

## SECTION 321313 – CONCRETE PAVEMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

#### 1.2 SUMMARY

- A. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.
- B. This section includes concrete pavement.
- C. Related sections include:
  - 1. Division 01 Section 014000-QUALITY REQUIREMENTS
  - 2. Division 31 Section 312300-EARTHWORK
  - 3. Division 33 Section 334000-STORM DRAINAGE

#### 1.3 SUBMITTALS

- A. Shop Drawings: For heated walks, paving areas showing the layout of expansion joints, tubing and manifold areas.
  - 1. Submit to Project Representative for approval.
  - 2. Design tubing system to minimize the crossing of expansion joints. Adjustments can be made to correspond to design requirements of the tubing system, with approval from Project Representative.

#### 1.4 QUALITY ASSURANCE

- A. Provide required testing and inspection as indicated in Division 01 Section “General Requirements - Quality Requirements.”
- B. Concrete sampling, testing, and inspection shall conform to the following requirements:
  - 1. Sampling Fresh Concrete: ASTM C172, except initial Samples shall be taken immediately after first 1/4 cubic yard (CY) has been discharged and subsequent Samples shall be taken as specified herein. If found to be in non-conformance, the concrete shall be removed from the forms.
  - 2. Slump: ASTM C143, except initial Sample shall be taken in accordance with paragraph above. Additional tests shall be made for each set of compressive strength test specimens, and as required by the Project Representative.
  - 3. Air Content: ASTM C231, except as previously specified herein and additional tests at the end of the load, if possible.

4. Concrete Temperature: Taken each time compression test specimens are made and hourly when temperature is 40 degrees F and below and over 80 degrees F.
5. Unit Weight: ASTM C138, except the Sample volume shall be equal to air content specimen.
6. Compressive Strength: ASTM C31 and C39, except one set of 3 cylinders for every 40 cy or fraction thereof. One specimen shall be tested at 7 days and the remaining 2 specimens shall be tested at 28 days. Strength level of the concrete will be considered unsatisfactory if the 7 day compressive strength does not equal or exceed 60% of the 28 day design strength. Strength level of concrete will be considered satisfactory if the average compressive strength of two consecutive 28 day tests equals or exceeds the 28 day design strength, and neither individual strength test results falls below the specified compressive strength requirement by more than 100 psi.
7. Inspection: Monitored by the Project Representative.
8. Frequency: In accordance with Division 01 Section "General Requirements - Quality Requirements."
9. Concrete Replacement: Failure of a test or to follow proper installation procedures will require that the concrete be removed and properly replaced at Contractor's expense.
10. Additional Tests: Contractor may have the testing agency make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42. Contractor shall pay for all such tests conducted. Holes shall be patched at the Contractor's expense.

#### 1.5 SEQUENCING AND SCHEDULING

- A. Concrete shall not be placed after October 15 without written permission from the Project Representative.

#### 1.6 WARRANTY

- A. Furnish and sign 2 year written warranty (last page of this section) which shall cover cracking, spalling, settling, finishing and forming.

### PART 2 - PRODUCTS

#### 2.1 CEMENT

- A. Portland cement conforming to the requirements of the current specifications for Portland Cement ASTM C150 Type 1.

#### 2.2 AIR-ENTRAINING ADMIXTURE

- A. Conform to ASTM C260 for concrete.

## 2.3 FINE AGGREGATE

- A. Limestone or other fine aggregate that is free of soft particles or other material that could cause staining or pitting of the pavement surface. For gradation purposes only, the material shall conform to MDOT Specification 2NS.

## 2.4 COARSE AGGREGATE

- A. Well-graded limestone. Gradation and physical requirements to conform to MDOT Specification 6AA.

## 2.5 WATER

- A. Potable.

