

**SECTION 32 14 13
INTERLOCKING CONCRETE PAVEMENTS FOR ROOF PLAZA DECKS
(1995 MasterFormat Section 02780)**

Note: This guide specification for the U.S. is for pavers used as ballast and/or paving on pedestrian plaza roof deck applications with an aggregate setting bed over an optional drainage mat. Drainage mat should not be used in vehicular areas. The text must be edited to suit specific project requirements. This Section includes the term "Architect." Edit this term as necessary to identify the design professional in the General Conditions of the Contract.

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Concrete paver units.
 - 2. Bedding and joint materials.
 - 3. Geotextiles.
 - 4. Drainage mat.
 - 5. [Cleaning and Sealing].
- B. Related Sections
 - 1. Section [] - Membrane roofing.
 - 2. Section [] - Roof drains.
 - 3. Section [] - Roof accessories.
 - 4. Section [] - Roof and Deck Insulation.
 - 5. Section [] - Sheet Metal Flashing and Trim.

Note: Pavements should be designed in consultation with a qualified civil engineer, in accordance with established pavement design procedures and in accordance with the ICPI Tech Spec technical bulletins. Use the current year reference.

1.02 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - 1. C 33, Specification for Concrete Aggregates.
 - 2. C 136, Method for Sieve Analysis for Fine and Coarse Aggregate.
 - 3. C 140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 - 4. C 144, Standard Specification for Aggregate for Masonry Mortar.
 - 5. C 936, Specification for Solid Interlocking Concrete Paving Units.
 - 6. C 979, Standard Specification for Pigments for Integrally Colored Concrete.
 - 7. C 1645, Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units.
 - 8. D 448, Standard Classification of Sizes of Aggregate for Road and Bridge Construction.
- B. Interlocking Concrete Pavement Institute (ICPI)
 - 1. ICPI Tech Spec Technical Bulletins

1.03 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. [Drainage mat sample.]
- D. Sieve analysis per ASTM C 136 for grading of bedding and joint materials.
- E. 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 paving unit requirements to ASTM C 936.
 4. Manufacturer's certification of concrete pavers by ICPI as having met applicable ASTM standards.
 5. Manufacturer's catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.
- E. Paver Installation Subcontractor:
1. A copy of Subcontractor's current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.
 2. Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.
 - 3.
- 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 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 bedding sand layer, 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 fork lift 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 bedding sand and 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. Do not install aggregate bedding materials or pavers during heavy rain or snowfall.
2. Do not install frozen sand or saturated aggregate bedding materials.
3. Do not install concrete pavers on frozen or saturated aggregate bedding materials.

1.07 MAINTENANCE

- A. Extra Materials: Provide [Specify area] [Specify 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

Note: Concrete pavers may have spacer bars on each unit. They are highly recommended for mechanically installed pavers. Manually installed pavers may be installed with or without spacer bars.

- A. Manufacturer: [Specify ICPI member manufacturer name.].
 1. Contact: [Specify ICPI member manufacturer contact information.].
- B. Interlocking Concrete Paver Units, including the following:
 1. Paver Type: [Specify name of product group, family, series, etc.].
 - a. Material Standard: Comply with material standards in ASTM C 936.
 - b. Color [and finish]: [Specify color.] [Specify finish].
 - c. Color Pigment Material Standard: Comply with ASTM C 979.
 - d. Size: [Specify.] inches [(Specify.)mm] x [Specify.] inches [(Specify.)mm] x [Specify.] inches [(Specify.) mm] thick.

Note: If 3 1/8 in. (80 mm) thick pavers are specified, their compressive strength test results per ASTM C 140 should be adjusted by multiplying by 1.18 to equate the results to that from 2 3/8 in. (60 mm) thick pavers.

- e. Average Compressive Strength (ASTM C 140): 8000 psi (55 MPa) with no individual unit under 7200 psi (50 MPa).
- f. Average Water Absorption (ASTM C 140): 5% with no unit greater than 7%.
- g. Freeze/Thaw Resistance (ASTM C 1645): 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. 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 BEDDING AND JOINT MATERIALS

- A. Provide bedding and joint sand as follows:
 1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
 2. Do not use limestone screenings or stone dust.
 3. Sieve according to ASTM C 136.
 5. Bedding Material Requirements: Conform to the grading requirements as shown in Table 1.

Table 1
Grading Requirements for Bedding Materials
No. 89 (per ASTM D 448)

Sieve Size	Percent Passing
3/8 in. (9.5 mm)	90 to 100
No. 4 (4.75 mm)	20 to 55
No. 8 (2.36 mm)	5 to 30
No. 16 (1.18 mm)	0 to 10
No. 50 (0.300 mm)	0 to 5

- B. Joint Sand Material Requirements: Conform to the grading requirements of modified ASTM C 33 bedding material as indicated in Table 2 below.

Table 2
Grading Requirements for Joint Sand
ASTM C 33

Sieve Size	Percent Passing
3/8 in.(9.5 mm)	100
No. 4 (4.75 mm)	95 to 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 1

2.04 ACCESSORIES

- A. Provide accessory materials as follows:
1. Geotextile Fabric:
 - a. Material Type and Description: [Specify material type and description.].
 - b. Material Standard: [Specify material standard.].
 - c. Manufacturer: [Acceptable to interlocking concrete paver manufacturer] [Specify manufacturer.].

