DIVISION 32 - EXTERIOR IMPROVEMENTS

Contents

32 01 00 Operations and Maintenance of Exterior Improvements

32 01 16 Cold Milling of Existing Asphalt Pavement

1. Milling shall reference the requirements of Division 31 and the appropriate sections of the SCDOT "Standard Specifications for Highway Construction". Specify milling must be scheduled so that the period between the milling and the installation of the new paving is minimized. The schedule must be approved by the Project Manager.

2. Specify the equipment to have a self-contained water system to control dust and other fine particles.

3. Specify the planed surface to be free from gouges, ridges, oil film, and shall have a uniform appearance suitable as a riding surface that is capable of handling traffic prior to the installation of the new paving.

4. The designer shall require particular care to be taken in milling adjacent to existing utility rings and covers and beneath existing tree cover. Damages to adjacent structures and areas where all the existing paving is removed shall be stabilized and/or repaired as directed by the project manager at no additional cost to the owner.

5. The milling debris becomes the property of the contractor and shall be disposed of by the contractor in compliance with all statutes governing the disposal of this waste.

32 05 00 Common Work Results for Exterior Improvements

1. Specify that all exterior improvements are to be coordinated with work covered by other divisions of this document including but not limited to site utilities, landscaping, OSHA regulations, erosion and sediment control, notifications to the local utility locating services.

2. Specify that all work is to comply with the University Fire Apparatus Access Requirements and CUFD Fire Lane Markings.

3. Specify that all testing and quality control requirements identified in Sections 01 40 00 and 01 45 00 are satisfied. The designer will also specify all testing requirements in accordance with pertinent codes and standards.

4. The University retains the right to engage a testing laboratory as needed to perform materials testing on the specified products as it sees fit.

5. Materials and work failing to meet the specified requirements shall be retested at the contractor's expense.

6. Specify that the testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.

7. Specify that the contractor shall be responsible for coordination of testing services and maintain a log, preparation of test cylinders, etc. as needed.

8. Specify complete technical data and performance properties for each product design, certifications, qualification of firms, etc. be provided to the University.

9. Specify any warranties, certificates, or test reports signed by the applicable manufacturer or contractor, certifying that each material complies with requirements.

10. Specify that SDS sheets on each product shall be provided as requested by the the University.

11. Specify that the contractor is to conduct operations to minimize any disruption to the owner's operation.

12. Specify that the contractor is responsible for the protection of any existing property or utilities in or adjacent to the construction site.

13. All exterior improvements shall be protected from damage. Protect the surface finish of newly placed concrete or asphalt paving from damage by rainwater or construction traffic. Maintain exterior improvements free of stains, discoloration, dirt, and other foreign material until substantial completion.

32 10 00 Bases, Ballasts, and Paving

1. The designer shall detail the examination, preparation, quality control measures, temperature and other environmental factors, for the installation of the base courses, paving, and concrete materials in accordance with applicable sections of this document.

2. Design all surface paving and exterior flatwork with a positive drainage flow towards appropriate conveyance.

3. Specify the type and frequency of testing and inspection.

4. Specify alterations or correction procedures.

5. Specify that the contractor verifies existing conditions before starting work.

6. Design, material, and execution shall adhere to applicable standards that apply to aspects of asphalt and concrete construction. Among these referenced may include the following:

    A. American Association of State Highway and Transportation Officials (AASHTO):

    - M 154 Air-Entraining Admixtures for Concrete
    - M 226 Viscosity Graded Asphalt Cement
    - T 179 Effect of Heat and Air on Asphalt Materials
    - T180 Moisture-Density Relations of Soils Using a 4.54-kg rammer and a 457- mm drop.

