SECTION 321400 - UNIT PAVING

New Edition: 06-15-2026. Updated ADA ramp pavers – pavers around detectable pavers.

(Consultant shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Turn off underlines.)

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. Section Includes:

1. Brick pavers in bituminous setting beds.
2. Concrete pavers in bituminous setting beds.
3. Galvanized or Aluminum edge restraints.

B. Related Requirements:

1. Division 32 for concrete base under unit pavers.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Brick Pavers.
2. Concrete Pavers.
3. Bituminous setting materials.
4. Expansion joint materials.
5. Galvanized or Aluminum edge restraints.
6. Asphaltic Expansion Material and cap.
7. Joint sealant.

B. Samples for Verification:

1. Full-size units of brick paver, (min. 3) showing the full range of variations expected in these characteristics.
2. Full-size unit (sample size) of concrete paver.
3. Joint material involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

Select A or B below, based on complexity of the project.

A. Installer Qualifications: An experienced installer who has completed unit paver installation similar in material, design, and extend to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.6 Installer Qualifications: The exterior brick unit paver installer shall have a minimum of five (5) years of successful experience in the installation of brick unit pavers of the specified sizes and setting beds, including the specified products, systems, and project scope. Experience may be demonstrated either through the installer's current business entity or through key personnel with equivalent experience obtained through prior organizations.

1.7 FIELD CONDITIONS

A. Weather Limitations for Bituminous Setting Bed:

1. Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry.
2. Apply asphalt adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

B. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements. Comply with cold-weather construction requirements contained in ACI 530.2/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

A. Manufacturer:

1. Glen Gery Corporation, Wyomissing, PA 19610. Color: Steel City.
2. Pine Hall Brick of Winston-Salem, NC 27105. Color: Pathway Red.

B. Pedestrian Paver Characteristics:

1. Thickness: 2 ¼ inches.
2. Face Size: 4 by 8 inches.
3. Finish: Wire Cut.

4. Edge Condition: Square Edge.
5. Conforming to the physical property requirements of ASTM C 902.

C. ADA Detectable Warning Paver Characteristics:

1. Comply with ADA requirements for detectable warning surfaces for use in the public right-of-way in accordance with R304 Guidelines.
2. Thickness: 2 ¼ inches.
3. Face Size: 4 by 8 inches.
4. Edge Condition: Square Edge.
5. Conforming to the physical property requirements of ASTM C 902.

2.2 CONCRETE PAVERS

A. Manufacturer: Hanover Prest Paver, Distributed by Hanover Architectural Products, 240 Bender Road, Hanover, PA 17331.

B. Pedestrian Paver Characteristics:

1. 85 psi compressive strength, 1100 flexible strength, less than 5% water absorption.
2. Color: Matrix M1385.
3. Face Finish: Tudor.
4. Edge Condition: Manufacturer's standard bevel edge.
5. Size:
   a. 17 5/8 " x 23 ½" x 2 ½", or match existing thickness for patching or infill.
   b. 11 ¾ " x 11 ¾ " x 3" (for driveway crossings),
6. Paving unit shall comply with ASTM C 936/C936M.

C. ADA Ramp Paver (installed around ADA Detectable Warning Pavers) Characteristics:

1. 85 psi compressive strength, 1100 flexible strength, less than 5% water absorption.
2. Color: Limestone Gray.
3. Face Finish: Natural Finish.
4. Edge Condition: Manufacturer's standard bevel edge.
5. Size: 3-7/8" x 7-7/8" x 2-3/8"
6. Paving unit shall comply with ASTM C 936/C936M.

2.3 EDGE RESTRAINTS

A. Edge Restraints: Galvanized steel or Aluminum angle 2" high x 5" horizontal leg x 3/16" thick. Attach at top of concrete base at 15" o.c. for finished height to be minimum ½" below face of brick pavers.

2.4 EXPANSION JOINT FILLER

A. Joint Filler: Asphalt Expansion Joint complying with ASTM D994, ½" thick.

1. Provide ½" high temporary joint spacer cap for proper configuration and ready to seal. Snap-Cap by W.R. Meadows or approved equal.