Note: Delete articles below if drainage mat, cleaners, and/or sealers are not specified.

2. Drainage Mat
 - a. [_____] or approved substitute.]
3. [Cleaners] [Sealers]
 - 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.].

Note: The elevations and surface tolerance of the roof deck determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies in elevations of the base surface with additional bedding sand 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 bedding materials.

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 roof conditions meet specifications for the following items prior to installation of interlocking concrete pavers.
 - a. Verify that geotextiles, if applicable, have been placed according to drawings and specifications.
 - b. Verify that roof deck materials, thickness, surface tolerances and elevations conform to specified requirements.
 - c. Provide written test results for roof deck materials to the Owner, General Contractor and paver installation subcontractor.
 - d. Verify location, type, and elevations of edge restraints, drains, drain holes, and inlets.
 - 2. Do not proceed with installation of bedding sand and interlocking concrete pavers until roof conditions are corrected by the General Contractor or designated subcontractor.

3.03 PREPARATION

- A. Verify that all surfaces, membrane(s), protection board, insulation, and drains, are free from dirt, oil, grease or any deleterious substances and debris that may prevent installation, drainage, and stability of the paver installation.
- B. Verify that roof has a minimum of [2%] slope to drains. Verify roof deck is clean and dry, and certified by General Contractor as meeting material, installation and grade specifications.
- C. Verify that roof deck [and geotextile] is ready to support sand, [edge restraints,] and, pavers and imposed loads.
- D. Edge Restraint Preparation:
 - 1. Install edge restraints per the drawings [and manufacturer's recommendations] [at the indicated elevations].

Note: Use the following paragraphs include drainage mat. Edit as required.

3.04 INSTALLATION

- A. Spread, join, and trim drainage mat according to manufacturer's recommendations.
- B. Spread geotextile and turn up at sides of installation against parapets and protrusions in the roof. Overlap downslope a minimum of 12 in. (30 cm) [as indicated on the drawings].
- C. Apply geotextile over the surface of the [deck] [drainage mat] and turn up vertically against it to prevent migration of bedding sand. Allow an extra 12 in. (30 cm) length at perimeters to fold over and capture bedding sand layer at edges. Place under pavers at perimeter of installation.
- D. Spread the bedding materials evenly over the geotextile and screed to a nominal 1 in. (25 mm) thickness.
 - 1. Do not disturb screeded sand.
 - 2. Screeded area shall not substantially exceed that which is covered by pavers in one day.
 - 3. Do not use bedding sand to fill depressions in the deck surface.

Note: When initially placed on the bedding sand, manually installed pavers often touch each other, or their spacer bars if present. Joint widths and lines (bond lines) are straightened and aligned to specifications with rubber hammers and pry bars as paving proceeds.

- B. Lay pavers in pattern(s) shown on drawings. Place units hand tight without using hammers. Make horizontal adjustments to placement of laid pavers with rubber hammers and pry bars as required.

Note: Contact manufacturer of interlocking concrete paver units for recommended joint widths.

- C. Provide joints between pavers between [1/16 in. and 3/16 in. (2 and 5 mm)] wide. No more than 5% of the joints shall exceed [1/4 in. (6 mm)] wide to achieve straight bond lines.
- D. Joint (bond) lines shall not deviate more than $\pm 1/2$ in. (± 15 mm) over 50 ft. (15 m) from string lines.
- E. Fill gaps at the edges of the paved area with cut pavers or edge units.
- F. Cut pavers to be placed along the edge with a [double blade paver splitter or] masonry saw.

Note. Specify requirements for edge treatment in G below.

- G. [Adjust bond pattern at pavement edges such that cutting of edge pavers is minimized.] [All cut pavers exposed to vehicular tires shall be no smaller than one-third of a whole paver.] [Cut pavers at edges as indicated on the drawings.]
- H. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and joint materials.
- I. Use a low-amplitude plate compactor capable of at least minimum of 4,000 lbf (18 kN) at a frequency of 75 to 100 Hz to vibrate the pavers into the bedding materials.
- J. [Inspect the drainage under a compacted area to be sure it is not crushed from compaction,]
- K. Remove any cracked or damaged pavers and replace with new units.
- L. Simultaneously spread, sweep and compact dry joint sand into joints continuously until full. This will require at least 4 to 6 passes with a plate compactor. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.
- M. All work within 6 ft. (2 m) of the laying face must shall be left fully compacted with sand-filled joints at the end of each day or compacted upon acceptance of the work.
- N. Cover the laying face or any incomplete areas with plastic sheets overnight if not closed with cut and compacted pavers with joint materials to prevent exposed bedding sand from becoming saturated from rainfall.
- O. Remove excess sand from surface when installation is complete.
- P. Surface shall be broom clean after removal of excess joint sand.

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. to 1/4 in. (3 to 6 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 and Sealing 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]

- A. [Clean] [Seal] 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