wind breaks or enclosures when the wind velocity exceeds 15 miles per hour (mph).
    - 3) Prior to grouting, heat masonry to a minimum of 40°F.
  - d. Meet requirements of Building Code and the following construction requirements when ambient temperature is below 20°F: Provide enclosures and auxiliary heat to maintain air temperature within enclosure to above 32°F.
3. Protection: Requirements of this section and Building Code apply after masonry is placed and shall be based on anticipated minimum daily temperature for grouted masonry and anticipated mean daily temperature for ungrouted masonry.
  - a. When temperature is between 40°F and 25°F, cover newly constructed masonry with a weather-resistive membrane for 24 hours after being completed.
  - b. When temperature is between 25°F and 20°F, cover newly constructed masonry with weather-resistive insulating blankets, or equal protection, for 24 hours after being completed. Extend time period to 48 hours for grouted masonry, unless the only cement in grout is Type III Portland cement.

- c. When temperature is below 20°F, maintain newly constructed masonry at a temperature above 32°F for at least 24 hours after being completed by using heated enclosures, electric heating blankets, infrared lamps or other acceptable methods. Extend time period to 48 hours for grouted masonry, unless the only cement in grout is Type III Portland cement.
- B. Hot weather construction: Implement hot weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.8 D, or the following procedures, when temperature or temperature and wind-velocity limits of this section are exceeded.
1. Preparation: Meet the following requirements prior to conducting masonry work.
    - a. Temperature: When ambient temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph (13 km/h):
      - 1) Provide necessary conditions and equipment to produce mortar having a temperature below 120°F.
      - 2) Maintain sand piles in a damp, loose condition.
    - b. Special Conditions: When ambient temperature exceeds 115°F, or 105°F with a wind velocity greater than 8 mph (13 km/h), implement requirements of Building Code, and shade materials and mixing equipment from direct sunlight.
  2. Construction: Meet the following requirements while masonry work is in progress.
    - a. Temperature: When ambient temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph (13 km/h):
      - 1) Maintain temperature of mortar and grout below 120°F.
      - 2) Flush mixers, mortar transport containers and mortar boards with cool water before they come into contact with mortar ingredients or mortar.
      - 3) Maintain mortar consistency by retempering with cool water.
      - 4) Mortar shall be used within 2 hours of initial mixing.
  3. Special conditions: When ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph, implement requirements of Building Code using cool mixing water for mortar and grout. The use of ice is permitted in mixing water prior to use. Do not use ice in mixing water when added to other mortar or grout materials.
  4. Protection: When mean daily temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph (13 km/h), fog-spray newly constructed masonry until damp at least three times a day until masonry is three days old.

- C. Protection of work:
1. During erection, at end of each day or shutdown period, keep walls dry by covering with waterproof material, anchored and overhanging each side of wall at least 2'-0".
  2. Remove misplaced mortar or grout immediately.
  3. Protect face materials against staining.
  4. Protect sills, ledges and offsets from mortar droppings during construction.
- D. Sequencing and scheduling: Do not enclose or cover mechanical or electrical work requiring inspection until such work has been accepted. Coordinate this work with work of other sections required to be built into masonry construction.

## **PART 2 - PRODUCTS**

### 2.1 FACE BRICK:

- A. Acceptable manufacturers:
1. Boral Bricks, Inc.
  2. Carolina Cermics.
  3. Endicott Clay Products Co.
  4. Glen-Gery Corp.
  5. Hanson Brick.
  6. Hebron Brick Co.
  7. Interstate Brick.
  8. Jenkins Brick Co.
  9. Taylor Clay Products, Inc.
  10. Tri State.
- B. Basis of design for brick masonry shall be Hebron Brick Co., Red River Blend, Velour. Products of other manufacturers may be submitted for Architect's consideration, subject to compliance with specified criteria.

### 2.2 ACCESSORIES:

- A. Weepholes:
1. Weephole ventilators for full head joint installation at grade level.
    - a. Acceptable products:
      - 1) Dur-O-Wal, Cell-Vent D/A 1006.
      - 2) Hohmann & Barnard, Inc., QV - Quadro-Vent.
      - 3) Wire-Bond, Cell Vent.
    - b. Characteristics: Flexible ultra-violet resistant polypropylene co-polymer vent with cellular structure. Color shall be as selected by Architect.
  2. Weep tubes with screens and wicks for all areas except grade level:
    - a. Acceptable products:
      - 1) AA Wire Products Co., #AA223KW;
      - 2) Hohmann & Barnard, Inc., #341.

- b. Characteristics: 3/8" o.d. plastic tubes with brass screening at face and twisted synthetic rope wicks inserted in tube and extending minimum 6" at back (cavity) side.
- B. Masonry cleaning compound: Use compound as recommended by brick manufacturer and cleaning compound manufacturer for selected brick, to ensure proposed masonry cleaning compound causes no staining nor discoloration of brick. Test cleaning compound on sample panel, as further specified.
1. Acceptable products:
    - a. Diedrich Technologies, Inc.,
      - 1) For dark colored brick and brick subject to non-metallic staining: 200 Lime Solv or 202 New Masonry Detergent.
      - 2) For light colored brick and brick subject to metallic staining: 202V Vana-Stop.
    - b. ProSoCo, Inc.,
      - 1) For dark colored brick and brick subject to non-metallic staining: 101 Lime Solvent or Sure Klean 600.
      - 2) For light colored brick and brick subject to metallic staining: Vana Trol.
  2. Type: Compound of organic and inorganic acids, wetting agents and inhibitors.

### **PART 3 - EXECUTION**

#### 3.1 SAMPLE WALL PANEL:

- A. Lay 6'-0" long by 4'-0" high sample wall panel of face brick using mortar as specified in Mortar and Masonry Grout section and reinforced concrete unit masonry and cold formed metal framing backup as specified in other sections. Orient panel as directed by Architect.
- B. Perform brick cleaning on completed sample panel, to ensure proposed masonry cleaning compound causes no staining nor discoloration of brick.
- C. Indicate the following:
  1. Bonding.
  2. Mortar color.
  3. Joint tooling.
  4. Brick color and texture.
  5. Reinforcement.
  6. Workmanship.
  7. Cavity clearance.
  8. Brick cleaning.
- D. Prepare panel at least 14 days prior to beginning masonry work. Should panel be disapproved, prepare additional panels until approved by Architect.
- E. Maintain panel throughout work as standard of masonry work. Do not destroy panel until directed by Architect. Undamaged, approved panel may remain as part of the complete work.

### 3.2 INSTALLATION:

- A. Workmanship: Install no cracked, broken or chipped units exceeding ASTM allowances.
1. Use abrasive power saws to cut brick. Avoid slivers less than one-third brick width.
  2. Lay brick plumb, true to line and with level courses, spaced within allowable tolerances.
  3. Do not furrow bed joints.
  4. Stop-off horizontal run by racking back in each course; toothing is not permitted.
  5. Adjust units to final position while mortar is soft and plastic.
  6. If units are displaced after mortar has stiffened, remove, clean joints and units of mortar, and relay with fresh mortar.
  7. Cutting and patching of finish masonry to accommodate work of other trades shall be done so as not to mar appearance of finished surface.
  8. Adjust shelf angles to keep work level and at proper elevation. Provide for a 3/8" joint below shelf angle.
  9. Mix units from pallets in work to diminish noticeable variation in color and texture between pallets.
  10. Provide brick expansion joints with pressure-relieving pads continuous under shelf angles.
  11. When joining fresh masonry to set or partially set masonry, remove loose brick and mortar, and clean and dampen exposed surface of set masonry prior to laying fresh masonry.
  12. Provide solid brick units free of cores or frogs where such characteristics would be exposed in the finished work.
  13. Wet brick with initial rate of absorption exceeding 30 grams/30 sq. in./min. when tested in accord with ASTM C67-07.
  14. Cavity walls: Keep cavity clear of mortar and other materials which project into cavity and decrease cavity clearance to less than minimum dimension indicated.
- B. Mortar beds:
1. Lay brick with full mortar coverage on horizontal and vertical joints in all courses.
  2. Provide sufficient mortar on ends of brick to fill head joints.
  3. Rock closures into place with head joints thrown against two adjacent bricks in place.
  4. Do not pound corners or jambs to fit stretcher units after setting in place.
  5. Where adjustment to corners or jambs must be made after mortar has started to set, remove mortar and replace with fresh mortar.
- C. Mortar joints:
1. Nominal thickness: 3/8".
  2. Tool joints exposed in finished work when "thumbprint" hard. Joints shall be tooled using a jointer at least 2'-0" in length.
  3. Joint profile: Concave.