## 2.6 REINFORCEMENT

- A. Welded Wire Reinforcement:
  - 1. Standard; Welded wire fabric (6 x 6 - W4.0 / W4.0) in flat sheets only, conforming to ASTM A1064.
  - 2. Heavy duty and heated pavement; Welded wire fabric (4 x 4 - W4.0 / W4.0) in flat sheets only, conforming to ASTM A1064.
- B. Bar Reinforcement: No. 3, No. 4 and No. 5 bar reinforcement as specified on the Drawings. It shall be new billet stock of intermediate grade in accordance with ASTM A615.

## 2.7 DOWELS

- A. Construction Expansion Joints:
  - 1. No. 5 speed dowel 9 inches long, as manufactured by Greenstreak, Inc., 3400 Tree Court Industrial Blvd., St Louis, MO; 800-325-9504; or approved equal.
  - 2. Dowel: 18 inches long, No. 5 smooth epoxy-coated rebar (coated all surfaces); or approved equal.
  - 3.  $1/4'' \times 4-1/2'' \times 4-1/2''$  electroplated zinc steel, ASTM A36, ASTM B633 with pocket formers
  - 2-a. Diamond Dowel System as manufactured by PNA Construction Technologies  
www.PNA-INC.com ; 800-542-0214 ; or approved equal.
- B. Construction Joints:
  - 1. As specified above.

## 2.8 FORMED KEYWAY

- A. Standard keyway, 1-5/8-inch x 1-3/4-inch x 2-3/4-inch, as manufactured by Dee Concrete Accessories Company, P.O. Box 11119, Chicago, IL 60611; or approved equal.

## 2.9 ASPHALT EXPANSION JOINTS

- A. Conform with ASTM Specification D994-53. Fiber joint material is not acceptable.

## 2.10 JOINT SEALER

- A. Tremco Spectrem 800. Primer: Tremco Silicone Primer No. 23. Tremco-Sealant/Weatherproofing Division, 3735 Green Road, Beachwood, OH 44122; 800 321 7906.

## 2.11 CURING AND ANTI-SPALLING COMPOUNDS

- A. Curing and Anti-Spalling Compound:

1. For use when the concrete is placed at 40 degrees F and above.
2. Sealtight brand Lin-Seal Emulsion curing and sealing compound; Clear emulsion product (not to be confused with Lin-Seal or Lin-Seal white).
3. Manufactured by M.G. by W.R. Meadows, Inc, PO Box 338, Hampshire, IL 60140 0338; 847-683-4500, 800-342-5976.

- B. Waterproofing Compound:

1. For use when the concrete is placed below 40 degrees F or when the concrete pavement is within 50 feet of building entrances; or both. Either of the following will be accepted.
2. Products:
  - a. Lifetime™ Water Sealant by Coatings International, Inc., 112 North Monroe, N.E. Rockford, MI 49341; 616-863-6529; Fax: 616-863-1076; [www.coatingsinternational.com](http://www.coatingsinternational.com)
  - b. Consolideck Saltguard WB by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046; 785-865-4200; Fax: 785-830-9016; [www.prosoco.com](http://www.prosoco.com).

- C. Evaporation Retardant:

1. Conspec Aquafilm by Conspec Marketing & Manufacturing, 636 S. 66<sup>th</sup> Terrace, Kansas City, Kansas 66111; 800-348-7351
2. Confilm Evaporation Reducer by BASF Construction Chemicals, LLC, 23700 Chagrin Boulevard, Cleveland, Ohio 44122-5544, 800-628-9990; Fax 216-839-8821
3. Approved equal

## 2.12 ADMIXTURES

- A. As approved by Project Representative.

## 2.13 FORMWORK

- A. Steel or wood forms of an approved section shall be used throughout the construction. On radii 3 feet or less, 1/4-inch plywood or masonite shall be used. All forms shall have a height equal to concrete thickness. Built-up, battered, bent, twisted, or broken forms shall be removed from the Work. Expansion joint materials shall not be used.