B. Horizontal Joint Sealant: One-component, low modulus, neutral-curing silicone or urethane joint sealant.

1. Manufacturer:
   a. DOWSIL 790 by Dow Corning.
   b. Pecora 300 SL by Pecora.
   c. Dymonic 100, by Tremco.

2.5 BITUMINOUS SETTING-BED MATERIALS

A. Fine Aggregate for Setting Bed: ASTM D1073, No. 2 or No. 3.

B. Asphalt Cement: ASTM D3381/D3381M, Viscosity Grade AC-10 or Grade AC-20.

C. Neoprene-Modified Asphalt Adhesive: Paver mastic adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos, by Hanover Architectural Products, or approved equal, or as recommended by the brick or unit paver manufacturer.

D. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.

2.6 BITUMINOUS SETTING-BED MIX

A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate unless otherwise indicated. Heat mixture to 300 deg F.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install concrete sub-slab to the line, extent and dimensions indicated on the Drawings and in accordance with Division 03 Section "Cast-in-Place Concrete."

1. Concrete slab shall receive a screed finish to provide a bonding surface for the bituminous setting-bed for unit pavers.

B. Remove substances from concrete substrates that could impair adhesion, including curing and sealing compounds, form oil, and laitance.

C. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern:< **As indicated**> <**Match and continue existing unit paver joint pattern**>.

E. Provide galvanized or aluminum edge restraints where no existing or planned concrete edge can serve as an edge restraint, and where paver meets a grass or planting surface:

1. Install edge restraints in accordance with the manufacturer's written instructions. Secure edge restraints with concrete anchors or mechanical fasteners spaced as required to maintain alignment and stability during and after installation of the brick unit pavers.
2. Edge restraints shall be fully installed at the beginning and end of each workday and prior to permitting vehicular traffic on completed pavement areas.
3. Install edge restraints plumb to permit proper paver abutment. Edge restraints shall extend to a minimum depth equal to the thickness of the setting bed into the concrete sub-slab.

F. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines.

3.4 BITUMINOUS SETTING-BED APPLICATIONS

~~A.~~ Verify concrete sub-slab is clean, dry, and free of dust, oil, grease, paint, wax, curing compounds, form release agents, and debris. Sweep the surface clean prior to installation. Conduct moisture testing; concrete shall have moisture content less than 5%.

B. Prepare for setting-bed placement by locating 3/4 inch-deep control bars approximately 11 feet apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated.

C. Place the bituminous setting bed where indicated directly over the prepared concrete subbase. Install hot bituminous material at a minimum temperature of 250 degrees F and complete placement promptly while the material remains workable.

1. Install depth-control rails or screed bars as required to establish the required line and grade. Screed the bituminous setting bed to a smooth, firm, and even surface with a compacted thickness not less than 3/4 inch, allowing for slight compaction after placement.
2. Compact the setting bed while the material remains hot using a plate tamper where appropriate for the area, or a metal hand tamper in confined locations. Complete compaction before the material cools below 185 degrees F, or in accordance with the approved manufacturer's installation instructions and referenced standards.
3. Immediately fill low spots and depressions with fresh hot bituminous material and recompact. Remove screed bars promptly after screeding and fill resulting voids with hot material; Tamp smooth to match adjacent surfaces.
4. Do not use the bituminous setting bed to compensate for irregularities or unevenness in the concrete base. The finished base surface shall be sufficiently true and smooth to allow proper installation of the setting bed and achieve the required finished paver elevations.
5. In small or confined areas, use hand tampers or a plate compactor where approved by the University and compatible with the installed paver system.

D. Apply neoprene-modified asphalt adhesive (paver mastic) to cold setting bed by squeegeeing or troweling to a uniform thickness of 1/8-inch. Proceed with setting of paving units only after adhesive is tacky.

3.5 UNIT PAVER INSTALLATION

A. General

1. Unit pavers shall include clay paving brick and regular concrete pavers, as indicated on the Drawings.
2. Pavers shall be installed on a bituminous setting-bed over a concrete sub-slab, utilizing neoprene-modified asphalt adhesive and sand-filled joints.
3. Installation shall be true to line, grade, and plane, and shall coincide and align with adjacent work and elevations.
4. Care shall be taken during layout to minimize cutting while maintaining pattern accuracy.
5. Installation shall accommodate differing paver thicknesses by adjusting the bituminous setting-bed elevation so all paver types finish flush to the required grade.

