

## SECTION 32 13 13 – CONCRETE PAVING

### PART 1 – GENERAL

#### 1.01 DESCRIPTION OF WORK

- A. The extent of concrete work is shown on drawings.
- B. For LEED Materials Credit 5.1 and 5.2, provide concrete components that are extracted or manufactured within 500 miles of project site.

#### 1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

#### 1.03 LEED REQUIREMENTS FOR PROJECT CERTIFICATION:

- A. Invoices and documentation from manufacturer or supplier to include the amounts of post-consumer and post-industrial recycled content by weight for all materials used, and city and state of origin of all materials and city and state of final assembly.
- B. Documentation from supplier of surface reflectance of finished concrete, or contractor to provide measurements of reflectance.

#### 1.04 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Utilize flagmen, barricades, warning signals and warning lights as required.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
- B. Use flexible spring steel forms or laminated boards to form radius bends as required.
- C. Coat forms with non-staining form release that will not discolor or deface surface of concrete.
- D. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 40. Cut bars true to length with ends square and free of burrs.
- E. Sealing Compound – for exposed aggregate finish ONLY: DSG-J.21 Acrylic cure seal and dust proofer 14.

#### 2.02 CONCRETE MIX AND DESIGN

- A. Use one brand of concrete throughout project as supplied by either I.M.I. Ready Mix, Nashville, TN (VU Sidewalk Mix #835) or Metro Ready Mix, Nashville, TN (VU Sidewalk Mix #44)
- B. Mixture to be composed of the following:
  - 1. Portland cement: Type 1 470 lbs./C.Y.
  - 2. River Sand: 1300 lbs./C.Y.
  - 3. Stone: (Brown river gravel 1/2" or less), 1600 lbs./C.Y.
  - 4. Water: 240/C.Y.
  - 5. 3/4" Fiber mesh: 1.5 lb./C.Y.

- 6. Fly Ash: 70 lbs./C.Y.
- C. Owner to approve sample.
- D. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water reducing as mixture (super-plasticizer), air-entraining admixture and water to produce the following properties:
  - 1. Compressive Strength: 3500 psi, minimum at 28 days.
  - 2. Slump Range: 3" for concrete.
- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Owner. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Owner before using in work.
- F. Admixtures:
  - 1. Use water-reducing admixture in all concrete.
  - 2. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50° F (10° C).
  - 3. Use air-entraining admixture in all concrete. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within following limits:
    - a. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure: 6% to 8% for maximum 3/4" aggregate
  - 4. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
- G. Slump limits: Proportion and design mixes to result in concrete slump at low point of placement as follows: Ramps and Sloping Surfaces: Not more than 3".
- H. Polypropylene Fibers: Use 1.5 pounds of fibers per cubic yard of concrete. Introduce the fibers into the concrete mix per the manufacturer's recommendations.

### 2.03 CONCRETE MIXING

- A. All concrete to be supplied by I.M.I. Ready Mix or Metro Ready Mix Concrete, Inc.
- B. Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1 1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu., yd., increase minimum 1-1 1/2 minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.
- C. Job-Site mixing shall be allowed for minor applications only.
- D. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
- E. Maximum of 2 gallons of water per cubic yard may be added to the batch of material of insufficient slump.
- F. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.
- G. When air temperature is between 86° F (30° C) and 90° F (32° C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90° F (32° C), reduce mixing and delivery time to 60 minutes.

## PART 3 – EXECUTION

### 3.01 EXCAVATION

- A. When excavating, avoid tearing tree roots. Saw cut any tree roots that interfere with walk layout.

Excavate 10 inches. In areas where tree roots are extensive, Owner may direct Contractor to install walks above existing grade to avoid excavation.

- B. Topsoil shall be stockpiled at location on campus as designated by Owner.

### **3.02 SURFACE PREPARATION**

- A. Remove loose material from compacted base surface immediately before placing concrete.
- B. Proof-roll prepared base surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been checked by Campus Planning & Construction, Vanderbilt, and have been corrected and are ready to receive paving. Spread 4" gravel base and proof-roll before placing 6" concrete.

### **3.03 PREPARATION OF FORM SURFACES**

- A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- C. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

### **3.04 FORM CONSTRUCTION**

- A. Replacement inspection: It shall be the contractor's responsibility to notify Campus Planning at least 24 hours prior to placing any forms.
- B. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

### **3.05 CONCRETE PLACEMENT**

- A. Pre-placement Inspection: It shall be the Contractor's responsibility to notify Campus Planning at least 24 hours prior to placing any concrete.
- B. All walks shall be 6" thick unless shown otherwise on drawings.
- C. Pour one 3' x 3' test panel of concrete pavement with finish to be selected by Owner.
- D. Do not place concrete until base and forms have been checked for line and grade. Moisten base as required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- E. Coordinate the installation of joint materials and moisture barriers with placement of forms.
- F. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.
- G. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- H. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
- I. When air temperature has fallen to or is expected to fall below 40° F (4° C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50° F (10° C), and

not more than 80° F (27° C) at point of placement.