- T 245 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

B. American Concrete Institute (ACI) Publications:

- ACI 301 Specifications for Structural Concrete
- ACI 305 Recommended Practices for Hot Weather Concreting
- ACI 306 Recommended Practices for Cold Weather Concreting
- ACI 308 Standard Practice for Curing Concrete
- ACI 318 Building Code Requirements for Structural Concrete
- ACI 347 Guide to Formwork for Concrete

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

- A 82 Steel Wire, Plain, for Concrete Reinforcement
- A 185 Welded Steel Wire Fabric for Concrete Reinforcement
- A 307 Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- A 615 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- A 780 Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- C 31 Making and Curing Concrete Test Specimens in the Field
- C 33 Concrete Aggregates
- C 39-72 Compressive Strength of Cylindrical Concrete Specimens
- C 42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- C 94 Ready-Mixed Concrete
- C 143 Slump of Hydraulic-Cement Concrete
- C 150 Portland Cement
- C 171 Sheet Materials for Curing Concrete
- C 172 Sampling Freshly Mixed Concrete
- C 231 Air Content of Freshly Mixed Concrete by the Pressure Method
- C 260 Air-Entraining Admixtures for Concrete
- C 309 Liquid Membrane-Forming Compounds for Curing Concrete
- C 494 Chemical Admixtures for Concrete
- C 881 Epoxy-Resin-Base Bonding Systems for Concrete
- C 1059 Latex Agents for Bonding Fresh To Hardened Concrete
- C 1064 Temperature of Freshly Mixed Hydraulic-Cement Concrete
- D 698 Laboratory Compaction Characteristics of Soil Using- Standard Effort
- D 946 Penetration Graded Asphalt Cement for Use in Pavement Construction
- D 979 Sampling Bituminous Paving Mixtures
- D 1188 Bulk Specific Gravity and Density of Compacted- Bituminous Mixtures Using Coated Samples
- D1556 Density of Soil in Place by the Sand-Cone Method.
- D1557 Laboratory Compaction Characteristics of Soil Using Modified Effort
- D 1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction

- D 1752 Preformed Sponge Rubber Cork and Recycled PVC- Expansion Joint Fillers for Concrete Paving and Structural Construction
- D 2167 Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- D 2726 Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
- D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods
- D 2950 Density of Bituminous Concrete in Place by Nuclear Methods
- D 3017 Water Content of Soil and Rock in Place by Nuclear Methods
- D 3549 Thickness or Height of Compacted Bituminous Paving Mixture Specimens
- D 5581 Resistance to Plastic Flow of Bituminous Mixtures
- E 329 Agencies Engaged in Construction Inspection, Testing, or Special Inspection

D. Asphalt Institute: MS-4 "The Asphalt Handbook"

E. Concretes and Reinforcing Steel (CRSI): "Manual of Standard Practice"

F. South Carolina Department of Transportation "Standard Specifications for Highway Construction"

32 11 00 Base Courses

32 11 23 Aggregate Base Courses

1. Provide placement instructions and emphasize that application on frozen, muddy, or soft surfaces is prohibited unless addressed in the design.

2. Contractor shall provide a ten (10) foot straight edge and any needed labor for its use in the vicinity of paving operation at all times for measuring surface irregularities. The surface of all courses shall be checked with a straight edge as necessary to detect surface irregularities.

3. Unless other conditions warrant, design tolerances from the above referenced standards are:

   - Flatness: Maximum variation of ½ inch measured with an acceptable 10–foot straight edge.

   - Scheduled Compacted Thickness: Within 3/8 inch.

   - Variation from Design Elevation: Within ½ inch.

32 11 26 Asphaltic Base Courses

1. As with aggregate base courses, tolerances shall be checked with a straight edge as necessary to detect surface irregularities. Unless other conditions warrant, design tolerances from the above referenced standards are:

- Flatness: Maximum variation of 1/4 inch measured with an acceptable 10-foot straight edge.
- Scheduled Compacted Thickness: Within 3/8 inch.
- Variation from Design Elevation: Within 3/8 inch.