## 2.14 CONCRETE QUALITY

- A. The mixture shall contain 6 sack Portland cement concrete, coarse aggregate, fine aggregate admixtures and water. The concrete mix design shall have a minimum 4000 psi compressive strength at 28 days. The maximum allowable slump shall be 4.5 inches. Aggregates shall be batched by weight. Air content shall be 5% to 8%. Maintain a maximum water/cement ratio of 0.46 pounds of water per pound of cement.
- B. Contractor shall provide the Project Representative with delivery tickets which shall list slump, sack mix, percent of air entraining agent, time the truck left the plant, arrived on the site and departed the site, and water added at the site.
- C. When requested, Contractor shall provide documentation from the concrete supplier certifying that the concrete meets the specifications of this section.
- D. Color shall be limestone. Consistency of the color shall be uniform throughout the Project.

## 2.15 DETECTABLE WARNING PLATES

- A. 24" x 24" Duralast Detectable Warnings, Product number 00700571, Natural Finish by East Jordan Iron Works, Inc.; 800-626-4653

*Note Remove this section if no heated pavement in Project.*

## 2.16 HEATED PAVEMENT SPECIAL PRODUCTS

- A. Joint Sealer:
  - 1. G-Seal #632 for 1/2-inch expansion joints, as manufactured by Greenstreak, Inc.; 800 352 9504.
  - 2. G-Seal #628 for 3/4-inch expansion joints; as manufactured by Greenstreak, Inc.
- B. Chairs:
  - 1. Reinforcing which will have the tubing wired to it shall be placed on chairs.
  - 2. Chairs shall be a continuous high chair, type CHCP, with earth bearing base of sheet metal having a sufficient gauge and bearing area.

## PART 3 - EXECUTION

### 3.1 PLACING FORMS

- A. Forms shall be so constructed and set as to resist, without springing or settlement, the pressure of the concrete. Forms shall not deviate more than 1/8-inch in 10 feet from the true horizontal alignment and no more than 1/8-inch in vertical alignment.
- B. Where forms are set above general surrounding area, earth shall be placed along outside edges of forms to ensure stability.
- C. Forms shall be cleaned and oiled each time they are used.
- D. Forms shall be reviewed by the Project Representative prior to pouring.

### 3.2 PLACING REINFORCEMENT

- A. Place reinforcement mesh as indicated on the Drawings and in the following areas:
  - 1. Where the pavement crosses a recently filled trench and extending a minimum of 5 feet beyond the trench wall.
  - 2. Where fill soil of 18 inches or more occurs.
  - 3. As directed by the Project Representative.
- B. Concrete shall be placed in 2 layers when mesh reinforcing is used. Use of brick, stones, etc., or unusual raising with bars or tools is prohibited. Proper positioning of the mesh can be achieved by either; (1) the use of metal or plastic chairs specifically intended for holding mesh reinforcement in the soil conditions present at the required depth, or (2) placing and consolidating a layer of concrete at the specified elevation of the reinforcement prior to placing reinforcement and a top layer of concrete

### 3.3 PLACING CONCRETE

- A. Placing 6-inch (or greater, if specified) concrete shall not commence until the subbase and forms have been approved. Subbase shall be moistened in advance of concreting, but shall not be muddy or excessively wet. A sufficient quantity of forms shall be placed to accommodate the concrete that is scheduled to be poured at any one time. Concrete shall be deposited with a minimum of re-handling and shall be spaded adjacent to forms and joints. In the case of isolation joints, concrete shall be placed simultaneously against both sides of the joint.
- B. Concreting shall not be continued when the air temperature is below 45 degrees F, unless the aggregates or water, or both, are heated to produce a placing temperature of the concrete between 60 degrees F and 90 degrees F., and unless adequate provisions are made for maintaining protection against freezing of the concrete for at least 7 days after placing. No concrete shall be placed on frozen subbase.
- C. Should placement of concrete be necessary over or near tree roots, a thin layer of sulfur shall be placed on the area of the subbase which may be affected by the roots. Owner shall place sulfur. Provide 2 day notice to coordinate work with Owner's crews.

