

Provided By:



BITUMEN-SET PAVERS

SECTION 32 14 13

*Note: This guide specification is for applications in the U.S. of concrete pavers adhered with a neoprene mastic to a bitumen-sand setting bed and tack coat over a concrete or asphalt base. This construction assembly is for pedestrian and vehicular areas. This Section includes the term "Architect." Edit this term as necessary to identify the design professional in the General Conditions of the Contract. The terms concrete pavers, paving units, and units are used interchangeably. This specification does not apply to larger paving slabs because they do not conform to the dimensional requirements of ASTM C936. Segmental concrete paving slabs should comply with ASTM C1782. **The text must be edited by a qualified, licensed design professional to suit specific project requirements. ICPI makes no representations or warranties of any kind, expressed or implied, and disclaims any liability for damages resulting in the use of this guide construction specification.***

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Concrete pavers and joint sand.
2. Bitumen setting bed.
3. Asphalt tack coat
4. [Cleaning and Sealing].

B. Related Sections

1. Section [] - Cast-in-Place Concrete Slab [for asphalt bed and pavers].
2. Section [] - Aggregate Subbase.
3. Section [] - Storm Drainage.
4. Section [] - Concrete [Walks] [Curbs] [and] [Gutters].
5. Section [] - Concrete Accessories.
6. Section [] - Joint Sealants.

Note: Pavements subject to vehicles should be designed in consultation with a qualified civil engineer, in accordance with established pavement design procedures, ASCE 58-16 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways, ICPI structural design software, and in accordance with the ICPI Tech Spec 4 for rigid pavement design and other ICPI Tech Spec technical bulletins.

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1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)**
1. C33 Specification for Concrete Aggregates.
 2. C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 3. C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 4. C144 Standard Specification for Aggregate for Masonry Mortar.
 5. C920 Specification for Elastomeric Joint Sealants.
 6. C936 Standard Specification for Solid Concrete Interlocking Paving Units.
 7. C979 Standard Specification for Pigments for Integrally Colored Concrete.
 8. D977 Standard Specification for Emulsified Asphalt.
 9. D1073 Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
 10. C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units.
 11. D3381 Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
- B. Interlocking Concrete Pavement Institute (ICPI) Technical Bulletins**
1. Tech Spec 4 Structural Design of Interlocking Concrete Pavements for Roads and Parking Lots.
 2. Tech Spec 5 Cleaning, Sealing and Joint Sand Stabilization of Interlocking Concrete Pavements.
 3. Tech Spec 20 Construction of Bituminous-Sand Set Interlocking Concrete Pavement.

1.04 SUBMITTALS

- A. In accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.**
- B. Manufacturer's drawings and details: Indicate perimeter conditions, relationship to adjoining materials and assemblies, [expansion and control joints,] concrete paver [layout,] [patterns,] [color arrangement,] installation [and setting] details.**
- C. Neoprene modified asphalt adhesive product catalog sheets with specifications.**
- D. Bituminous setting bed: asphalt cement mix design to be used in the bituminous setting bed conforming to ASTM D3381.**
- E. Sieve analysis per C136 for sand mixed with bitumen and sand for joints between concrete pavers.**
- F. Concrete pavers:**
1. [Four] representative full-size samples of each paver type, thickness, color, finish that indicate the range of color variation and texture expected in the finished installation. Color(s) selected by [Architect] [Engineer] [Landscape Architect] [Owner] from manufacturer's available colors.
 2. Accepted samples become the standard of acceptance for the work.
 3. Test results from an independent testing laboratory for compliance of concrete pavers with ASTM C936.
 4. Manufacturer's catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.
- G. Paver Installation Subcontractor:**
1. Current certificates from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program for job foremen on the project.
 2. Job references from projects of a similar size and complexity. Provide Owner/ Client/General Contractor names, postal address, phone, fax, and email address.

1.04 QUALITY ASSURANCE

- A. Paving Subcontractor Qualifications:**
 1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
 2. Utilize an installer holding a current certificate of completion from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.
- B. Regulatory Requirements and Approvals: [Specify applicable licensing, bonding or other requirements of regulatory agencies].**
- C. Mock-Ups:**
 1. Install a 7 ft x 7 ft (2 x 2 m) paver area.
 2. Use this area to determine surcharge of the bitumen-sand layer and adhesive, joint sizes, lines, laying pattern(s), color(s) and texture of the job.
 3. This area will be used as the standard by which the work will be judged.
 4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
 5. If mock-up is not retained, remove and properly dispose of mock-up.

