

**CITY OF COLUMBUS
DEPARTMENT OF PUBLIC SERVICE
DIVISION OF DESIGN AND CONSTRUCTION
SUPPLEMENTAL SPECIFICATION 1524
ROADWAY PAVERS
May 8, 2014**

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Purpose of the Specification: The purpose of the Supplemental Specification 1524 – Roadway Pavers (SS-1524), shall be used for roadways subject to heavy vehicular traffic. SS-1524 provides the designer a standard by which to design and specify roadway pavers in the City of Columbus. The “Roadway Paver” specification should not be confused with paver design and applications to other surfaces such as sidewalks (see Standard Drawing 2301), parking lots, or other hardscape surfaces. Supplemental Specification 1524 Roadway pavers (SS-1524) may be specified for such pavements outside of the defined roadway as design criteria dictates. Roadway is defined as any City of Columbus public street or road used by motorized vehicles within City owned rights of way and/or other roadway pavements as directed by the specific project scope.

Instructions to Designers:

- 1) Follow SS-1524 for all of the following:
 - a. Roadway Paver Plan Notes
 - b. Roadway Paver detailed drawings
 - c. Roadway Paver cross sections
 - d. Reference/cite SS-1524 in general summary item descriptions and within all notes and drawings mentioned above as well as any reference to roadway paver design in the project plans and specifications.

- 2) Consultant shall confirm with the Capital Improvements Project (CIP) Engineer (Project Manager) for every City of Columbus CIP specifying roadway paver application for project specific direction or variation (As Per Plan) to SS-1524 as each CIP may have unique circumstances that would dictate a variant design.

- 3) As with all City of Columbus standards and specifications, the design consultant should contact the City design project manager for any questions of interpretation of SS-1524.

Note: Department of Public Service intends to develop a standard drawing with associated notes consistent with SS-1524; until such standard drawing is developed, SS-1524 shall serve in its entirety the applicable standard for design of roadway pavers in the City of Columbus and any details required shall be incorporated in the plan set. It should be understood that this specification does not preclude the standard City of Columbus pavement design process.

1524.01 GENERAL

1524.01.1 Description of the Work: This specification covers the installation of new roadway unit pavers where unit pavers are used in vehicular traffic areas.

1524.01.2 Work in this Section: This work includes furnishing and installation of Portland Cement Concrete (PCC) base, filter fabric, tack coat, bituminous setting bed, neoprene adhesive, unit pavers, joint sand, joint sand stabilizer.

1524.01.3 Work in other Sections: CMSC Items 204 and 304

1524.02 APPLICABLE STANDARDS

1524.02.1 ASTM (Current Standards):

- A. C29 Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate.
- B. C33 Standard Specification for Concrete Aggregates.
- C. C67 Standard Test Method for Sampling and Testing Brick and Structural Clay Tile.
- D. C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- E. C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
- F. C144 Standard Specification for Aggregate for Masonry Mortar.
- G. C936 Standard Specification for Solid Concrete Interlocking Paving Units.
- H. C979 Standard Specification for Pigments for Integrally Colored Concrete.
- I. C1272 Standard Specification for Heavy Vehicular Paving Brick.
- J. D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft lbf/ft³ (600 kN m/m³)).
- K. D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft lbf/ft³ (2,700 kN m/m³)).

- L. D2940 Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.

1524.02.2 AASHTO (Current Standards): AASHTO M 320 Standard Specification for Performance-Graded Asphalt Binder.

1524.02.3 City of Columbus CMS (CMSC): CMSC Items: 305, 407, 703.05 and 712.09

1524.02.4 Manufacturer's Installation Specifications: Manufacturer's Installation Specifications shall be adhered to for all materials specified herein unless otherwise specified in the project plans.

1524.03 SUBMITTAL REQUIREMENTS

1524.03.1 Manufacturers' Information: Shall include product information, test results, installation instructions and MSDS data for the following.

- A. Filter Fabric.
- B. Tack Coat.
- C. Bituminous Setting Bed.
- D. Neoprene Modified Asphalt Adhesive.
- E. Clay Pavers.
- F. Concrete Pavers.
- G. Polymeric Joint Sand.
- H. Bulk Natural Joint Sand.
- I. Liquid-Applied Joint Sand Stabilizer.
- J. Temporary edge restraint (Pavers) during part width construction.

The Contractor shall not start work until manufacturers' information and samples have been approved by the Engineer. Quality control tests as applicable shall be submitted to the Engineer within 5 days of undertaking the respective test.