32 12 00 Flexible Paving

32 12 16 Asphalt Paving

1. Design must indicate placement of hot-mix asphalt binder course in number of lifts and thicknesses. Unless other conditions warrant, design tolerances from the above referenced standards are:

    - Base and Binder Course Thickness: Within ½ inch.
    - Surface Course Thickness: Within ¼ inch.

2. Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straight edge applied transversely or longitudinally to paved areas:

    - Base or Binder Course: ¼ inch
    - Surface Course: 1/8 inch
    - Crowned Surface: Test with crowned template centered and at right angle to crown.
    - Maximum Variance from template is ¼ inch.

3. Designate contractor to reset utility frames for manhole covers, cleanout covers, valve boxes, and other such units with areas to be paved to the final grade as part of this work. It is required that adjustments be made with appropriate paving rings.

4. Surround the frames that have been adjusted to grade with a ring of compacted asphalt base prior to paving. Adjust frames as required for paving, providing temporary closures over openings to prevent damage during the rolling operations and construction traffic. Replace covers at the completion of the paving operation.

5. The contractor shall be responsible for the installation of any signalization sensors or inductive loops beneath the finish asphalt surface course. The installation of these sensor loops shall be provided by an SCDOT approved installer/contractor. Loops shall not be saw-cut into the surface course of asphalt. They shall be installed prior to its placement.
6. Design concrete paving in lieu of asphalt, at any loading dock, dumpster pad, or receiving area subject to heavy vehicular traffic, or where liquid oxygen or nitrogen may be present.

32 13 00 Rigid Paving

33 13 13 Concrete Paving

1. Unless other conditions warrant, specify concrete with the compressive strength of

4000 psi for 28-day strength as minimum for pavements and curb and gutter subject to vehicular traffic.

2. Specify reinforcement method.

3. Specify slump in the range of 1" for slip-form paving and no greater than 4" for fixed-form or other means of paving.

4. Specify entrained air voids in the mix ranges from 3% to 6% at the point of placement in the roadway. Unless other conditions warrant, design tolerances are:

    - Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.
    - Maximum Variation from True Position: 1/2 inch.
    - Maximum Variation in Thickness: 1/2 inch.

5. Specify that concrete pavement operations can be performed only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

6. The contractor shall provide and maintain sufficient tools and equipment on hand to facilitate uninterrupted placement of the concrete.

7. Do not use concrete that is not placed within one hour after water is first introduced into the mix.

8. Consolidate concrete with care to prevent dislocating formwork, reinforcement, dowels, and joint devices. Honeycombed areas are considered defective and will not be accepted.

9. Specify construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete.

10. Specify temperature and environmental conditions acceptable for concrete pouring.

11. Specify that concrete failing to meet strength requirements, dimensional tolerances, weathertightness criteria, or is otherwise deficient due to insufficient curing, improper consolidation or physical damage shall be replaced or repaired as instructed by the project manager at no expense to the University.

12. Specify finish surfaces appropriate for the intended use. Broom finishes shall be drawn across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

13. Allow concrete curing by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these methods.

14. Contractor to protect freshly placed concrete from mechanical injury, premature drying, and excessive cold or hot temperatures. Exclude vehicular traffic from concrete pavement for at least 14 days after placement.

32 14 00 Unit Paving

32 14 16 Brick Unit Paving

1. Walkways and pedestrian circulation are discussed in the University Site Design Guidelines and must be reviewed by University Planning when selecting paving material for walkways on the campus.

2. The brick that is in general use for brick paved areas on the campus is a solid paver in the red-brown range. All brick pavers shall be installed with a 4" concrete sub-base with a ¾" sand base.

32 16 00 Concrete Curbs, Gutters, Sidewalks, and Driveways

1. Concrete work shall reference the requirements of Division 3 as well as Section 32 13 13. The location and type of curb and gutter shall match adjacent whenever possible.