4. Trowel point or concave tool joints below grade.
  5. Flush-cut joints not to be exposed in finished work.
  6. As work progresses, trowel protruding mortar fins in cavity flat to inner face of wythe.
- D. Bonding pattern: 1/3 coursing.
- E. Brick expansion joints: Install materials in accord with Masonry Accessories section. Joint size shall be same width as mortar joints.
1. Space pressure-relieving pads at expansion joints indicated on drawings.
  2. Coordinate location of expansion joints in brick work with control joints in unit masonry backup.
- F. Building expansion joints: Keep clean of mortar and debris. Make joints 1" wide. Stop horizontal joint reinforcement 1" each side of joint. Caulk in accord with Joint Sealants section.
- G. Flashing:
1. Clean surface of masonry smooth and free from projections which might puncture flashing material.
  2. Place through-wall flashing on bed of mortar and cover with mortar as specified in Self-Adhering Sheet Flashing section.
- H. Weepholes:
1. Provide weepholes in exterior wythe of masonry at 1'-4" o. c. horizontally at heads and sills of openings, in exterior walls at grade and in other locations where flashing is indicated.
  2. Weephole ventilators:
    - a. Provide weephole ventilators at grade level.
    - b. Install weephole ventilator in open head joint, flush with low edge of adjacent brick.
  3. Install weep tubes at all weep holes except at grade level where weephole ventilators are installed. Install weep tubes at bottom of head joint with screening to exterior; lay extra length of wick horizontally in cavity.
  4. Keep weep holes and area above flashing free of mortar droppings.
  5. Install cavity mortar drainage net in cavity behind wicks. Install continuous at grade.
- I. Sealant joints: Retain 1/2" wide sealant joint around outside perimeter of exterior doors, window frames and other wall openings.
- J. Pointing: Cut out defective mortar joints and holes in exposed work. Repoint with new mortar.
- K. Dry cleaning: Brush brick surfaces with stiff bristle brush. Do not allow mortar droppings to harden on exposed surfaces.

### 3.3 SITE TOLERANCES:

- A. Acceptable tolerances:
1. Maximum variation from plumb:
    - a. In lines and surfaces of walls and arrises:
      - 1) 1/4" in 10'-0".
      - 2) 3/8" in any story or 20'-0" maximum.
      - 3) 1/2" in 40'-0" or more.
    - b. For external corners, expansion joints and other conspicuous lines:
      - 1) 1/4" in any story or 20'-0" maximum.
      - 2) 3/8" in 40'-0" or more.
  2. Maximum variation from level or grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
    - a. 1/4" in any bay or 20'-0".
    - b. 1/2" in 40'-0" or more.
  3. Maximum variation of linear building line from established position in plan and related portions of columns, walls and partitions:
    - a. 1/2" in any bay or 20'-0".
    - b. 3/4" in 40'-0" or more.
  4. Maximum variation in cross-sectional dimensions of columns and thickness of walls: Not less than 1/4" smaller nor more than 1/2" larger than indicated.

### 3.4 FINAL CLEANING:

- A. At least 21 days prior to application of specified cleaning solution to brick work, apply solution on half of the surface of sample panel. Should discoloration of brick or mortar joints, staining or efflorescence appear on sample panel, notify Architect and await further instructions.
- B. No wet cleaning shall take place within seven days of placing masonry.
- C. Apply masonry cleaning compound on brick masonry as tested on sample panel in accord with manufacturer's product data. Flush with clean water.
- D. At least two hours prior to application of cleaning solution to brick work, saturate mortar joints with clean water and flush off loose debris.
- E. Begin cleaning process at highest point of wall, working downward. Work in areas of 20 sq. ft., maximum. As cleaning progresses, flush wall to prevent accumulation of scum.
- F. Safely discard solutions containing debris and residue.
- G. Do not scrub mortar joints with cleaning solution.
- H. Protect materials adjacent to brick work which are subject to corrosion from contact with cleaning solution.
- I. Remove stains in accord with recommendations of the SBA/BIA, Technical Notes #20. Use cleaning agents only after pre-testing on sample panel.

End of Section

SECTION 04 2200

CONCRETE UNIT MASONRY

**PART 1 - GENERAL**

1.1 SUMMARY:

- A. Work of this section includes architectural and standard concrete masonry units, and building in of work of other trades.
- B. Related work specified elsewhere:
  - 1. Concrete.
  - 2. Concrete reinforcing.
  - 3. Brick masonry.
  - 4. Water-repellent coating.
- C. Work installed but furnished under other sections:
  - 1. Mortar and masonry grout.
  - 2. Cement grout for reinforced masonry.
  - 3. Masonry accessories.
  - 4. Flexible flashing.
  - 5. Metal door frame wall anchors.

1.2 SUBMITTALS:

- A. Samples: Submit three samples for each type of architectural concrete masonry unit, indicating range of color and texture to be expected in finished work, if requested by the Architect.
- B. Certificates:
  - 1. Submit certificates from masonry manufacturer prior to delivery of concrete masonry units to project site. Each certificate shall be signed by an authorized officer of the manufacturing company and shall contain the name and address of the Contractor, the project location and the quantities and date or dates of shipment or delivery to which the certificate applies.
  - 2. Units shall be certified for compliance with specification requirements, including compressive strength, moisture content and linear drying shrinkage.
  - 3. Time-rated, fire-resistant masonry units shall be certified by manufacturer to comply with mix design and equivalent thickness requirements of Underwriters Laboratories, Inc., (UL) for time ratings indicated. Certification shall include evidence of manufacturer's qualification to manufacture fire-rated units.

1.3 QUALITY ASSURANCE:

- A. Applicable standards:
  - 1. Standards of ASTM International (ASTM), as referenced herein.
  - 2. Portland Cement Association (PCA), "Concrete Masonry Handbook".

- B. Manufacturer's qualification: Manufacturer of time-rated, fire-resistant masonry units shall be qualified in writing by Underwriters Laboratories, Inc., (UL) for manufacture of fire-rated units.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Keep units dry. Allow air circulation around stacked units. Wet concrete masonry units shall not be installed.
- B. Protect units to be exposed in finish work from staining and physical damage of exposed faces.
- C. Segregate pallets of various fire-rated units from each other and from other non-rated units; maintain clear indication of rating of stored units for easy identification and selection.

1.5 PROJECT/SITE CONDITIONS:

- A. Cold-weather construction: Implement cold weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.8 C, or the following procedures, when either ambient temperature falls below 40°F or temperature of masonry units is below 40°F.
  - 1. Preparation:
    - a. Provide temperatures of masonry units not less than 20° F when laid in masonry. Do not lay masonry units containing frozen moisture, visible ice or snow on their surface.
    - b. Remove visible ice and snow from top surface of existing foundations and masonry to receive new construction. Heat these surfaces to above freezing, using methods that do not result in damage.
  - 2. Construction: The following requirements shall apply to work in progress and shall be based on ambient temperature.
    - a. Meet the following construction requirements when ambient temperature is between 40°F and 32°F:
      - 1) Do not heat water and aggregates used in mortar and grout above 140°F.
      - 2) Heat mortar sand or mixing water to produce mortar temperatures between 40°F and 120°F at time of mixing. Heat water and aggregates for grout if they are below 32°F.
    - b. Meet requirements of Building Code and the following construction requirements when ambient temperature is between 32°F and 25°F:
      - 1) Maintain mortar temperature above freezing until used in masonry.
      - 2) Heat aggregates and mixing water for grout to produce grout temperature between 70°F and 120°F at time of mixing. Maintain grout temperature above 70°F at time of grout placement.

- c. Meet requirements of Building Code and the following construction requirements when ambient temperature is between 25°F and 20°F:
    - 1) Heat masonry surfaces under construction to 40°F.
    - 2) Provide wind breaks or enclosures when the wind velocity exceeds 15 miles per hour (mph).
    - 3) Prior to grouting, heat masonry to a minimum of 40°F.
  - d. Meet requirements of Building Code and the following construction requirements when ambient temperature is below 20°F: Provide enclosures and auxiliary heat to maintain air temperature within enclosure to above 32°F.
3. Protection: Requirements of this section and Building Code apply after masonry is placed and shall be based on anticipated minimum daily temperature for grouted masonry and anticipated mean daily temperature for ungrouted masonry.
- a. When temperature is between 40°F and 25°F, cover newly constructed masonry with a weather-resistive membrane for 24 hours after being completed.
  - b. When temperature is between 25°F and 20°F, cover newly constructed masonry with weather-resistive insulating blankets, or equal protection, for 24 hours after being completed. Extend time period to 48 hours for grouted masonry, unless the only cement in grout is Type III Portland cement.
  - c. When temperature is below 20°F, maintain newly constructed masonry at a temperature above 32°F for at least 24 hours after being completed by using heated enclosures, electric heating blankets, infrared lamps or other acceptable methods. Extend time period to 48 hours for grouted masonry, unless the only cement in grout is Type III Portland cement.
- B. Hot weather construction: Implement hot weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.8 D, or the following procedures, when temperature or temperature and wind-velocity limits of this section are exceeded.
1. Preparation: Meet the following requirements prior to conducting masonry work.
    - a. Temperature: When ambient temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph (13 km/h):
      - 1) Provide necessary conditions and equipment to produce mortar having a temperature below 120°F.
      - 2) Maintain sand piles in a damp, loose condition.
    - b. Special conditions: When ambient temperature exceeds 115°F, or 105°F with a wind velocity greater than 8 mph (13 km/h), implement requirements of Building Code, and shade materials and mixing equipment from direct sunlight.