1524.03.2 Samples:

- A. Pavers (Clay and/or Concrete) 20-Each or as directed by the Engineer.
- B. Joint Sand (50-lb bag of bulk sand and/or one (1) bag of polymeric sand based on Contractor's material selection).

1524.03.3 Test Reports for Quality Control:

- A. Brick Paver test results or certification from/of each batch (100,000 units or any part thereof) that each batch supplied is compliant with ASTM C1272.
- B. Concrete Paver test results or certification from/of each batch (100,000 units or any part thereof) that each batch supplied is compliant with ASTM C936.
- C. Joint sand gradation report from/of each batch (20 tons or any part thereof) that each batch supplied is compliant with ASTM C144.

1524.04 MATERIALS

1524.04.1 Portland Cement Concrete Base: Shall meet the requirements of CMSC Item 305 except as specified in the project plans and specifications.

1524.04.2 Filter Fabric: Woven or non-woven geotextile fabric shall meet the requirements of CMSC Item 712.09, Type D, except as specified in the project plans and specifications.

1524.04.3 Tack Coat: Comply with CMSC Item 407.

1524.04.4 Bedding Sand: (Not permitted on roadways in the City of Columbus).

1524.04.5 Bituminous Setting Bed:

- A. Asphalt binder shall be PG 64-22 asphalt binder conforming to AASHTO M320.
- B. Aggregate shall be manufactured sand and shall meet the requirements of CMSC Item 703.05. It shall be composed of hard, tough, durable, uncoated particles, free from clay, silt, organic material or other deleterious substances. The aggregate shall have verifiable history of being resistant to stripping. An anti-stripping agent shall be used as necessary.

- C. The mix shall be approximately 6 percent asphalt binder by weight with 94 percent aggregate. The supplier shall determine the exact proportions to achieve the best mix to suit the materials and the site and installation conditions.
- D. The minimum bituminous setting bed temperature during placement shall be 250 Degrees F. Bituminous setting bed shall not be placed when ambient temperature is below 40 Degrees F.

1524.04.6 Neoprene Modified Adhesive: Furnish Neoprene modified asphalt adhesive that contains 2% neoprene grade WMI oxidized asphalt with a 150-Degree F softening point (77 penetration) 10% long fiberized inert material, or approved equal.

1524.04.7 Pavers:

- A. Clay Pavers shall meet the requirements of ASTM C1272, Type F, Application PX.
- B. Concrete Pavers shall meet the requirements of ASTM C936.
- C. Efflorescence shall not be a cause for rejection.
- D. Size – all pavers shall have a 2:1 module of plan dimension, and shall measure 8 in. by 4 in. (plus or minus 10 percent). When sixteen pavers are lined up end to end adjacent to 32 pavers lined up side by side, the overall length of each row should not differ by more than 1 in; except where dimensional size and shape are specified in the plans.
- E. Lugs – all pavers shall have spacing lugs unless otherwise specified in the plans. Lugs shall be located on at least one side and one end.
- F. Chamfers – all pavers shall have chamfered top edges unless otherwise specified in the plans.
- G. No more than 2 percent of the installed pavers shall exhibit any chipping, and no more than 10 percent of any edge shall be chipped.

1524.04.8 Joint Filling Sand:

- A. As specified in the project plans, the gradation for jointing sand shall either be: 1) bulk natural sand meeting ASTM C144 or, 2) polymeric manufactured sand meeting the gradation requirements of ASTM C144. ASTM C33 (Concrete sand) shall only be used as specified in the project plans.

- B. Polymeric sand selection shall be of those on the City of Columbus, Ohio Approved Producers / Products list.

1524.04.9 Joint Sand Stabilizer: All sand joints shall be stabilized using one of the following methods unless called out otherwise in the plans.

- A. Polymeric sand - polymeric joint sand shall consist of a factory prepared mixture of manufactured sand and moisture activated polymer that binds the sand particles together.
- B. Liquid applied stabilizer – when used, the stabilizer shall be a liquid-applied epoxy resin or polyurethane resin product, capable of penetrating the joint sand prior to polymerization. It shall seal the top surface of the paver without causing discoloration, a noticeable sheen or cause the coefficient of friction to be reduced. The stabilizer shall be applied in accordance with manufacturer's instructions and at a rate that will achieve bonding of the sand particles to a minimum depth of 1/2 in. Liquid-applied stabilizer shall not be applied if rain is forecast within 12-Hours of application.