2. Provide concrete with the compressive strength of 3000 psi for 28-day strength as minimum for sidewalks and curb and gutters not subject to vehicular traffic. Specify slump and air entrainment, environmental conditions, reinforcement method and joint location.

3. Finish all concrete surfaces in accordance with the following schedule:

    - Form finish: Surfaces not ordinarily exposed to view; including the underside of slabs not exposed to view by repairing defective concrete, filling tie holes and depressions deeper than 1/4". Remove fins exceeding 1/8" in height.

    - Broom finish: Exterior slabs exposed to view including: Outdoor floor slabs and walkways, other floors which may become wet or otherwise require a non-skid surface, Sidewalks and concrete pavements. Provide a scored texture by drawing a broom across the surface perpendicular to predominant travel direction.

    - Edge finish: Tool edges with a ¼" radius tool.

32 16 23 Sidewalks

1 All sidewalks and concrete walking paths shall be at least 5 feet in width.

2 Sidewalks shall also have a maximum of 2% cross-slope, and a maximum of 5% running slope everywhere technically feasible. Notify Building Official when these slopes are exceeded for any reason.

3 All sidewalks and concrete walking paths also meet all applicable requirements set forth in the current edition of ICC A117.1.

32 17 00 Paving Specialties

32 17 23 Pavement Markings

1. Specify paving to cure for 14 to 30 days before starting pavement markings.

2. Sweep and clean surface prior to painting to remove any loose material and dust. Apply paint with mechanical equipment to produce pavement markings with uniform, straight edges.

3. Pavement markings shall consist of pavement marking paint or thermoplastic pavement markings as required by the Project Manager or authorities having jurisdiction. Paint shall typically be used for low traffic installations such as parking lots and Thermoplastic shall be used for higher traffic applications.

4. Fire lane markings shall be placed in accordance with the CUFD Fire Lane Markings Standards and approved by the University Fire Code Official.

32 31 00 Fences and Gates

32 31 11 Gate Operators

1. All vehicular access gates that will be used for emergency vehicle access shall be powered and shall be siren operated unless card access is provided.

32 80 00 Irrigation

1. Provide an irrigation system if determined necessary by the University Planning for all new or renovated lawn areas and planting beds designed and constructed by the project.

2. Specify all site irrigation system controls shall be Weathermatic compatible.

3. Specify that all irrigation systems contain a master valve.

4. Design all systems with appropriate backflow preventers and require a manual shutoff valve to isolate the irrigation system from the water supply main.

5. Record "as-built" drawings for all newly installed, removed and/or relocated irrigation sprinkler piping including location and type designation of all associated sprinkler heads, valves, controllers, etc.

6. The contractor shall take necessary precautions to protect site conditions to remain. All work in the vicinity of trees shall be in accordance with the Urban Forest and Landscape Management Policy.

32 84 00 Planting Irrigation and Underground Sprinklers

1. Clemson University Retains the right to self-perform any sprinkler installation. The designer shall discuss this with the Project Manager.

2. If the installation of the underground sprinkler system is specified as part of the construction contract, specify that the contractor shall notify Landscape Services prior to beginning the installation and make all underground work available for inspection by Landscape Services and University Facilities Survey Group prior to covering.

32 92 00 Turf and Grasses

1. All permanent ground cover, seeding schedules, etc. must be approved by University Planning and University Landscaping Services as the needs will differ based on the area of Campus served.

2. Except for Turf Grass, do not specify non-indigenous species.

3. Do not specify any nuisance or invasive species.

PRODUCTS AND MATERIALS - DIVISION 32 – EXTERIOR IMPROVEMENTS

Aggregate Base Course

- Shall conform to Section 305 of SCDOT Standard Specifications.

Emergency Gate Operator Sensor

- SOS VIII Siren Operated Sensor or approved equal

Geosynthetic Soil Reinforcement Grid

- Tensar BX1100 Geogrid 32 12 16-2 or approved equal

Hot Mix Asphalt Surface Course:

- Type C as specified in Section 403 of SCDOT Standard Specifications (2" compacted typical) unless otherwise directed.