2. Construction: Meet the following requirements while masonry work is in progress.
    - a. Temperature: When ambient temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph (13 km/h):
      - 1) Maintain temperature of mortar and grout below 120°F.
      - 2) Flush mixers, mortar transport containers and mortar boards with cool water before they come into contact with mortar ingredients or mortar.
      - 3) Maintain mortar consistency by retempering with cool water.
      - 4) Mortar shall be used within 2 hours of initial mixing.
  3. Special conditions: When ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph, implement requirements of Building Code using cool mixing water for mortar and grout. The use of ice is permitted in mixing water prior to use. Do not use ice in mixing water when added to other mortar or grout materials.
  4. Protection: When mean daily temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph (13 km/h), fog-spray newly constructed masonry until damp at least three times a day until masonry is three days old.
- C. Protection of work:
1. Keep walls dry during erection by covering at end of each work period with a waterproof membrane. Similarly protect partially completed walls not being worked on. Covering shall overhang at least 2'-0" on each side of wall and shall be anchored on each side of wall.
  2. Protect finished exposed work from stains.
  3. Mortar droppings sticking to unit faces shall be allowed to dry and then be removed with trowel, and surface lightly scrubbed with bristled brush.
  4. Particular care shall be given to keeping masonry units clean in areas not to be painted.
- D. Install and inspect mechanical and electrical work prior to enclosing or covering with masonry. Where runs of piping or conduit are required, cut away web of masonry unit without disturbing face or bond.
- E. Coordinate installation of masonry anchors with structural system to which masonry is attached.

## **PART 2 - PRODUCTS**

### **2.1 CONCRETE MASONRY UNITS:**

- A. Hollow load-bearing units:
1. Meeting ASTM C90-06b, normal weight.
  2. Nominal face dimensions: 8" by 1'-4".
  3. Depths: As indicated on drawings.

- B. Fire-rated units: Manufacture in accord with UL-618.
- C. Architectural concrete masonry units:
  - 1. Acceptable manufacturer: Metromont Materials Corp.
  - 2. Meeting ASTM C90-06b, normal weight.
  - 3. Nominal face dimensions: 8" by 1'-4"
  - 4. Pattern: Split face.
  - 5. Color: Standard color as selected by Architect.
  - 6. Furnish special factory corner units and other special shapes as indicated on drawings.
- D. Units shall be manufactured with normal weight aggregate meeting ASTM C33-03.
- E. Water repellent additive for architectural units:
  - 1. Acceptable products:
    - a. BASF Admixtures, Rheopel® WR.
    - b. W. R. Grace & Co.-Conn., Dry Block Integral Water-Resistant Admixture.
  - 2. Characteristics: Integral water-repellent additive, added during architectural concrete masonry unit production in proportions recommended by product data.
  - 3. Architectural concrete masonry units shall have an absorption rate between 7 and 10 lbs./cu. ft. After treatment with water repellent additive.
- F. Exposed external corners of interior concrete masonry units shall be square type.
- G. Masonry units for use in reinforced masonry construction shall be plain (square) end units.

## 2.2 ACCESSORY PRODUCTS:

- A. Weepholes:
  - 1. Weephole ventilators for full head joint installation at grade level.
    - a. Acceptable products:
      - 1) Dur-O-Wal, Cell-Vent D/A 1006.
      - 2) Hohmann & Barnard, Inc., QV - Quadro-Vent.
      - 3) Wire-Bond, Cell Vent.
    - b. Characteristics: Flexible ultra-violet resistant polypropylene co-polymer vent with cellular structure. Color shall be as selected by Architect.
  - 2. Weep tubes with screens and wicks for all areas except grade level:
    - a. Acceptable products:
      - 1) AA Wire Products Co., #AA223KW;
      - 2) Hohmann & Barnard, Inc., #341.
    - b. Characteristics: 3/8" o.d. plastic tubes with brass screening at face and twisted synthetic rope wicks inserted in tube and extending minimum 6" at back (cavity) side.
- B. Masonry cleaning compound:
  - 1. Acceptable products:
    - a. Diedrich Technologies, Inc., 200 Lime Solv.
    - b. ProSoCo, H. D. Concrete Cleaner.

2. Type: compound of inorganic and organic acids, wetting agents and inhibitors.

### **PART 3 - EXECUTION**

#### 3.1 SAMPLE WALL PANEL:

- A. Lay 6'-0" long by 4'-0" high sample wall panel for concrete unit masonry in conjunction with face brick sample panel specified in Brick Masonry section.
- B. Lay a 6'-0" long by 4'-0" high sample panel for architectural masonry work. Construct using a 4" nominal thickness architectural masonry face unit and backup construction indicated on drawings. Orient as directed by Architect.
- C. Indicate the following:
  1. Bonding.
  2. Mortar color.
  3. Joint tooling.
  4. Unit masonry color and texture.
  5. Reinforcement.
  6. Workmanship.
  7. Cavity clearance.
- D. Prepare panel at least 14 days prior to beginning masonry work. Should panel not be acceptable to the Architect, prepare additional panels until accepted by Architect.
- E. Maintain panel throughout work as standard of masonry work. Do not destroy panel until directed by Architect.
- F. Erect separate panel for each type of masonry unit or mortar color required.

#### 3.2 WORKMANSHIP:

- A. Lay only dry masonry units.
- B. Lay masonry plumb, level and true to line with accurate coursing as indicated on the drawings.
- C. Lay standard units in running bond with head joints centered in alternate courses.
- D. Lay architectural units in stacked bond with head joints aligned.
- E. Cutting of masonry shall be done with abrasive power saw. Lay out units to minimize cutting. When cutting architectural masonry, remove cutting residue immediately to avoid staining.

- F. Cavity walls: Keep cavity clear of mortar and other materials which project into cavity and decrease cavity clearance to less than minimum dimension indicated. Provide mortar net in bottom of cavity and at flashing. Grout bottom of cavity solid as indicated on drawings.
- G. Fire and smoke barrier identification:
1. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings shall be effectively and permanently identified with signs or stenciling in a manner acceptable to the Authority having Jurisdiction.
  2. Such identification shall be above any decorative ceiling and in concealed spaces.
  3. Suggested wording for fire and smoke barriers: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS."
- H. Site tolerances:
1. Maximum variation from plumb: 1/4" in 10'-0"; not exceeding 3/8" in 20'-0".
  2. Maximum variation from level: 1/4" in 20'-0"; not exceeding 1/2" in 40'-0" or more.
  3. Maximum variation in linear building line from location indicated: 1/2" in 20'-0".

### 3.3 BUILDING-IN OF OTHER WORK:

- A. Build in work of other trades indicated to be built-in with masonry, including anchors, wall plugs, expansion joints and accessories, as work progresses. Space and align built-in parts and exercise care not to displace other materials from position. Fill in spaces around built-in items with cement grout.
- B. Fill hollow metal frames in masonry walls with cement grout. Rake back 1/2" joint between hollow metal frame and adjacent masonry to receive sealant.
- C. Lay masonry to receive flashing with smooth joints without projections that could puncture flashing materials. Provide fresh mortar on both sides of flashing in masonry joints.
- D. Unless indicated otherwise, provide minimum 8" of solid end bearing full height of wall from floor to bearing points for lintels, beams and other load-supporting members by either solid block or filling cores with cement grout.
- E. Install accessory materials in accord with Masonry Accessories section.
1. Space pressure-relieving pads at control joints indicated on the drawings.
  2. Coordinate location of control joints in architectural masonry units with control joints in unit masonry backup.
- F. Provide lintels and bond beams where indicated using lintel blocks laid with joints matching adjacent work. Reinforcement shall be as indicated and block filled with concrete.

- G. No lintels are required for masonry openings of 3'-4" or less where support is provided by metal door frames and grouted with cement grout.

3.4 REINFORCED AND GROUTED UNIT MASONRY:

- A. Align vertical unit masonry cells to be filled to maintain unobstructed vertical cell, continuous to foundation, equal to the cell void of an individual masonry unit. Remove mortar droppings and debris from cells.
- B. Provide cleanouts at bottom of each vertical cell, at each pour of grout. Seal cleanouts after inspection of reinforcement, before grouting begins with concrete unit masonry face shell.
- C. Fabricate in accord with approved shop drawings.
- D. Provide dowels of same size as reinforcement at foundations at each vertical bar, as indicated on drawings.
- E. Install vertical reinforcing bar positioners at top of first course, at course below top of wall, and at a maximum space of 192 vertical bar diameters between top and bottom bar positioner.
- F. Install vertical reinforcement and horizontal bond beam reinforcement as indicated on drawings. Extend tops of vertical bars through openings made in bottom of bond beam units and bend horizontally into bond beam. Set anchor bolts and other devices indicated into bond beams prior to grouting.
  - 1. Placing tolerance for detailed position of vertical wall reinforcement:  $\pm 1/2"$ .
  - 2. Minimum distance between masonry unit faces and reinforcing bars:
    - a. Fine grout:  $1/4"$ .
    - b. Coarse grout:  $1/2"$ .
- G. Lap vertical bars not less than 2'-0". Extend bars into bond beams and foundation as indicated on drawings.
- H. Stop horizontal bond beam reinforcement 3" back from both sides of expansion and control joints.
- I. At specified reinforced cells, bond beams and open cells indicated to receive grout, fill solid as specified in Cement Grout For Reinforced Masonry section.
- J. Wet masonry prior to placement of grout. Wet no masonry until mortar has set and wetting will not damage mortar or mortar bond.
- K. Consolidate grout by working reinforcement bars and by rodding non-reinforced cells.