### 3.4 JOINTING

- A. As indicated on the Drawings, as directed in the field by the Project Representative and in the following situations, unless otherwise specified:
1. Control (contraction) joints shall ordinarily be placed at intervals equal to the width of the slab or 8 feet, whichever is less. They shall be 1/8-inch to 3/16-inch wide and 1-1/4 inch deep, or 1/4 the thickness of the slab, whichever is greater. Where slabs exceed 8 feet in width, a straight longitudinal control joint shall be placed along the centerline of the slab. This joint shall begin and end only at isolation or construction joints.
  2. Expansion joints shall be placed as indicated on the Drawings and if not conflicting with Drawings at intervals of at least every 40 lineal feet (LF), adjacent to footings and foundations, adjacent to curbs when required, adjacent to existing concrete where new concrete is to abut or at next available joint that is parallel to the edge of the existing concrete. Continue joints in adjoining concrete, in the same location as existed in the concrete that was removed, and where 2 or more walks intersect. Joints shall be placed in a vertical position through the entire slab thickness.
  3. Construction joints (with dowels) shall be installed when placing operations are delayed more than a 1/2-hour at locations where normal control joints would occur, as indicated on the Drawings and as directed by the Project Representative.
- B. Joints shall be tooled to the specified depth. If the pavement thickness is greater than 6 inches, sawing will be permitted after the joints have first been tooled. The only exception to this requirement is for basketball courts, where only saw cutting is permitted.
- C. Joints shall be perpendicular to the edge and tangents and normal to curves. The joints shall not vary from the true line more than 1/4-inch.
- D. When new walkways are adjacent to new curb and gutter or when required by the Project Representative, the Contractor shall install a formed keyway. A pre-molded tongue and groove is not permitted.
- E. Place sealant in non-heated pavement joints when specified, according to manufacturer's recommendations, using primer as specified.

### 3.5 FINISHING

- A. Concrete shall be placed and struck off with a straight board until voids are removed in the surface at the required grade and cross section.
- B. Adding water to the surface of the concrete to assist in finishing operations is not permitted. If a finishing aid is permitted by the Project Representative, it shall only be an approved product for that intended purpose and then applied according to the product recommendations.
- C. Immediately after the concrete has been struck off, the surface shall be floated with a magnesium bull float, just enough to produce a smooth surface free from irregularities. Edges shall be rounded to a radius of 1/4-inch with an approved edging tool. Jointing shall then

commence immediately after edging and before the large aggregate in the concrete has started to settle.

- D. The entire surface shall then be steel-troweled so that the large aggregate is set and the surface is free of edging joints and trowel marks.
- E. The surface shall be heavy-broomed, keeping mortar out of joints. Brooming direction shall generally be perpendicular to the normal path of travel, unless otherwise directed by the Project Representative. Provide 2-inch retool at joints, if detailed on the Drawings.
- F. Surface variations greater than 1/8-inch in 10 feet are unacceptable.
- G. Walks shall be protected from pedestrian traffic for 2 days and vehicles for 7 days.
- H. Concrete shall be stamped at each end of the work with the Contractor's name and the current year.

### 3.6 CURING AND ANTI-SPALLING COMPOUND APPLICATION

- A. For temperatures above 40 degrees F, concrete shall be cured utilizing the specified curing/anti-spalling compound in accordance with product specifications using only a motorized sprayer. This application includes the sides of the concrete, once the forms have been removed.
- B. For temperatures between 32 degrees F and 40 degrees F and on concrete within 50 feet of building entrances, cure pavement using an approved wet cure method for a period of not less than 7 full days while maintaining a concrete temperature above 34 degrees F for 14 days. After 30 days, the specified water proofing compound shall be applied according to product specifications.

### 3.7 DETECTABLE WARNING PLATES

- A. Follow manufacturer's installation specifications to properly install detectable warning plates per site plan layout. Pay special attention to be sure the plastic concrete comes through all the holes in the plate to eliminate all cavities below the plate that could trap water.