Hot Mix Asphalt Binder Course:

- Type C as specified in Section 402 of SCDOT Standard Specifications (3" compacted typical) unless otherwise directed.

Hot Mix Asphalt Base Course:

- Type B as specified in Section 310 of SCDOT Standard Specifications (4" compacted typical) unless otherwise directed.

Traffic Marking Paint:

Sherwin Williams SetFast Traffic Marking Paint (Lead Free) or approved equal:

- Handicap Blue: Finish 0.0TM2133 – Latex Paint Blue
- Fire lane Red: Finish 0.0TM2132 - Latex Paint Red
- Blackout Black: Finish 0.0TM2135 - Latex Paint Black
- Highway Yellow: Finish 0.0TM0227 - Acrylic Waterborne Paint Yellow
- Highway White: Finish 0.0TM0226 – Acrylic Waterbourne Paint White
- Green Marking Paint: Finish 0.0TM0226 - Acrylic Waterborne Paint White (Formula [5 gallons] – 50/32 b1, 60/32 y3, 8 oz. G2, 47/32 y1)
- Clemson Orange Marking Paint: Finish 0.0TM0227 – Acrylic Waterborne Paint Yellow (Formula [5 gallons] – add 1-gallon DTM safety Red to 4 gallons Setfast Yellow
- Magenta: Finish 0.0TM0226 - Acrylic Waterborne Traffic Marking Paint White (Formula [5 gallons] 4 oz. 47/32 b1, 61/32 1/128 r2, 16 oz. .38/32 r33)

All paints must comply with AASHTO M-247

Underground Sprinkler Irrigation Systems

Bubbler:

- Rain Bird 1400 Series Pressure Compensating Trickle Bubbler .5 GPM or approved equal

Controller:

- Weathermatic SL9648TW, SL9696TW, or approved equals

Each shall come with a Weathermatic SL-Aiircard-M1 LTE with one-year subscription

Decoder:

- Weathermatic SLDEC1, SLDEC2, or SLDEC4 or approved equals

Drip:

- NDS Agrifim SFPC-BR-6412-05 (.620) or approved equal with 40PSI pressure regulator and filter.
- Only Jain Power-Loc fittings to be used.

Flowmeters:

- Tee type Weathermatic 1.5'' SLFSI-T1.5 or 2'' SLFSI-T2 or approved equal
- Saddle mount Weathermatic 3'' SLFSI-S30 or 4''SLFSI-S40 or approved equal

Lightning Arrestor:

- Weathermatic SLGDT or approved equal. Install at each end of wire runs and every 600 feet.

Master Valves:

- 1.5'' Superior 3300150 or approved equal
- 2.0'' Superior 3300200 or approved equal
- 2.5'' Superior 3300250 or approved equal
- 3.0'' Superior 3300300 or approved equal

Rotary Heads:

- Weathermatic T3, CT70 or approved equal (Contact Landscaping Services for replacement if unavailable)

Spray Heads:

- Rainbird1800 with Rainbird VAN nozzle or approved equal

Valves:

- 1'' = Weathermatic max-dw-10 for 1” or approved equal
- 1.5'' = Weathermatic max-dw-15 for 1.5” or approved equal
- 2'' = Weathermatic max-dw-20 for 2” or approved equal
- Contact Landscape Services for valves larger than 2”

Valve Boxes:

- NDS Pro Series 6'' 208BC or approved equal
- NDS Pro Series 10'' 212BC or approved equal
- NDS Pro Series Square 314BC or approved equal

Weather Station:

- Weathermatic Smartline SLW 5 or approved equal

Wire:

- Weathermatic SLWIRE 142-1000, SLWIRE 142-2500, SLWIRE 122-1000, SLWIRE 122-2500 or approved equals

Wire Connectors:

- Weathermatic SLCONN or approved equal