- L. Grout masonry in maximum 5'-0" high lifts. Form horizontal construction joints between lifts by stopping pour not less than 1-1/2" below top of uppermost course in lift. Form horizontal construction joint between lifts at courses to receive through-wall flashing.
- M. Provide not less than 8" of solid grouted end bearing, full height of wall, for lintels, beams, and other load-supporting members bearing on unit masonry walls.
- N. Prevent grout seepage or spillage onto exposed masonry unit faces.

### 3.5 MORTAR JOINTS:

- A. Bed joints for unreinforced partitions:
  - 1. Lay first course in full bed of mortar.
  - 2. On all other bed joints, apply mortar on face shell only of masonry unit already laid.
  - 3. On masonry unit to be laid, apply a beveled buttering to face shell to ensure full head joints.
- B. Bed joints for reinforced and fire-rated partitions:
  - 1. Lay all courses in full bed of mortar.
  - 2. Head joints: Apply mortar to vertical face shells on both the masonry unit already laid and the unit to be laid to ensure full head joint.
- C. Place masonry unit by rolling it to a vertical position and shoving it against adjacent unit, achieving position and alignment with minimum of adjusting.
- D. Adjustment shall be made only while mortar is still soft and plastic by tapping to plumb and bringing to alignment. Remove unit and relay in fresh mortar when unit must be pulled back to align.
- E. Check each unit as laid with mason's level for level and for plumb with wall below.
- F. Where adjustment must be made after mortar has started to set, remove and replace mortar with fresh mortar.
- G. Keep bed and head joints uniform in width, except for minor variations required to maintain bond and locate returns. Standard thickness for both horizontal and vertical mortar joints shall be 3/8".
- H. As work progresses, trowel protruding mortar fins in cavity flat to inner face of wythe.
- I. Sealant joints: Retain 1/2" wide sealant joint around outside perimeter of exterior doors, window frames and other wall openings.
- J. Weepholes:
  - 1. Provide weepholes in exterior wythe of masonry at 1'-4" o. c. horizontally at heads and sills of openings, in exterior walls at grade and in other locations where flashing is indicated.

2. Weephole ventilators:
  - a. Provide weephole ventilators at grade level.
  - b. Install weephole ventilator in open head joint, flush with low edge of adjacent brick.

3.6 BUILDING EXPANSION JOINTS:

- A. Make joints 1" wide, unless otherwise indicated.
- B. Keep joint clear of mortar by temporarily filling with polystyrene as wall is laid.
- C. Stop horizontal joint reinforcement 1" from expansion joint.
- D. Leave joint open and clean for caulking in accord with Joint Sealants section.

3.7 CONCRETE UNIT MASONRY CONTROL JOINTS:

- A. Make joint 3/8" wide, unless otherwise indicated. Align joints in concrete unit masonry backup with masonry veneer control joints.
- B. Stop horizontal joint reinforcement 1" from control joint.
- C. Provide joints in accord with PCA Handbook, as follows:
  1. In running walls spaced maximum 20'-0" o. c.
  2. At corners, joint located one header or stretcher unit from corner
  3. At intersecting walls, either of which is more than 10'-0" long.
  4. Above joints in foundations and floors and below joints in roofs and floors that bear on masonry walls.
  5. At all abrupt changes in wall height.
  6. At all changes in wall thickness, such as those at pipe or duct chases and those adjacent to columns or pilasters.
  7. At a distance of not over one-half of the allowable joint spacing from bonded intersections or corners.
  8. At door and window openings unless other crack control measures are used, such as joint reinforcement or bond beams.
    - a. At one side of openings less than 6'-0" wide.
    - b. At both sides of openings greater than 6'-0" wide.
- D. Where control joints occur in running walls, provide sash block with rubber control joint filler.
- E. Leave joint open and clean for caulking in accord with Joint Sealants section. Caulk joints exterior and interior.

3.8 JOINT TREATMENT:

- A. Flush joints: Strike joints flush in masonry to receive finish work of trades other than painting.
- B. Tooled joints: Strike exposed joints flush in standard masonry units and, when partially set, tool using V-shaped or concave tool.

- C. Joints in architectural units: Tool joints to match pattern in face of masonry unit.
- D. Point mortar joints. Remove and replace units with excessive spalls or chips.

3.9 CLEANING:

- A. Keep masonry work free of mortar droppings as work progresses. At completion of work, rub masonry to remove excess mortar.
- B. Architectural masonry sample panel cleaning: At least 21 days prior to application of cleaning solution to architectural masonry units, apply cleaning solution to half the surface of sample panel. Should discoloration of masonry or mortar joints, staining or efflorescence appear on sample panel, notify Architect and await further instructions.
- C. Clean exposed masonry using specified cleaning compound as follows:
  - 1. No wet cleaning shall take place within seven days of placing masonry.
  - 2. At least two hours prior to application of cleaning solution to masonry work, saturate mortar joints with clean water and flush off loose debris.
  - 3. Begin cleaning process at highest point of wall, working downward. Work in areas of 20 sq. ft., maximum. As cleaning progresses, flush wall to prevent accumulation of scum.
  - 4. Safely discard solution containing debris and residue.
  - 5. Do not scrub mortar joints with cleaning solution.
  - 6. Protect materials adjacent to masonry work which are subject to corrosion from contact with acid solution.

End of Section

SECTION 05 1200

STRUCTURAL STEEL

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Structural Steel Framing Members
- B. Baseplates
- C. Grouting Under Baseplates

1.2 RELATED SECTIONS

- A. Section 05 5000 - Metal Fabrications: Non-framing fabrications affecting structural steel work.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A36-04 Structural Steel.
  - 2. ASTM A53-02 Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
  - 3. ASTM A307-03 Carbon Steel Externally Threaded Standard Fasteners.
  - 4. ASTM A325-02 High Strength Bolts for Structural Steel Joints.
  - 5. ASTM A490-02 Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
  - 6. ASTM A500-01a Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
  - 7. ASTM A563-00 Carbon and Alloy Steel Nuts.
  - 8. ASTM A572-04 High-Strength Low-Alloy Columbium - Vanadium Structural Steel.
  - 9. ASTM F436-02 Hardened Steel Washers.
  - 10. ASTM F959-02 Compressible - Washer - Type Direct Tension Indicator for Use with Structural Fasteners.
  - 11. ASTM A992-04a Steel for Structural Shapes for Use in Building Frame.
  - 12. ASTM F1554-99 Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 KSI Yield Strength.
  - 13. ASTM F1852-00 "Twist Off" Type Tension Control Structural Bolt / Nut / Washer / Assemblies, Steel, Heat Treated, 120 / 105 KSI Minimum Tension Strengths.
- B. American Welding Society (AWS):
  - 1. ANSI/AWS D1.1-04 Structural Welding Code-Steel.
- C. American Institute of Steel Construction (AISC):
  - 1. Specification of Structural Steel Buildings - Allowable Stress and Plastic Design, June 1, 1989, with commentary.

2. Load and Resistance Factor Design Specification for Structural Steel Buildings, 1999.
  3. Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts, Approved by the Research Council for Structural Connections of the Engineering Foundation, June 23, 2000 and endorsed by the AISC.
  4. Code of Standard Practice for Steel Buildings and Bridges, March 7, 2000.
- D. Steel Structures Painting Council (SSPC):
1. Steel Structures Painting Manual, Volume 2, Systems and Specifications, 1989.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01 3300.
- B. Shop Drawings:
  1. Indicate profiles, sizes, spacing, and locations of structural members and openings.
  2. Connections.
  3. Cambers.
  4. Indicate welds by standard AWS symbols. Show size, length and type of each weld.
  5. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages.
  6. Paragraph 4.2.2 of AISC Code of Standard Practice for Steel Buildings and Bridges is deleted as a reference to this project in any form.
  7. Do not make shop drawings using reproductions of or making reference to Contract Drawings.
- C. Manufacturer's Mill Certificate: Submit certifying that products meet or exceed specified requirements.
- D. Mill Test Reports: Submit Manufacturer's Certificates, indicating structural strength, destructive and non-destructive test analysis.
- E. Submit manufacturer's product data indicating products meet all specified requirements, and submit complete installation instructions for:
  1. Load indicator washers
  2. Alternate design high strength bolts.
- F. Welders' Certificates: Submit welders' certificates for each welder to be employed on this project. Certificates to indicate welder has been tested on type of weld in last 12 months.
- G. Field Quality Control Reports: Submit reports of specified tests and inspections.

#### 1.5 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC - Specification for Structural Steel Buildings - Allowable Stress and Plastic Design.

#### 1.6 QUALIFICATIONS

- A. Fabricator: Certified by AISC Quality Certification Program under category I, "Conventional Steel Building Structures."
- B. Erector: Company specializing in performing the work of this Section with minimum 10 years documented experience.
- C. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Florida.
- D. Employ welders on the Work that have successfully qualified for the welding positions required in accordance with AWS D1.1-04, Chapter 5, Qualification, within the last 12 months. Welders are required to carry proof of their qualification on their person.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Structural Steel Shapes
  - 1. W-Shapes: ASTM A992-04a, Grade 50.
  - 2. Channels: ASTM A36-04.
  - 3. Angles: ASTM A36-04.
- B. Structural Steel Plates and Bars: ASTM A36-04.
- C. Cold Formed Steel Tubing: ASTM A500, Grade B.
- D. Hot Formed Steel Tubing: ASTM A501. Type E or S, Grade B.
- E. Pipe: ASTM A53 Type E or S, Grade B.
- F. High Strength Bolts: All material, domestic manufacture, marked with lot identification.
  - 1. High strength bolts:
    - a. Standard bolts: ASTM A325, or ASTM A490, type I.
    - b. Alternate design bolts: Conforming to ASTM F1852.
      - 1) NSS Industries, Rapid Tension Bolts.
      - 2) Le Jeune Bolt Company, Tension Control Bolts.
      - 3) Bethlehem Steel Corporation, Load Indicator Bolt.
      - 4) Substitutions: Under provisions of Section 01 2513.
  - 2. Nuts: ASTM A563.
  - 3. Washers:
    - a. Hardened steel washers: ASTM F436.
    - b. Direct tension indicator washer (Load Indicator Washer): ASTM F959.