B. Installation Sequence

1. Paving of each area shall proceed from one side or end; installation shall not commence from opposite ends or sides.
2. Full paver units shall be laid first; cut shall be done subsequently.
3. Do not permit traffic or walking directly on uncompacted bituminous setting-bed. Where limited access over installed pavers is necessary, provide protective plywood panels and advance panels as work progresses.

C. Layout and Placement

1. Starting at paver layout baselines, commence laying pavers on the compacted bituminous setting-bed in the pattern and color shown on the Drawings.
2. Set pavers with joint widths as indicated on the Drawings.
3. Use string lines as necessary to maintain accurate alignment and pattern continuity. Maximum deviation of joint lines from true alignment shall not exceed 1/8 inch in 10 feet.
4. Fit pavers neatly around gutters, building faces, utility penetrations, and other vertical elements, maintaining a maximum joint width of ¼ inch.
5. Filed-cut pavers shall comply with the following minimum size requirements:
   a. In vehicular traffic areas, no cut paver shall be smaller than one-third of a whole unit.
   b. In pedestrian-only areas, no cut paver shall be smaller than one-quarter of a full paver.
6. All pavers requiring cutting shall be saw-cut.
7. Where multiple paver types with differing thicknesses are installed, verify each paver type is set at correct elevation to achieve uniform final finished grade.

D. Placement and jointing

1. Set pavers firmly onto the adhesive in the bituminous setting-bed with a rubber mallet as needed to ensure paver is in place, completely supported, and at final finished grade.
2. Do not remove or reposition pavers after placement, as disturbance may disrupt the adhesive bond and setting bed.
3. Fill joints by sweeping dry sand into joints until completely filled. Sand shall comply with ASTM C144 for masonry sand or ASTM C33 for concrete sand.
4. Repeat joint-filling operation approximately 30 days after initial installation to ensure joints remain fully filled.

E. Movement Joints

1. Provide sealant in lieu of sand within all movement joints, including expansion joints, control joints, and perimeter joints.
2. Extend movement joints continuously through the concrete sub-slab, setting bed, and paver surface.
3. Provide ½” bituminous joint with joint filler at change in paver materials, at locations indicated, and at width recommended for proper installation.
4. Install pre-molded bituminous joint filler as units are set; maintain top of filler 3/8 inch below exposed paver surface for sealant insertion, using temporary joint spacer caps.
5. Install in accordance with Division 7 – Sitework Joint Sealants and the sealant manufacturer’s recommendations.
6. Joint sealant materials and installation shall comply with ASTM C920.

F. ADA Accessibility Compliance

1. Completed paving surfaces shall comply with ADA 2010 Section 302.1 through 302.3 and shall be firm, stable, and slip-resistant.
2. Vertical displacement (lippage) between adjacent pavers shall not exceed 1/8 inch.
3. Vertical changes ¼ inch to ½ inch shall be beveled at maximum 1:2 slope in accordance with ADA Section 303.

G. Completion and Tolerances

1. Surface Cleaning:
   a. Clean completed paving surfaces and wash down as required.
   b. Remove all adhesive stains, excess sand, and debris from completed work.
2. Tolerances

Parameter	**Tolerance**
Final surface vs. design level	+/- 3/8 inch under 10-ft straightedge
Adjacent to drainage outlets/gutters/channels	Max 3/16 inch deviation
Lippage (adjacent pavers)	Max 1/8 inch difference
Joint line straightness	Max 1/8 inch in 10 feet

3. Correct all humps, depressions, or irregularities exceeding specified tolerances at no additional cost to the Owner.

H. Extra Materials:

1. Furnish extra materials equal to 5 percent of each type and color of paver installed, from the same production run, for Owner maintenance and future repairs.

3.6 REPAIRING, POINTING, AND CLEANINGEND OF SECTION 321400

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 321400