- J. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen sub-grade or on sub-grade containing frozen materials.
- K. Do not use salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
- L. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 as herein specified.
- M. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90° F (32° C). Mixing water may be chilled or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing.
- N. Wet forms thoroughly before placing concrete.
- O. Use water-reducing retarding admixtures (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.
- P. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Vanderbilt's option. If machine placement is to be used, concrete mix to be same as sidewalk with sandblasted finish as specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

### 3.06 JOINTS

- A. Pre-placement Inspection: It shall be the responsibility of the contractor to notify Campus Planning at least 24 hours prior to the placement of any joints.
- B. General: Construct expansion and weakened-plane construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.
- C. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.
- D. Construction and Control Joints: "Form A Key" metal keyed joint with removable cap. Available from Enco Materials.
- E. Expansion Joints: Provide 1/2" bituminous felt joint filler for expansion joints abutting concrete curbs, catch basins, man-holes, inlets, structures, walks and other fixed objects, unless otherwise indicated.
- F. Locate expansion joints at 30' o.c. for each pavement lane, unless otherwise indicated.
- G. Extend joint fillers full-width and depth of joint. Place top of joint filler flush with finished concrete surface.
- H. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.
- I. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

### 3.07 CONCRETE FINISHING

- A. After striking-off and consolidating concrete, smooth surface by screeding and bull floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture, working gravel below the finish surface.
- B. After floating, test surface for trueness with a 10' straight-edge. Distribute concrete as required to remove surface irregularities, and refloat repaired area to provide a continuous smooth finish.
- C. Work edges, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

- D. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace area or sections with major defects, as directed by Landscape Architect. Rub surfaces with a magnesium hand float, sealing all holes and smoothing the surface.

### **3.08 EXPOSED AGGREGATE FINISH ONLY**

- A. Apply Aggretex "H" retardant, by A.C. Horn, Rugasol C/S/, by Sika, or approved equal, to surface in strict accordance with manufacturer's directions for exposing approximately 1/8" of surface aggregate. After 24 hours, remove matrix by scrubbing with stiff fiber brushes and hosing off. For slab edges and step risers, coat forms with Aggretex "F" or Rugasol FD according to manufacturer's directions and follow with cleaning as above.
- B. Prepare samples of both methods for approval.

### **3.09 CONCRETE CURING AND PROTECTION**

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- D. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by membrane curing, and by combinations thereof, as herein specified.
- E. Provide moist curing by following methods:
  - 1. Keep concrete surface continuously wet by covering with water.
  - 2. Continuous water-fog spray.
  - 3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
- F. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover (polyethylene-coated burlap waterproof paper, polyethylene film) for curing concrete, placed in widest practicable with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- G. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces exposed to heating by the sun or to wind by keeping forms wet in place for the full curing period or until forms can be safely removed. If forms are removed, continue curing by methods specified above, as applicable till the end of the full curing period.
- H. Remove metal control joint caps after curing is complete.

### **3.10 SANDBLAST FINISH ONLY**

- A. Sandblast concrete at 7 to 10 days.
- B. Test panel is to be sandblasted while University Landscape Architect is present on site. Landscape Architect will choose the finish that Vanderbilt will accept. Notify Campus Planning no later than 3 days prior to sandblasting.

### **3.11 REPAIRS AND PROTECTIONS**

- A. Replace broken or defective concrete, as directed by the Owner.

- B. Drill test cores where directed by Campus Planning, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy resin grout.
- C. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.
- D. Drill test cores where directed by Campus Planning, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy resin grout. Haul off all debris.

### **3.12 QUALITY CONTROL TESTING DURING CONSTRUCTION**

- A. If testing is required, it shall be at Owner's expense as directed by Owner. All defective materials shall be removed and replaced at Contractor's expense and at no cost to Owner.

### **3.13 TOPSOIL BACKFILLING AND LAWN REPAIR**

- A. All new walk edges and disturbed areas resulting from construction shall be backfilled with topsoil by contractor. Topsoil must be furnished as specified: equivalent to Maury silt loam: 12-27% clay, 20-50% sand, 40-70% silt, permeability 2-6 inches per hour, low shrink-swell potential, pH 6.5 - 7.0, minimum 2% organic matter. Topsoil shall be tested for physical properties, organic content, pH and nutrients content by a reputable soil testing lab. Test results shall be submitted to Owner for approval before topsoil is brought to site.
- B. All new walk edges shall be sodded with a 24" width of mixed fescue sod after backfilling unless directed otherwise by University Landscape Architect. Sod shall be thoroughly hand watered by sod contractor immediately after installation of sod. In non-irrigated areas, sod contractor shall water sod every day for 2 weeks, or until final acceptance by Owner, whichever comes first. In irrigated areas, sod contractor shall contact Owner to arrange irrigation scheduling to insure survival of sod. Other disturbed lawn areas shall be seeded with a mixture of 50% Rebel fescue and 50% Falcon fescue.
- C. Coordinate scheduling of backfilling and seeding or sodding with Irrigation Contractor. Irrigation system installation should be complete before backfilling begins.

END OF SECTION