- G. Anchor Rods: ASTM F1554, Grade 36.
- H. Electrodes for welding in accordance with References.
- I. Shop Paint and Touch-Up Primer
  - 1. Shop paint for interior steel:
    - a. Type: Modified soya oil alkyd resin - lead and chromate free.
    - b. Solids Content: 55%
  - 2. Shop paint for exterior steel:
    - a. Vehicle type: Inorganic Ethyl Silicate (self-curing).
    - b. Pigment type: Zinc dust plus colorant (green).
    - c. Pigment content: 85% Zinc dry film by weight.
    - d. Solids content: 79% by weight, 71% by volume packing density ratio of wet to dry film.
- J. Non-Shrink Grout: See Section 03 3000.

## 2.2 FABRICATION

- A. General: In accordance with the References.
- B. Fabricate and assemble structural assemblies in shop to greatest extent possible and deliver to the site ready for erection.
- C. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs and other defects. Do not weld or grind a member once finishing is complete.
- D. Connections:
  - 1. Shop connections: Welded or as otherwise indicated on the Drawings.
  - 2. Field connections: Bolted except where shown as welded on the Drawings.
    - a. Provide ASTM A325 bolts unless noted otherwise.
    - b. Minimum bolt diameter is 3/4 inches.
    - c. Provide a minimum of two bolts at each connection.
  - 3. When not specifically detailed on the Drawings, provide the following beam connections.
    - a. Where beam reactions are given, provide the capacity shown.
    - b. Where beam reactions are not given, design connections to support one half of the total uniform load capacity shown in the Allowable Uniform Load Tables of the AISC Manual of Steel Construction Allowable Stress Design, Ninth Edition, or the AISC Manual of Steel Construction Load Resistance Design 3<sup>rd</sup> Edition if using LRFD.
    - c. Where reactions are subject to eccentricity, such eccentricity shall be taken into account.
  - 4. Shop attach column base plates to columns unless noted otherwise on the Drawings.

- E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on the Drawings.
- F. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
- G. Shop painting: Prime all steel surfaces not otherwise specified. Use paint complying with all Federal, State and Local VOC requirements where it is applied.
  - 1. Surfaces to be primed:
    - a. Interior steel:
      - 1) Surface preparation: Hand tool cleaning (SSPC-SP2).
      - 2) Apply one coat of interior steel shop coating.
      - 3) Dry film thickness: 2 to 3 mils.
    - b. Exterior steel:
      - 1) Surface preparation: Commercial blast cleaning (SSPC-SP6).
      - 2) Apply one coat of exterior steel shop coating.
      - 3) Dry film thickness: 3 mils (85% Zinc, dry film by weight).
    - c. Work shop paint into all angles and crevices.
    - d. Apply shop paint uniformly and free from holidays and bare spots.
  - 2. Surfaces to be encased in concrete:
    - a. Surface preparation: Power tool cleaning (SSPC-SP3).
    - b. Prime surfaces to be exposed as described in the shop painting paragraph of this Section.
  - 3. Surfaces to be fireproofed:
    - a. Surface preparation: Commercial blast cleaning (SSPC-SP6).
    - b. Ship to job site unprimed.
  - 4. Do not paint:
    - a. Surfaces to receive weld metal.
    - b. Faying surfaces of high strength bolted connections.

### 2.3 SOURCE QUALITY CONTROL AND TESTS

- A. Testing Laboratory perform the following:
  - 1. Inspection of shop assembled high strength bolts under provision of Field Quality Control of this Section.
  - 2. Inspection of shop welds under the provisions of Field Quality Control of this Section.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. It is the Contractor's responsibility to guy and brace the structure until the Work is complete.

- B. Column bases are designed unrestrained.

### 3.2 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

### 3.3 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain the structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- B. Anchor Rods:
  - 1. Furnish anchor rods and other connectors for securing structural steel to foundations and other in-place work.
  - 2. Furnish templates for presetting bolts and other anchors accurately.
- C. Setting Bases and Bearing Plates:
  - 1. Clean concrete and masonry bearing surfaces to remove bond reducing materials.
  - 2. Roughen bearing surfaces to improve bond.
  - 3. Clean the bottom surface of base and bearing plates.
  - 4. Set loose and attached base and bearing plates on wedges or other adjusting devices.
  - 5. Tighten anchor bolts after supported members have been positioned and plumbed.
  - 6. Do not remove wedges or shims. If protruding cut flush with edge of base or bearing plate prior to installation of grout.
  - 7. Install grout according to manufacturer's recommendations and using a method that ensures that no voids remain. Finish exposed surfaces and cure.
- D. Field Assembly:
  - 1. Set structural frames accurately to lines and elevations indicated on the Drawings.
  - 2. Align and adjust members forming a complete frame or structure before permanently fastening. Level and plumb individual members of the structure within tolerances specified in Erection Tolerances of this Section.
  - 3. Splice members only where indicated on approved shop drawings.
  - 4. Do not enlarge holes in members by burning or by use of drift pins. Ream holes that must be enlarged to admit bolts.
- E. High Strength Bolts:
  - 1. General:
    - a. Install bolts so that they are in bearing with threads out of the shear planes.

- b. Tighten bolts using methods specified in this Section and in conformance with the procedures described in Section 8, Installation and Tightening of AISC Specification for Structural Joints using ASTM A325 or A490 bolts.
  2. Calibrate tightening methods used in conformance with Section 8, Installation and Tightening of AISC Specification for Structural Joints using ASTM A325 or A490 bolts.
  3. Tightening methods: Use one of the following:
    - a. Calibrated wrench.
    - b. Direct tension indicator.
    - c. Alternative bolt design: Bolt with twist off element.
  4. Do not use turn of the nut method, unless continuously observed by testing agency.
- F. Gas Cutting: Do not use gas cutting torches in the field for correcting errors in structural framing.
- G. Touch-Up Painting
1. For members that require painting only.
  2. Immediately after erection clean field welds, bolted connections, and abraded areas.
  3. Apply paint to exposed areas using the same material as used for shop painting.
  4. Apply paint with brush or spray to provide a minimum dry film thickness of 2.0 mils.

### 3.4 ERECTION TOLERANCES

- A. General: See AISC Code of Standard Practice for tolerances.
- B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- C. Maximum Offset From True Alignment: 1/4 inch.

### 3.5 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 4529.
- B. General
  1. Inspection of high strength bolted and welded connections will be performed by the Testing Laboratory.
  2. When the work has progressed to a degree that connections to be inspected are readily accessible, the Testing Laboratory will begin inspection for compliance with the Contract Documents.
  3. When the steel framework does not provide a suitable platform for inspection.
    - a. Contractor, provide necessary scaffolds and platform for the Testing Laboratory.
    - b. Provide scaffolds and platforms that comply with all project safety requirements.

- C. High Strength Bolted Connections:
  - 1. Inspection with calibrated torque wrench.
    - a. Job Inspecting Torque: Determine inspecting torque using method in Section 8, Inspection and Tightening, in AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts.
      - 1) Testing frequency:
      - 2) Test 10%, minimum of all bolts.
      - 3) Test 2 bolts minimum in each connection.
    - b. Acceptance criteria:
      - 1) If any bolt head or nut is turned by the inspecting wrench, the connection is not acceptable.
      - 2) All bolts in the connection shall be reworked.
    - c. Test frequency for reworked bolts:
      - 1) Test 50%, minimum, of all bolts.
      - 2) Repeat this process until the acceptance criteria is met.
  - 2. Inspection using direct tension indicators, or alternate design bolts:
    - a. Use manufacturer's acceptance criteria.
    - b. Inspect 100% of all connections.
- D. Welded Connections
  - 1. General:
    - a. Inspect welds in accordance with Chapter 6, Inspection, ANSI/AWS D1.1-04.
  - 2. Responsibility of Testing Laboratory
    - a. Inspect all full penetration welds and all butt welds made by the fabricator using non-destructive testing other than visual.
    - b. Inspect all full penetration welds and all butt welds made in the field using non-destructive testing other than visual.
- E. Inspect 15% of all fillet welds.
- F. Contractor correct all work not approved by Testing Laboratory..

End of Section

SECTION 05 2100

STEEL JOISTS

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Open web steel joists, with bridging, attached seats, and anchors.
- B. Joist Girders.
- C. Loose bearing plates and anchor bolts for site placement.