1.05 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirement Section.**
- B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.**
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers packaging with identification labels intact.**
 1. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
 2. Deliver concrete pavers to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by forklift or clamp lift.
 3. Unload pavers at job site in such a manner that no damage occurs to the product.
- D. Storage and Protection: Store materials protected such that they are kept free from mud, dirt, and other foreign materials. [Store concrete paver cleaners and sealers per manufacturer's instructions.]**
 1. Cover joint sand with waterproof covering if needed to prevent exposure to rainfall or removal by wind. Secure the covering in place.

1.06 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:**
 1. Minimum ambient temperature of 40° F and rising.
 2. Do not install bitumen setting bed or pavers during heavy rain or snowfall.
 3. Do not install bitumen setting bed and pavers over frozen base materials.
 4. Do not install frozen bitumen setting bed materials.
 5. Do not install concrete pavers on frozen bitumen setting bed materials.

1.07 MAINTENANCE

- A. Extra Materials: Provide [Specify area or percentage] additional material for use by owner for maintenance and repair.**
- B. Pavers shall be from the same production run as installed materials.**

PART 2 PRODUCTS

2.01 CONCRETE PAVERS

- A. Manufacturer: [Specify ICPI member manufacturer name].**
 - 1. Contact: [Specify ICPI member manufacturer contact information].
- B. Concrete Paver Units, including the following:**
 - 1. Paver Type: [Specify name of product group, family, series, etc.].
 - a. Material Standard: Comply with ASTM C936.
 - b. Color [and finish]: [Specify color] [Specify finish].
 - c. Color Pigment Material Standard: Comply with ASTM C979.

Note: Concrete pavers may have spacer bars on each unit. Spacer bars are recommended for mechanically installed pavers and for those in heavy vehicular traffic. Manually installed pavers may be installed with or without spacer bars. Overall dimensions should not include spacer bars.

- d. Size: [Specify inches or mm] x [Specify inches or mm] x [Specify inches or mm] thick.
- e. Average Compressive Strength (ASTM C140): 8000 psi (55 MPa) with no individual unit under 7200 psi (50 MPa).
- f. Average Water Absorption (ASTM C140): 5% with no unit greater than 7%.
- g. Freeze/Thaw Resistance (ASTM C1645): 28 freeze-thaw cycles with no greater loss than 225 g/m² of paver surface area or no greater loss than 500 g/m² of paver surface area after 49 freeze-thaw cycles when immersed in a 3% saline solution. Use -15 deg. C as the lowest test temperature for applications subject to deicers. Freeze-thaw testing requirements shall be waived for applications not exposed to freezing conditions.

2.02 PRODUCT SUBSTITUTIONS

- A. Substitutions: No substitutions permitted.**

2.03 BITUMEN SETTING BED MATERIALS

- A. Primer for base: Anionic asphalt emulsion SS-1 or SS-1h, per ASTM D977.**

Note: Municipal or state DOT specifications for the finish surface of asphalt pavement typically consists of a sand-asphalt mix. These materials can be used for the setting bed. In some areas it may be difficult to find an asphalt producer that provides a product that meets the recommended sand gradation. In these areas it may be necessary to use a mix design that has particles up to 9 mm per ASTM D1073. This coarser material will have a more textured surface. The aggregate should have a verifiable history of being resistant to stripping. Manufactured sands typically have a higher stability than natural sands.

- B. Sand for asphalt bed**
 - 1. Clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
 - 2. Do not use limestone screenings, stone dust, or sand in the bedding material that does not conform to the grading requirements.
 - 3. Graded according to ASTM C136.

Note: Bedding sand gradation can conform to ASTM D1073, Grading No. 2 which is similar to the gradation in Table 1.

- 4. Bedding Sand Material Requirements: Conform to the grading requirements of ASTM C33 with modifications as shown in Table 1.

Sieve Size	Percent Passing
No. 4 (4.75 mm)	100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85

No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	10 to 30
No. 100 (0.150 mm)	2 to 10
No. 200 (0.075 mm)	0 to 5

- C. **Asphalt cement: Meet ASTM D3381, viscosity grade AC-20; heated to 300° F (150° C), 7% asphalt mixed with 93% sand in batches 145 lbs. (66 kg) asphalt to 1,855 lbs. (840 kg) sand. Exact proportions to be determined by the Contractor.**
- D. **Neoprene modified asphalt adhesive: brush/squeegee grade with the following characteristics: Viscosity at 77° F (25° C): 12,000-18,000 centipoise (cps); specific gravity at 25° C: 1.02; weight per gallon at 25° C: 8.1 lbs; percent solids by weight: 70%; softening point of rubber blend: 149° F (65° C); inorganic material: 6.5%; long fiber: 10%; neoprene: 2% min. [Karnak 237 2% neo-asphalt paving block adhesive or approved equal].**

2.04 JOINT MATERIALS

- A. **Joint sand: grading conforming to ASTM C144.**
- B. **Sealant and backer materials: [Specify].**

Note: Delete article below if cleaners, sealers, and/or joint sand stabilizers are not specified.