### 3.8 HEATED PAVEMENT AREAS

- A. Layout:
  - 1. Each zone shall have its manifold area within the area heated and each zone shall be independent from other zones and separated with sealed expansion joints.
  - 2. All main line piping shall be bedded under the concrete slab. If this is not possible, then the main line piping shall be installed in appropriate sleeving to protect it from damage by gardening equipment.



- B. Coordinate height of sand chair to correspond to the depth of tubing from the concrete paving surface to top of tubing.
- C. Reinforcing shall be held at the correct elevation with sand chairs. No other materials shall be permitted.
- D. Drainage from a heated pavement area shall flow to a catch basin within the heated pavement area or directly adjacent to the heated paving. No drainage shall flow onto a cold pavement surface.
- E. In areas designated on the Drawings as a barrier free parking space, either so noted or with a uniform barrier free graphic symbol, the slope of the parking space and adjacent access aisle shall not exceed 2 percent (1/4-inch per foot) in any direction.
- F. Installation of concrete shall be as specified in this section.
- G. For heated pavement systems, the heated portion of the concrete shall be stamped with the words "Heated Pavement Limit." Stamp locations shall be approved by the Project Representative.
  - 1. Text shall be placed along the entire edge of the heated concrete at uniform increments of approximately 10 feet to 15 feet and shall be readable when standing on the heated pavement. This includes along buildings and structures.
  - 2. If the edge of the heated surface is curb/gutter, then the stamp shall be placed on the gutter pan rather than on the adjacent pavement.
  - 3. The cast aluminum stamp may be available for use from Engineering and Architectural Services, Physical Plant Division if arrangements are made in advance and the stamp is available. Otherwise, Contractor is responsible to secure a stamp that is approved by the Project Representative and identical to the EAS heated pavement stamps reading "Heated Pavement Limit."

(CONCRETE PAVEMENT WARRANTY ON THE FOLLOWING PAGE.)

## CONCRETE PAVEMENT WARRANTY

**PROJECT:**

**CONTRACTOR:**

**OWNER: BOARD OF TRUSTEES  
MICHIGAN STATE UNIVERSITY**

We, the undersigned, herewith warranty all the work to be free from defective workmanship and/or materials for **two (2) years** from November 1<sup>st</sup> of the calendar year of the date written below, in accordance with the requirements set forth in the Drawings and Specifications for the above-named Project.

The Contractor agrees that by acceptance of this Work and in consideration thereof, for them and for each of their Subcontractors, binds themselves to all warranties called for. The Contractor shall warranty all work, except as noted elsewhere in these Contract Documents in which a longer warranty is specified. This shall include, but not be limited to, the following defects:

1. Cracking
2. Spalling
3. Settling
4. Finishing
5. Forming

If during the warranty period, it is found by the Owner's Representative, that the warranty Work needs to be repaired or replaced because of the use of materials, equipment, or workmanship which is inferior, defective, or not in accordance with the terms of Agreement, the Contractor, upon notification, shall promptly and without additional expense to the Owner:

- a. Place in satisfactory condition all of such warranted Work,
- b. Make good all damage to the project, or contents thereof, which is a result of such unsatisfactory warranted Work, and
- c. Make good any Work, materials and equipment that are disturbed in fulfilling the Warranty, including any disturbed work, materials and equipment that may have been warranted under another contract.

Should the Contractor fail to proceed promptly in accordance with the Warranty, the Owner's Representative may have such work performed at the expense of the Contractor and their surety.

CONTRACTOR: \_\_\_\_\_ DATE: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

AUTHORIZED REPRESENTATIVE: \_\_\_\_\_ (Print) \_\_\_\_\_ (Signature)

SUBSCRIBED AND SWORN TO BEFORE ME,

THIS \_\_\_\_\_ DAY OF \_\_\_\_\_

A.D. \_\_\_\_\_

NAME

MY COMMISSION EXPIRES

END OF SECTION 321313