

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete paving for:
 - a. Concrete parking areas and roads.
 - b. Concrete sidewalks.
 - c. Concrete curbs and gutters.

B. Related Requirements:

1. Section 312323 - Fill: Compacted subbase for paving.
2. Section 321123 - Aggregate Base Courses.
3. Section 321216 - Asphalt Paving.

1.2 PRICE AND PAYMENT PROCEDURES

A. Concrete Paving:

1. Basis of Measurement: By square yard.
2. Basis of Payment: Includes forms, reinforcing, concrete, accessories, placing, finishing, and curing.

1.3 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

B. ASTM International:

1. ASTM A775/A775M - S Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
2. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
3. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
4. ASTM C33 - Standard Specification for Concrete Aggregates.
5. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
6. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.

8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
11. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
12. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
13. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
14. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
15. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
16. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 SUBMITTALS

A. Product Data:

1. Submit data on concrete materials, joint filler, admixtures, curing compounds.

B. Design Data:

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

C. Source Quality Control Submittals: Indicate results of tests and inspections.

1.5 QUALITY ASSURANCE

A. Obtain cementitious materials from same source throughout.

B. Perform Work according to City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years' experience.

1.7 AMBIENT CONDITIONS

- A. Do not place concrete when base surface temperature is less than 35 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE COURSE

- A. Aggregate Base Course: As specified in Section 321123.

2.2 CONCRETE PAVING

- A. Performance / Design Criteria:

- 1. Paving: Pavement section as specified in the drawings.

- B. Form Materials:

- 1. Wood or Steel form material, profiled to suit conditions.
- 2. Joint Filler: ASTM D1751; Asphalt impregnated fiberboard or felt, ¼ inch thick.

- C. Reinforcement:

- 1. Deformed Reinforcing: Steel: ASTM A615/A615M, #4, 60 ksi yield grade, deformed billet bars epoxy coated finish.
- 2. Synthetic Macro-fiber: Synthetic macro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, **1 to 2-1/4 inches** long.
 - a. Manufacturers:
 - 1) ABC Polymer Industries.
 - 2) Euclid Chemical Company (The); an RPM company.
 - 3) GCP Applied Technologies Inc.
 - 4) Propex Operating Company, LLC.
 - 5) Sika Corporation.

- D. Concrete Materials:

- 1. Cement: ASTM C150 Type II modified, low C₃A-; gray color.
- 2. Fine and Coarse Aggregates: In accordance with City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements.
- 3. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete.
- 4. Water: In accordance with City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements.
- 5. Air Entrainment: In accordance with City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements.
- 6. Chemical Admixture: In accordance with City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements.

7. Fly Ash: In accordance with City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements.
8. Slag: In accordance with City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements.
9. Plasticizing: In accordance with City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements

2.3 MIXES

A. Concrete Mix - By Performance Criteria:

1. Mix and deliver concrete according to City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements.
2. Provide concrete to the following criteria:
 - a. Compressive Strength: 4000 psi at 28 days.
 - b. Slump: 2 to 4 inches
 - c. Minimum Cement Content: 6 sacks/cu yd.
 - d. Water/Cement Ratio: 4.5 to 5.5 gallon per sack
 - e. Air Entrainment: 4.5 to 7.5 percent.

2.4 FINISHES

A. Shop Finishing - Reinforcement:

1. Epoxy Coated Finish for Steel Bars: ASTM A775/A775M

2.5 ACCESSORIES

- A. Curing Compound: According to City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements.
- B. Joint Sealers: ASTM D6690, Type II; hot applied type.
- C. Epoxy Grout: Per Table 819.2-1 of the WYDOT Standard Specifications for Road and Bridge Construction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify compacted granular base course is dry and ready to support paving and imposed loads.
 1. Remove soft base course and recompact as specified in Section 321123.00
- B. Verify gradients and elevations of base are correct.

3.2 PREPARATION

- A. Moisten substrate to minimize absorption of water from fresh concrete.
- B. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 INSTALLATION

A. Base Course:

- 1. Aggregate Base Course: Install as specified in Section 321123.

B. Forms:

- 1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
- 2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Reinforcement:

- 1. Place tie bar at mid-height of paving.
- 2. Provide tie bar at 18 inch spacing at connection to existing concrete by drilling into existing concrete. Epoxy grout tie bar into existing concrete.
- 3. Repair damaged epoxy coating to match shop finish.

D. Placing Concrete:

- 1. Place concrete according to City of Casper Standard Specifications for Public Works Construction and Infrastructure Improvements
- 2. Place concrete continuously over the full width of the panel and between predetermined construction joints.

E. Joints

- 1. Place contraction joints as indicated on drawings.
- 2. Provide keyed joints as indicated.
- 3. Seal joints as indicated on Drawings.
- 4. Contraction joints may be sawcut or tooled. Saw cut joints shall be installed as soon as possible without causing raveling of the joint.

F. Finishing:

- 1. Paving: Finish shall match the look of adjacent existing concrete pavement.
- 2. Place curing compound on exposed concrete surfaces immediately after finishing.

G. Curing and Protection

- 1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- 2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.4 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

3.5 FIELD QUALITY CONTROL

- A. Owner to provide field testing of concrete.
- B. Inspect tie bar placement for size, spacing, location, support.
- C. Testing firm will take cylinders and perform slump and air entrainment tests according to ACI 301.
- D. Testing Frequency:
 - 1. One test will be taken for first concrete pour.
 - 2. One test will be taken for all concrete paving that falls within vehicle traffic areas.
 - 3. Additional tests may be taken at discretion of the Engineer.
- E. Strength Test Samples:
 - 1. Sampling Procedures: ASTM C172.
 - 2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
 - 3. Sample concrete and make one set of three cylinders for every day of concrete placement.
- F. Field Testing:
 - 1. Slump Test Method: ASTM C143/C143M.
 - 2. Air Content Test Method: ASTM C231.
 - 3. Temperature Test Method: ASTM C1064/C1064M.
 - 4. Measure slump and temperature for each compressive strength concrete sample.
 - 5. Measure air content in air entrained concrete for each compressive strength concrete sample.
- G. Cylinder Compressive Strength Testing:
 - 1. Test Method: ASTM C39/C39M.
 - 2. Test Acceptance: 4000 psi at 28 days.
 - 3. Test one cylinder at 7 days.
 - 4. Test one cylinder at 28 days.
 - 5. Retain one cylinder for testing when requested by Engineer.
 - 6. Dispose remaining cylinders when testing is not required.
- H. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.6 PROTECTION

- A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit vehicular traffic over paving for 7 days minimum after finishing and until 75 percent design strength of concrete has been achieved.

END OF SECTION 321313