1.2 RELATED SECTIONS

- A. Section 05 1200 - Structural Steel.
- B. Section 05 3110 - Steel Roof Deck: Support framing for small openings in roof deck.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A36-04 Structural Steel.
  - 2. ASTM A307-03 Carbon Steel Externally Threaded Standard Fasteners.
- B. American Welding Society (AWS):
  - 1. AWS D1.1-04 Structural Welding Code - Steel.
- C. Steel Joist Institute (SJI)
  - 1. Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders, latest edition.
- D. Steel Structures Painting Council (SSPC)
  - 1. Systems and Specifications, Steel Structures Painting Manual, Volume 2, 1989.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 3300.
- B. Shop Drawings: Include the following:
  - 1. Indicate standard designations, configurations, and sizes.
  - 2. Location and spacing of joists by identification marks.
  - 3. Details of end anchorages including minimum bearing requirements.
  - 4. Details of joist extensions, bottom chord anchorages including locations of connections.
  - 5. Spacing and type of bridging.
  - 6. Detail welds using AWS symbols.
  - 7. Details of bridging connections to joists and to structure where lines of bridging terminate.

8. Details and locations of accessories for uplift.
9. Details of splices.
10. Do not make shop drawings using reproduction of or reference to Contract Drawings.

C. Welders' Certificates: Submit welder's certificates.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Member of Steel Joist Institute.
- B. Perform Work in accordance with SJI Standard Specifications, Load Tables, and Weight Tables, including headers and other supplementary framing.
- C. Welder Qualifications: Employ members on the Work who have been successfully qualified for the welding positions required, in accordance with Chapter 5 "Qualification," AWS D1.1, within the last 12 months. Operators are required to carry proof of qualification on their person.

#### 1.6 QUALIFICATIONS

- A. Fabricator: Member of Steel Joist Institute.
- B. Erector: Company specializing in performing the work of this Section with minimum 3 years documented experience.
- C. Connection Designer: Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Georgia.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of SJI requirements.
- B. Store and protect products under provisions of SJI requirements.
- C. Protect joists from distortion or damage.

#### 1.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on shop drawings.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- A. Open Web Joists Members: SJI Type K open web and LH longspan.
- B. Bolts, Nuts, and Washers: ASTM A307-03.
- C. Primer: SSPC - Paint 15, Type 1.

- D. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36-04.
- E. Welding Materials: AWS D1.1-04; type required for materials being welded.

## 2.2 FABRICATION

---

**Edit below based on chord extension requirements for this project.**

---

- A. Provide bottom and top chord extensions as indicated. Provide load carrying capacity equal to or greater than loads shown on the Drawings for area being supported.
- B. Bridging:
  - 1. Provide horizontal or diagonal type bridging. Where horizontal bridging is used, provide a vertical "x" brace in the second bay at each end interior panel and in every sixth bay.
  - 2. Provide bridging anchors for ends of bridging lines terminating.
- C. End Anchorage: Provide end anchorages to attach joists to adjacent construction.
  - 1. Sloped end bearing: Provide beveled or sloped bearing connections where joists are sloped, except where slope is equal to or less than 1/4 inch per foot.
  - 2. Special end bearing: Provide special end supports at shelved end bearings and at those locations where joist bearing area is less than minimum recommended by SJI specifications.
- D. Header Units: Provide header units to support joist tails at roof openings not framed with steel shapes.
- E. Bolts: Provide erection and permanent bolts.

## 2.3 FINISH

---

**Verify if joists will be fireproofed**

---

- A. Shop prime joists. Do not prime surfaces that will be fireproofed or field welded.
- B. Surface preparation: SSPC - SP2
- C. Application: Apply paint in one coat with continuous dry film thickness of not less than 1 mil.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

### 3.2 ERECTION

---

**Verify that drawing details are coordinated with Paragraph A.**

---

- A. Comply with all requirements of OSHA Regulation 29 CFR Part 1926.757- Open Web Steel Joists.
- B. Erect and bear joists on supports.
- C. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment until completion of erection and installation of permanent bridging and bracing.

---

Edit below as required.

---

- D. Coordinate placement of anchors in concrete and masonry construction for securing bearing plates and angles.
- E. As structural steel is installed, bolt strut joists in place with two-1/2 inch diameter bolts at each end. Then weld each end with a 3/16 inch fillet weld all around.
- F. After joist alignment and adjustment into accurate location and spacing, field weld joist seat to bearing plates and angles with a 3/16 inch by 2 inch fillet weld each side unless indicated to be bolted.
- G. Position and field weld joist chord extensions and wall attachments.
- H. Frame roof openings greater than 18 inches with supplementary framing.
- I. Bridging installation:
  - 1. Install bridging immediately after erection and permanent fastening of joists.
  - 2. Install bridging before construction loads are applied to joists.
  - 3. Permanently attach lines of bridging to walls or beams where bridging terminates.
  - 4. Weld bridging to joists.
  - 5. Provide bolted x-bridging for line of bridging closet to center of span for joists 39'-0 or longer.
- J. Do not permit erection of decking until joists are braced, bridged, and permanently fastened.

- K. Do not field cut or alter structural members without approval of joist fabricator.
  - L. Do not subject roof joists to loads in excess of 20 psf.
  - M. Touch-up painting:
    - 1. After joist installation, paint field bolt heads and nuts, welded areas, and abraded or rusty surfaces on joists and steel supporting members.
    - 2. Wire brush surfaces and clean with solvent before painting.
    - 3. Use same type paint as used for shop painting.
- 3.3 ERECTION TOLERANCES
- A. Maximum Variation From Plumb: 1/4 inch.
  - B. Maximum Offset From True Alignment: 1/4 inch.
- 3.4 FIELD QUALITY CONTROL

---

**Edit below based on responsibility of the Testing Laboratory.**

---

- A. Testing Laboratory provide qualified representatives at the site to inspect the following:
  - 1. Erected joists for damage.
  - 2. Joist spacing.
  - 3. Proper seating of joist bearing.
  - 4. Welded and bolted connections.
  - 5. Installation of bridging.
- B. Testing Laboratory submit inspection reports:
  - 1. State if installation conforms to the requirements of this Specification and the Drawings.
  - 2. List in detail any deviations.

End of Section



## SECTION 05 3110

## STEEL ROOF DECK

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\* This Section includes structural metal roof deck, including miscellaneous accessories. If concrete fill is used in conjunction with this deck, refer to Section 05313 - Steel Floor Deck for concrete references and accessories that may be required.

---

**PART 1 - GENERAL**

## 1.1 SECTION INCLUDES

- A. Steel roof deck and accessories.
- B. Formed steel cant strips, roof sump pans, metal closure strips, hips, valleys, and ridges.
- C. Framing for openings up to and including 18 inches.

## 1.2 RELATED SECTIONS

- A. Section 05 1200 - Structural Steel: Structural framed openings larger than 18 inches.
- B. Section 05 2100 - Steel Joists: Structural framed openings larger than 18.

## 1.3 REFERENCES

- A. American Iron and Steel Institute (AISI):
  - 1. Specification for the Design of Cold-Formed Steel Structural Members, 1996.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A36-04 - Structural Steel
  - 2. ASTM A1008-04b - Steel, Cold Rolled Sheet, Carbon, Structural, High Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.
  - 3. ASTM A653-04a- Steel Sheet, Zinc Coated (Galvanized) or Zinc - Iron Alloy - Coated (Galvannealed) by Hot Dipped Process.
  - 4. ASTM A924-04 - Steel Sheet, Zinc Coated, Galvanized by the Hot-Dip Process.
- C. American Welding Society (AWS):
  - 1. AWS D1.1-04, Structural Welding Code - Steel.
  - 2. AWS D1.3-98, Structural Welding Code - Sheet Steel.
- D. Federal Specification:
  - 1. DOD-P-21035 A, Galvanizing Repair Paint.
- E. Steel Deck Institute (SDI)

1. Steel Deck Institute Design Manual for Composite Decks, Form Decks, Roof Decks and Cellular Metal Floor Deck with Electrical Distribution.
2. Diaphragm Design Manual.

#### 1.4 SUBMITTALS

---

Verify correct submittal section.

01330 is the Spiker Baldwin number as of Nov. 2001. Last verified Mar 2004.

---

- A. Submit under provisions of Section 01 3300.
- B. Shop Drawings - Indicate:
  1. Decking plan and erection sequence
  2. Support locations
  3. Openings and reinforcement
  4. End lap and side lap details
  5. Accessories including type, size, and spacing of fasteners.
  6. Fastener pattern including type, size, and spacing of fastener
  7. Temporary shoring of decking where required.
  8. Do not make shop drawings using reproductions of or making reference to Contract Drawings.
- C. Product Data: Provide manufacturer's specifications and installation instructions for each type of deck and accessory.
- D. Manufacturer's Installation Instructions: Indicate specific installation sequence and special instructions.

---

Edit below depending on who is responsible for field quality control required by this section.

---

- E. Testing Laboratory: Provide field quality control inspection reports.

#### 1.5 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this Section with minimum 3 years documented experience.
- B. Manufacturer: Member of Steel Deck Institute.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

---

Verify correct Section number for A and B below

---

- A. Deliver products to site under provisions of Section 01600.
- B. Store and protect products under provisions of Section 01600.
- C. Cut plastic wrap to encourage ventilation.
- D. Store decking on dry wood sleepers; slope for positive drainage.

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on shop drawings.