1524.05 EXECUTION – CONSTRUCTION REQUIREMENTS

1524.05.1 Preparation:

- A. Subgrade - prepare in accordance with CMSC Item 204.
- B. Aggregate Base - install in accordance with plans and CMSC Item 304.

1524.05.2 Concrete Base:

- A. Joints; construction, longitudinal, expansion, control, tie bars, dowels and reinforcement, in accordance with Item 305, unless otherwise specified. Traverse control joints shall be spaced at 10-Foot intervals, where curb exist, traverse joints shall be coincident with the curb control joints unless otherwise specified in the project plans.
- B. Portland Cement Concrete bands shall be installed as paver restraint wherever pavers terminate adjacent to flexible pavement or any non-rigid surface.
- C. If partial width pavement is installed to maintain traffic, the new paver pavement shall be restrained against lateral movement prior to allowing traffic on the new pavers. Lateral restraint shall be provided by angle iron

secured soundly and tight against new pavers or by Contractor means and methods previously approved by the Engineer.

- D. Concrete base shall have drainage weep holes placed as specified in the project plans.
- E. Concrete base finished surface tolerance shall meet plan grading requirements within (+/-) 1/4 in. as measured with a string line, straight edge, or laser as applicable. Work not meeting specified tolerance shall be remedied by Contractor submitted corrective measures approved by the Engineer.
- F. Where roadway pavers are placed adjacent to adjoining flexible pavement, or any other flexible materials (e.g., soil), a concrete collar minimum 12-inches wide shall be provided at the end of the paver work adjacent to the adjoining flexible material with surface elevation coincident/ flush with the finished roadway pavers and adjoining flexible pavement/material. Concrete collar shall be cast integral with the concrete base or as specified in the plans. Additionally, all roadway castings where pavers abut, shall have a minimum 8-inch concrete collar boxed out (square or rectangular) around the casting to include, but not limited to storm inlets, manholes, water valves, and etc.

1524.05.3 Sequencing: All temporary and permanent edge restraints, drainage weep holes, manhole and utility covers, and other surface penetrations shall be completed before installation of the pavers.

1524.05.4 Geotextile: Install filter fabric as specified on weep hole execution (see detailed dwg. in plans as applicable).

1524.05.5 Tack Coat: Apply in accordance with CMSC Item 407.

1524.05.6 Bituminous Setting Bed:

- A. Bituminous Setting Bed shall be placed 3/4 in. thick (+/- 1/4 in.). The bed thickness shall be adjusted so that when the pavers are set on the adhesive layer, their top surface will be 1/8 in. above the required grades.
- B. Remove materials that have cooled below 175 degrees F that are not sufficiently compacted.

1524.05.7 Neoprene Adhesive:

- A. Apply neoprene adhesive in accordance with Manufacturer's recommendations. Work adhesive onto the setting bed so as to provide a complete and adequate bond.

- B. Allow sufficient time for the adhesive to become tacky and skin over before installing the pavers.
- C. Old adhesive not covered in the previous day should be scraped off the setting bed prior to applying new adhesive.

1524.05.8 Pavers:

- A. Install pavers tight in accordance with the plan specified pattern.
- B. Use pavers from at least two packs of each color at any one time. Follow the manufacturer's recommendations on color blending.
- C. Adjust to form uniform joint widths and straight pattern lines after every 5 ft. of progress. The joint width shall be between 1/16 in. and 3/16 in. and no more than one third of the joints shall be greater than 1/8 in. wide in any one square yard area. The maximum deviation from a 30 ft. string line shall be +/- 1/4 in. Joint widths will take precedence over alignment.
- D. All cut pavers shall be cut by masonry saws in such a manner that no paver segment is smaller than one third of a full paver when the cut line crosses a long side and no smaller than one half of a full paver when the cut line crosses both ends. The cut faces shall be vertical.
- E. After a suitable area of pavers has been installed each day, the pavers have been aligned, cut pavers have been positioned and prior to final set of the adhesive, roll the surface of the pavers to set the pavers into place with sufficient pressure to achieve a full bond to the setting bed.
- F. Temporary edge restraints methodology shall be proposed to the Engineer as a pre-construction submittal "Shop Drawing" (see Section 1524.03). Proposed temporary paver restraint methodology shall be approved by the Engineer prior to implementation.

1524.05.9 Joint Sand:

- A. Sweep dry jointing sand over the surface of the pavers so that it penetrates into the joints and secures the pavers. Remove all surplus sand immediately so that all particles are removed from the chamfers and surface of the pavers.
- B. Additional rolling shall be undertaken to settle the sand, adding additional sand as necessary. Paver joints shall be completely filled with specified sand to the bottom of brick paver chamfers (or 1/8 in. below top of paver).