2.05 ACCESSORIES

- A. **Provide accessory materials as follows:**
1. [Cleaners] [Sealers] [Joint sand stabilizers]
 - a. Material Type and Description: [Specify material type and description].
 - b. Material Standard: [Specify material standard].
 - c. Manufacturer: [Specify manufacturer].

PART 3 EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. **[Specify acceptable paving subcontractors.].**

3.02 EXAMINATION

- A. **Acceptance of Site Verification of Conditions:**
1. General Contractor shall inspect, accept and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers:
 - a. Verify that concrete base materials, thickness, surface tolerances and elevations conform to specified requirements.
 - b. Verify location of [2 in. (50 mm) diameter] weep holes [at 20 ft (7 m)] centers [at lowest elevations] against curbs, walls, or other permanent structures [as indicated on the drawings]. Verify holes filled with washed pea gravel. Provide temporary plugs for holes to prevent ingress of sand-asphalt setting bed or neoprene adhesive during construction. Remove plugs when paving adjacent to drain holes.
 - c. Verify that concrete surfaces to receive the bitumen bedding material are free of dust, oil, grease, paint, wax, curing compounds, primer, sealers, form release agents, from cracks

Note: The elevations and surface tolerance of the concrete base determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies in the base surface with additional bitumen setting materials or by other means. Therefore, the surface elevations of the base should be checked and accepted by the General Contractor or designated party, with written certification to the paving subcontractor, prior to placing setting bed materials and concrete pavers.

- a. Verify that concrete base materials, thickness, surface tolerances and elevations conform to specified requirements.
- b. Verify location of [2 in. (50 mm) diameter] weep holes [at 20 ft (7 m)] centers [at lowest elevations] against curbs, walls, or other permanent structures [as indicated on the drawings]. Verify holes filled with washed pea gravel. Provide temporary plugs for holes to prevent ingress of sand-asphalt setting bed or neoprene adhesive during construction. Remove plugs when paving adjacent to drain holes.
- c. Verify that concrete surfaces to receive the bitumen bedding material are free of dust, oil, grease, paint, wax, curing compounds, primer, sealers, form release agents, from cracks

over 3/16 in. (5 mm) in width, or any deleterious substances and debris which may prevent or reduce bonding.

- d. Conduct moisture tests to verify that concrete surfaces are cured, free from hydrostatic pressure and having a moisture content of less than 5%.
- e. Verify location, type, and elevations of edge restraints, [concrete collars around] utility structures, and drainage inlets.
- f. Do not proceed with installation of bedding sand and interlocking concrete pavers until base conditions are corrected by the General Contractor or designated subcontractor.

3.03 PREPARATION

- A. **Verify base is clean and dry, certified by General Contractor as meeting material, installation and grade specifications.**
- B. **Verify that base is clean, dry, and ready to accept tack coat, bitumen setting bed, pavers, and imposed loads.**
- C. **Verify location of weep holes at lowest elevations filled with washed pea gravel and covered with geotextile to prevent ingress of the sand-bitumen layer.**

3.04 INSTALLATION

- A. **Concrete base preparation**
 1. Fill any cracks under 3/16 in. (5 mm) wide with mortar.
 2. Sweep the surface clean.
- B. **Asphalt primer**
 1. Apply at a rate of [] gal/ yd² [(l/m²)].

Note: Undiluted emulsified asphalt primer tack coats are typically applied at a rate of 0.6 to 1.0 gal per 100 ft² (2.5 to 4.1 liters per 10.0 m²) to an asphalt base and 0.9 to 1.3 gal per 100 ft² (3.6 to 5.3 liters per 10.0 m²) to concrete base. Diluted 1:1 (cutback) asphalt tack coats are typically applied at a rate of 1.0 to 1.3 gal per 100 ft² (4.1 to 5.3 liters per 10.0 m²) to asphalt base and 1.2 to 1.5 gal per 100 ft² (4.8 to 6.1 liters per 10.0 m²) to a concrete base. Once applied, the tack coat should not be disturbed and should be allowed to cure before covering with the setting bed material. This may take a few hours depending on weather conditions. Asphalt primer tack coats are recommended for vehicular applications.