**PART 2 - PRODUCTS**

2.1 MATERIALS

- A. Sheet Steel: ASTM A653-04a, Grade 33 Structural Quality; with G90 galvanized coating designation conforming to ASTM A924-04.
- B. Bearing Plates: ASTM A36-04 steel, unfinished.
- C. Welding Materials: AWS D1.1-04.
- D. Touch-Up Primer: Zinc chromate type.

2.2 ACCESSORIES

- A. Flute Closures: Closed cell foam rubber, one inch thick; profiled to fit tight to the decking.
- B. Fasteners:
1. Screws: Acceptable manufacturers:
    - a. Manufacturer: Hilti Corporation.
      - 1) Product: Kwik-Pro Self-Drilling Screws.
      - 2) Product Data Publication: Hilti Fastening Technical Guide (H-437-5/89).
    - b. Manufacturer: ITW Buildex
      - 1) Product: Buildex TEKS Self-Drilling Screws.
      - 2) Product Data Publication: ITW Buildex metal Fastening Systems Guide, 1985.
    - c. Manufacturer: Elco Industries, Inc.
      - 1) Product: Dril-Flex.
      - 2) Product Data Publication: Dril-Flex Fastening Guide.
  2. Powder Actuated Fasteners:
    - a. Provide fastener listed in SDI Diaphragm Design Manual.

---

This description is based on Hilti ENP and ENKK fastener

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- b. Fasteners are drive pin type, installed with powder actuated tools.
- c. Provide steel alloy drive pins.
  - 1) Rockwell C hardness of 52 to 56.
  - 2) Zinc plated to minimum thickness of 52 to 56.
  - 3) Knurled conical shaft, ballistic point, and a pre-mounted steel washer 1/2 inch in diameter.
  - 4) Length: approximately 1 inch.

---

Weld washers are required for fastening deck less than 0.028 (22 gage) thick.  
Edit below as required.

---

- C. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

### 2.3 FABRICATION

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Check with the architect to see if a UL rating is required for fireproofing.

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- A. Metal Decking: Sheet steel, configured as follows:
  - 1. Minimum Metal Thickness (Excluding Finish): 20 gage
  - 2. Nominal Height: 1-1/2 inch fluted profile to SDI WR
  - 3. Side Joints: Lapped
  - 4. Flute Sides: Plain vertical face
- B. Accessories:
  - 1. Metal Closure Strips, 20 gage galvanized sheet steel; of profile and size to provide tight fitting closure of open ends and side of decking.
  - 2. Fabricate roof sump pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

---

Verify cant strip configuration with Architect.

---

- 3. Cant Strips: Formed sheet steel, 20 gage thick, 45 degree slope, 3-1/2 inch nominal width and height, flange for attachment.
- 4. Hips, valley, and Ridges: Fabricate from 16 gauge, galvanized sheet steel. Fabricate not less than 4 1/2 inches wide and bent to provide tight fitting closure with deck units.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means installer accepts existing conditions.

### 3.2 INSTALLATION

- A. Placement of Deck Units:
  - 1. Place units with side ribs up and with ribs perpendicular to supports.
  - 2. Place units in first row end to end along one side of area to be decked.
  - 3. Use 2-inch end laps centered over supports. Bear decking on steel supports 1 1/2 inches minimum.
  - 4. Do not stagger end laps.

5. Place second row of decking end to end. Lap one edge rib over edge rib of previously placed deck.
6. Adjust decking to final position before attaching permanently.

---

Openings cut in field can be limited to 16 square feet

---

7. Perform skew cutting and cutting for openings in the field.

---

Fasteners spacing may require editing for specific diaphragm load requirements.

---

- B. Fasten ribbed deck to steel support members at ends and intermediate supports with mechanical fasteners at 12 inches o/c maximum, parallel with the deck flute and at every other transverse flute, unless noted otherwise on drawings.

---

Side lap fastener spacing may require editing for specific diaphragm load requirements.

---

- C. Mechanically fasten male/female side laps at 24 inches o/c maximum, unless noted otherwise on the Drawings.

---

The following paragraph describes framing for openings up to and including 12 inches. Verify that Drawings show structural framing requirements for openings larger than 12 inches. (see new PEC roof opening detail developed and put into use Feb 1, 2007, ELH)

---

- D. Reinforce steel deck openings from 6 to 12 inches in size with 2 x 2 x 1/8-inch steel angles or 2 x 2 x 68 mil light gauge angles. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and mechanically attach to deck with two #10 TEK screws at each flute.
- E. Install 6 inch minimum wide sheet steel cover plates, of same thickness as decking, where deck changes direction. Mechanically attach 12 inches o/c maximum.

---

Edit the following paragraphs as appropriate to project conditions. Include Paragraph F only where concrete is placed over decking, and where steel angles are not utilized.

---

- F. To contain wet concrete, install stops at roof edge upturned to top surface of slab. Provide stops of sufficient strength to remain stationary under wet concrete without distortion.
- G. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.
- H. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.

- I. Position roof sump pans with flange bearing on top surface of deck. Mechanically attach at each deck flute.
- J. Place metal cant strips in position and mechanically attach.
- K. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up prime paint.

### 3.3 HANGING LOADS

- A. Do not hang loads from deck.

### 3.4 TOUCH UP PAINTING

- A. After decking installation, wire brush, clean and paint scarred areas and rust spots on top and bottom surfaces of decking.

---

Edit below depending on type of deck used in this project.

---

- B. Touch up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

### 3.5 FIELD QUALITY CONTROL

---

Edit below with respect to whom is responsible for field quality control of roof deck installation.

---

- A. Testing laboratory provide qualified personnel at the site during roof deck installation to inspect the following:
  - 1. Roof deck type, depth, gauge, and finish.
  - 2. End bearing and end and side laps.
  - 3. Fastener installation.
- B. Inspection report: Indicate deviations from requirements of Specifications and Drawings.

End of Section

SECTION 05.4000

COLD FORMED METAL FRAMING

**PART 1 - GENERAL**

1.1 SUMMARY:

- A. Related work specified elsewhere:
  - 1. Structural steel framing.
  - 2. Rough carpentry.
  - 3. Brick masonry.
  - 4. Concrete unit masonry.
  - 5. Masonry accessories.
  - 6. Metal soffit system.

1.2 SUBMITTALS:

- A. Product data: Include manufacturer's description of framing, load tables, span deflection tables and installation data. Mark material to indicate only products proposed for use. Submit sheathing manufacturer's installation instructions, special procedures and perimeter conditions requiring special attention.
- B. Shop drawings: Submit shop drawings showing fabrication and erection procedures.
  - 1. Show locations, sizes, gauges, spacing and types of framing components, details of connections and framing of windows, doors and punched openings.
  - 2. Indicate all prefabricated framing, if used, with individual panels shown for each condition.
  - 3. Indicate supplemental strapping, bracing, splices, bridging, accessories and details required for installation.
  - 4. Drawings shall indicate sequence and method of erection details of all connections of cold formed steel framing to other elements of the building structure.
- C. Welder certification: Submit welders' certifications in accord with AWS D1.1-02, current within the previous 12 months, for Architect's information.
- D. Structural design calculations: Submit for Architect's information. Indicate compliance with specified design criteria. Calculations shall bear the seal of a professional engineer licensed in the State of Georgia.

1.3 QUALITY ASSURANCE:

- A. Applicable standards; standards of the following, as referenced herein:
  - 1. American Iron and Steel Institute (AISI).
  - 2. ASTM International (ASTM).
  - 3. American Welding Society (AWS).
  - 4. Steel Structures Painting Council (SSPC).

- B. Qualifications of welders:
1. Welders employed on the work shall have passed qualification tests within the past 12 months in the position for which employed, using AWS D1.1-02 and AWS D1.3-98 test procedures.
  2. Contractor shall require any welder to retake qualification test when, in Architect's opinion, welder's work creates a reasonable doubt as to welder's proficiency. Conduct requalification tests at no additional expense to Owner. Make recertification to Architect after welder has passed retest.
- C. Design criteria:
1. Wind loads and seismic loads: Design framing system to withstand wind load pressures and seismic loading in accord with International Building Code requirements.
  2. Maximum allowable deflection: Comply with manufacturer's product data or design calculations to meet height and load conditions with maximum allowable deflection under full wind load of L/360 for joist and metal soffit.
- D. Cold formed steel framing shall be designed in accord with AISI "Cold Formed Steel Design Manual".
- E. Single source responsibility: Framing members shall be manufactured and supplied by one manufacturer and be of type and size indicated on drawings and as specified herein.
- F. Welding: Welding shall be in accord with applicable standards of the American Welding Society (AWS) and cold-formed steel framing manufacturer's product data.
- G. Forced entry fasteners: Gas- and powder-driven forced entry fasteners shall be approved in current ICC Evaluation Service report.
- 1.4 DELIVERY, STORAGE, AND HANDLING:
- A. Deliver materials in unbroken bundles with each type of member identified with permanent marking with manufacturer's name, brand, type and gauge. Store in protected area to prevent rusting and damage.
- 1.5 PROJECT/SITE CONDITIONS:
- A. Existing conditions: Inspect structure for compliance with specified erection tolerances.
- B. Coordinate installation and location of anchors and inserts with structural system to which cold formed steel framing is attached.