- C. On completion of rolling, before and after joint filling, surface tolerances shall be within 1/8 in. under a 10 ft. straight edge and 1/8 in. high to flush with the finished elevation of adjacent features. There shall not be a difference in elevation between adjacent units of greater than 1/16 in. Elevations should be such that no water ponds on the surface.
- D. Protect joint sand against moisture until the activating the polymeric sand or joint sand stabilizer is applied.

1524.05.10 Joint Sand Stabilization:

- A. The surface of the pavement shall be made clean and free from oil, laitance, dust and any loose material prior to activating the polymeric sand or the application of liquid joint sand stabilizer.
- B. When polymeric sand is used, activate the polymer by misting the surface of the pavers with water in accordance with the manufacturer's instructions.
- C. When liquid-applied joint sand stabilizer is used, apply with spray equipment to achieve a uniform coverage in accordance with the manufacturer's instructions. Work the material into the joints using neoprene squeegees, ensuring that the chamfers are flooded and no surplus material is left on the surface of the pavers. Continue to flood of the chamfers and to squeegee the surface until the stabilizer ceases to soak into the joint sand.
- D. Verify that the bonding the sand particles has occurred to a depth of at least 1/2 in. Where the application results in a patchy sheen the stabilizer shall be reactivated and worked as necessary to produce an even appearance.

1524.06 QUALITY ASSURANCE AND CONTROL

- 1524.06.1 Quality Assurance:** The Contractor shall prepare and submit a method statement to indicate the proposed starting points, direction of operations and progress of works, the installation methods, the pattern dimensional controls to be used, the measures for protecting the work, the quality control procedures to be adopted, and the personnel and equipment to be kept on site at all times.

1524.06.2 Quality Control:

- A. First 50-Feet of project pavement to be installed as test section (Mockup), balance of pavement placed on Project shall meet or exceed test pavement.
- B. Materials and completed work failing to meet the specified requirements shall be removed from site and replaced to a suitable standard.

1524.07 METHOD OF MEASUREMENT

1524.07.1 Concrete Base: The City will measure Concrete Base (including weep holes and filter fabric) under Brick Pavers by the number of square yards completed and accepted in place. The width equals the base width shown in the typical cross-section of the plans plus additional widening as the Engineer directs in writing. The City will field measure the length along the centerline of the roadway or ramp.

1524.07.2 Brick Pavers: The City will measure Pavers (including tack coat, bituminous setting bed, pavers, joint sand, and/or joint sand stabilizer) by the number of square yards completed and accepted in place. The width equals the surface width shown in the typical cross-section of the plans plus additional widening as the Engineer directs in writing. The City will field measure the length along the centerline of the roadway or ramp.

1524.07.3 Concrete Edge Restraint: The City will measure Concrete Edge Restraints (including pavement dowels) by the number of linear feet completed and accepted in place. The City will field measure the concrete edge restraint along the length of the centerline of the concrete edge restraint.

1524.08 BASIS OF PAYMENT

1524.08.1 Thickness Variations:

- A. For base deficient in thickness, the City will pay a reduced price according to CMSC Item 451.17.
- B. The City will not make additional payment over contract unit price for any base with an average thickness in excess of that shown in the plans.

1524.08.2 Payment: The City will pay for accepted quantities at contract price as follows.

Item	Unit	Description
1524	Square Yard	Concrete Base
1524	Square Yard	Pavers
1524	Linear Foot	Concrete Edge Restraint

1524.09 WARRANTY

1524.09.1 Term: Contractor shall warrant the finished roadway paver pavement for a period of 2-Years from the date of final acceptance by the City.

1524.09.2 Joint Sand Loss:

- A. The pavement shall be inspected at the 1st year anniversary after acceptance by the City; if required, Contractor shall re-sand and seal the areas of joint sand loss as directed by the Engineer.
- B. The pavement shall be inspected at 18-Months after acceptance by the City; Contractor shall re-sand (with polymeric joint sand) the areas of joint sand loss as directed by the Engineer.

1524.09.3 Creep: Project shall be inspected for paver Creep at the 1st year anniversary after acceptance by the City; if required, Contractor shall replace pavers, re-sand and seal the creep as directed by the Engineer.

1524.09.4 Rutting: Project shall be inspected for paver Rutting at the 1st year anniversary after acceptance by the City; if required, Contractor shall replace full depth pavement section as directed by the Engineer.