- C. **Bituminous setting bed**
 1. Place in panels between [¾ in. (20 mm)] high screed rails spaced approximately 12 ft (4 m). Rake and screed smooth with strike board.
 2. Use screed rails to achieve a level setting bed conforming to elevations and slope shown on the drawings. After one panel is complete, advance screed rails to the next position in readiness for screeding adjacent panels with strike board. Fill depressions left from removed screed rails and smooth to height consistent with panel.
 3. Place an area in size that will remain at least 270° F (130° C) during compaction.
 4. Compact the setting bed with a with a powered roller compactor to an even, nominal thickness of [¾ in. (20 mm)] after compaction.
 5. Re-heat, fill, and compact low areas with setting bed materials to conform to slope and elevation shown on the drawings.
 6. Re-heat, remove, level, and compact setting bed in high areas to conform to slope and elevation shown on the drawings.
 7. Irregularities or evenness in the grade of the concrete base surface may be corrected with setting bed materials only with approval by the [Architect].
- D. **Neoprene modified asphalt adhesive**
 1. Apply to cold asphalt setting bed with a brush or squeegee at the rate of 1.5 to 2 gallons per 100 square

feet (0.6 to 0.8 liters per square meter) or as recommended by the manufacturer. Do not exceed this application rate. Do not apply pavers to adhesive until dry skin forms on surface of adhesive. This typically takes an hour.

E. Concrete pavers

1. Free from dust, dirt, and stains. Do not use soiled, cracked, or broken units.
2. Place paving units firmly onto adhesive with joints not to exceed 1/8 in. (3 mm), or as recommended in manufacturer's literature. Maintain straight pattern lines, joint lines and coursing per the drawings.
3. Cut pavers to fit edges with a masonry saw. No cut paver shall be smaller than 1/3 of a whole unit if exposed to vehicular traffic. Firmly place all edge units on adhesive.
4. After pavers have been installed in an area, sweep clean and seat then into the adhesive with a static hand-operated water-filled drum roller. Make at least two passes, the second pass perpendicular to the first. All paver should be seated into the adhesive at the end of each day and joints filled with sand.

F. Pavement Joint filler and sealant

1. Extend control and structural joints through full depth of paving units. Do not extend joints through bituminous bedding materials from joints in concrete base that control shrinkage cracking.
2. Install joints at all building facades or other vertical surfaces.
3. Install pre-molded pavement joint filler as units are set in bituminous bed. Maintain top of filler 3/8 in. (10 mm) below exposed faces of paving units for insertion of sealant.
4. Install joint sealant per manufacturer's recommendations.

G. Joint sand

1. After the pavers, pavement joint filler, and sealant are installed, spread dry joint sand and fill joints between the slabs.
2. Sweep surface clean.

3.05 FIELD QUALITY CONTROL

Note: Surface tolerances on flat slopes should be measured with a rigid straightedge. Tolerances on complex contoured slopes should be measured with a flexible straightedge capable of conforming to the complex curves on the pavement surface.

- A. The final surface tolerance from grade elevations shall not deviate more than $\pm 3/8$ in. (± 10 mm) under a 10 ft (3 m) straightedge.**
- B. Check final surface elevations for conformance to drawings.**
- C. The surface elevation of pavers shall be 1/8 in. (3 mm) above adjacent drainage inlets, concrete collars or channels.**
- D. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.**

Note: Cleaning and sealing may be required for some applications. See ICPI Tech Spec 5, Cleaning, Sealing and Joint Sand Stabilization of Interlocking Concrete Pavements for guidance on when to clean and seal the paver surface, and when to stabilize joint sand. Delete article below if cleaners, sealers, and or joint sand stabilizers are not applied.

3.06 [CLEANING] [SEALING] [JOINT SAND STABILIZATION]

- A. [Clean] [Seal] [Apply joint sand stabilization materials between] concrete pavers in accordance with the manufacturer's written recommendations.**

3.07 PROTECTION

- A. After work in this section is complete, the General Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.**

END OF SECTION

ABOUT CMHA

The Concrete Masonry & Hardscapes Association (CMHA) represents a unification of the Interlocking Concrete Pavement Institute (ICPI) and National Concrete Masonry Association (NCMA). CMHA is a trade association representing US and Canadian producers and suppliers in the concrete masonry and hardscape industry, as well as contractors of interlocking concrete pavement and segmental retaining walls. CMHA is the authority for segmental concrete products and systems, which are the best value and preferred choice for resilient pavement, structures, and living spaces. CMHA is dedicated to the advancement of these building systems through research, promotion, education, and the development of manufacturing guides, design codes and resources, testing standards, and construction practices.

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