## **PART 2 - PRODUCTS**

### 2.1 COLD FORMED STEEL FRAMING:

- A. Acceptable manufacturers:
  - 1. Aegis Metal Framing, LLC.
  - 2. Allied Studco.
  - 3. Bailey Metal Products, Ltd.
  - 4. Clark Steel Framing Systems.
  - 5. Dale/Incor.
  - 6. Dietrich Metal Framing.
  - 7. The Steel Network, Inc.
  - 8. United Steel Systems.
  
- B. Cold formed framing:
  - 1. Type: Channel type, roll-formed from steel complying with ASTM C955-06, Metallic Coated, CP 60.
  - 2. Material: Metallic coated steel meeting ASTM A1003-05, Coating Designation G60, with the following Classification:
    - a. Runners, 18 gauge and lighter: Structural Grade 33, Type H, chemically treated, not oiled.
    - b. Members, 18 gauge and lighter: Structural Grade 33 minimum, chemically treated, not oiled.
    - c. Members and runners heavier than 18 gauge: Structural Grade 50, Type H, chemically treated, not oiled.
  
- C. Joists:
  - 1. Size, gauge, spacing and anchorage of joists shall be as qualified by design and as indicated on approved shop drawings.
  - 2. Components shall be unpunched and continuous without splicing.

### 2.2 FASTENERS:

- A. For fastening cold formed steel framing members to each other: Type S, galvanized, pan head screws in sizes recommended by framing manufacturer for applications indicated.
  
- B. For fastening cold formed steel framing to masonry surfaces: Powder- or gas-driven forced entry type galvanized steel or stainless steel fasteners, capable of withstanding manufacturer's calculated single shear and bearing forces without exceeding allowable stress design of fastener or member being fastened.
  
- C. For fastening cold formed steel framing to structural steel, clip angles and inserts: Welding, using methods and electrode types in accord with manufacturer's product data. Comply with AWS requirements; do not weld 18 ga. and lighter members.
  
- D. Do not wire tie cold formed steel framing.
  
- E. For fastening plywood to cold formed steel framing: Type S, hot dip galvanized, bugle head screws extending a minimum of 1/2" through framing member.

2.3 ACCESSORY MEMBERS:

- A. Bracing and bridging: Same material as studs and runners; gauges as required by manufacturer's product data and design analysis.
- B. Steel clips and angles to which cold formed steel framing is attached shall comply with ASTM A36-05.
- C. Cold galvanizing compound: Pre-mixed, zinc dust and organic binders formulated specifically for use on steel surfaces. Compounds shall have concentrations of zinc dust in the range of 65% to 69% or above 92% in the dried film in accord with ASTM A780-01(2006).

**PART 3 - EXECUTION**

3.1 JOIST INSTALLATION:

- A. Bear joists directly on bearing surfaces or studs, unless continuous headers are used.
- B. Provide web stiffeners at reaction points where indicated on approved shop drawings.
- C. Prior to loading joists, provide joist bridging at spacing indicated on approved shop drawings.
- D. Provide an additional joist under parallel partitions where partition length exceeds  $\frac{1}{2}$  joist span and around floor and roof openings which interrupt one or more spanning members unless indicated otherwise on approved shop drawings.
- E. Provide end blocking where joist ends are not restrained against rotation.
- F. Do not load floor/rafter system beyond limits for which it was designed.

End of Section

SECTION 05 5000

METAL FABRICATIONS

**PART 1 - GENERAL**

1.1 SUBMITTALS:

- A. Shop drawings: Indicate sizes, shapes, fabrication and installation details for metal fabrications. Indicate anchorage to adjacent surfaces. Indicate shop finish. Where shop primer is required, indicate exact product used.
- B. Product data: Submit for manufactured items. Indicate materials, construction, finishes and installation instructions.

1.2 QUALITY ASSURANCE:

- A. Allowable tolerances: Machine fabricated, field and shop assembled mechanical joints shall fit within  $\pm 1/32$ ". Install freestanding items to  $\pm 1/4$ " of proper position. Sizes of each element of an assembly shall be correct within  $1/8$ "; total size of a freestanding assembly shall be correct within  $1/2$ ".
- B. Applicable standards:
  - 1. American Institute of Steel Construction (AISC), "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
  - 2. American Iron and Steel Institute (AISI), standards as referenced herein.
  - 3. American Welding Society (AWS):
    - a. AWS D1.1-02, "Structural Welding Code -- Steel."
    - b. AWS D1.2-90, "Structural Welding Code -- Aluminum."
    - c. AWS B2.1-00, "Welding Procedure and Performance Qualification."
  - 4. ASTM International (ASTM), standards as referenced herein.
  - 5. Steel Structures Painting Council (SSPC), standards as referenced herein.
- C. Qualifications of welders:
  - 1. Welders employed on the work shall have passed qualification tests within the past 12 months in the position for which employed, using test AWS D1.1-02 procedures.
  - 2. Contractor shall require any welder to retake the qualification test when, in the opinion of the Architect, the welder's work creates a reasonable doubt as to the proficiency of the welder. Requalification tests shall be conducted at no additional expense to the Owner. Recertification shall be made to Architect after the welder has passed the retest.
- D. Field measurements: Take field measurements prior to preparation of shop drawings and fabrication, to ensure fitting of work.

## **PART 2 - PRODUCTS**

### 2.1 GENERAL REQUIREMENTS:

- A. Materials shall be free from defects impairing strength, durability or appearance. Exposed surfaces throughout project shall have the same inherent texture and color for like locations.
- B. Fasteners: Fasteners and anchors shall be non-corrosive, non-staining and concealed, except as indicated on approved shop drawings. Exposed fasteners shall be of same materials, color and finish as material to which applied, shall be countersunk and finished flush.

### 2.2 BASIC MATERIALS:

- A. Structural steel shapes: Meeting ASTM A36-05.
- B. Hot-rolled carbon steel sheets and strips: Meeting ASTM A568-06a and ASTM A1011-06b; Grade 40, minimum.
- C. Cold-rolled carbon steel sheets: Meeting ASTM A1008-07, Grade 40, Type 2, minimum.
- D. Steel tubing: Meeting ASTM A500-03a, Grade B, minimum 0.148" wall thickness.
- E. Other steel: Mild steel.
- F. Primer paint for surfaces to receive finish painting: Compatible with required finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Painting and Coating section.
- G. Primer paint for components which do not receive further finish and components to be embedded into concrete: Organic zinc-rich primer meeting SSPC-Paint 20, Type II.
- H. Bituminous coating for separation of dissimilar materials: Cold-applied asphalt mastic meeting SSPC-Paint 12.
- I. Cold galvanizing compound: Pre-mixed, zinc dust and organic binders formulated specifically for use on steel surfaces. Compounds shall have concentrations of zinc dust in the range of 65% to 69% or above 92% in the dried film in accord with ASTM A780-01(2006).

### 2.3 MISCELLANEOUS CONSTRUCTION:

- A. Provide items indicated or required to complete the work, including but not limited to the following:
  - 1. Toilet compartments: Provide supports for panels, pilasters and urinal screens in gypsum board partitions.
  - 2. Lintels and shelf angles:
    - a. Exterior: Hot dip galvanized.
    - b. Interior: Mild steel.
  - 3. Anchors:
    - a. Exterior: Hot dip galvanized.

- b. Interior: Mild steel.
  - 4. Metal panels: Purlins, clip angles and bracings not supplied by panel manufacturer.
  - 5. Structural supports for signage.
  - 6. Corner guard angles: 4" by 4" by 1/4" by 4'-0" long, located at corners exposed to vehicular traffic and where shown. Anchor with expansion fasteners.
  - 7. Steel pipe bollards.
  - 8. Hanger rods not provided by other trades: In size and length indicated or required; threaded full length or at ends.
  - 9. Counter support brackets, welded construction.
  - 10. Overhead door frames: Provide welded steel channel jambs and head for overhead door openings.
- B. Finish on miscellaneous items: Prime paint, unless otherwise specified.

#### 2.4 STEEL RAILINGS:

- A. Provide steel tubing handrails and guardrails where indicated, consisting of top and intermediate rails, posts and bracket-mounted handrails at walls. Provide balusters in designs and configurations as indicated on the drawings, with anchorage and connections as indicated on approved shop drawings.
- B. Join posts and rails at corners by mitered and welded joints made by fitting posts and rails together, mitering corners, groove-welding joints, and grinding smooth.
  - 1. Butt railing splices and reinforce using internal connectors.
  - 2. Join intermediate rail to posts in same manner.
- C. Ends of handrails shall be rounded or returned to floor, wall or post as indicated on drawings. Discontinuous railings shall extend beyond stair termination as further specified, in compliance with ADA requirements. Close wall return ends using welded steel caps and grind smooth.
- D. Railings shall be bent at corners indicated instead of joining. Bends shall be uniformly formed in jigs, with cylindrical cross-section of tubing maintained throughout entire bend.
- E. Finish for steel railings:
  - 1. Exterior: Hot dip galvanized after fabrication.
  - 2. Interior: Prime paint.

#### 2.5 UTILITY TYPE STAIR NOSINGS:

- A. Acceptable products; subject to compliance with specified requirements:
  - 1. American Safety Tread Co., Type 801.
  - 2. Safe-T-Metal Co., Inc., Style AX.
  - 3. Wooster Products, Inc., Type 101.
- B. Characteristics:
  - 1. Type: Cast iron.
  - 2. Surface: Hatched abrasive design.