SECTION 32 14 13.13
INTERLOCKING CONCRETE UNIT PAVING GRANULAR BASE

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Note: This guide specification for concrete paver applications in the U.S. for concrete pavers and bedding sand over a compacted aggregate base for pedestrian and vehicular applications.

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interlocking Concrete Paver Units (manually installed).
   2. Bedding and Joint Sand.
   3. Edge Restraints.
   4. {Cleaner, Sealers, and Joint sand stabilizers].

B. Related Sections:
   1. Section: [ ]-Curbs and Drains.
   2. Section: [ ]-Aggregate Base.
   3. Section: [ ]-Cement Treated Base.
   4. Section: [ ]-Asphalt Treated Base.
   5. Section: [ ]-Pavements, Asphalt and Concrete.
   6. Section: [ ]-Roofing Materials.
   7. Section: [ ]-Geotextiles.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM C 33, Standard Specification for Concrete Aggregates.
   2. ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   3. ASTM C 140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   4. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar.
   5. ASTM C 936, Standard Specification for Solid Concrete Interlocking Paving Units.
   6. ASTM C 979, Standard Specification for Pigments for Integrally Colored Concrete.
   7. ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft^3 (600 kN-m/m^3)).
   8. ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   9. ASTM C 1645, Standard Test Method for Freeze-thaw and De-icing Durability of Solid Concrete Interlocking Paving Units.
   10. ASTM D 2940, Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.

B. Interlocking Concrete Pavement Institute (ICPI):
   1. ICPI Tech Spec Technical Bulletins

C. American Society of Civil Engineers (ASCE)
   1. ASCE 58-10 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways.

D. U.S. Green Building Council (USGBC)
   1. Leadership in Energy and Environmental Design (LEED) version 4.

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. Sieve analysis per ASTM C 136 for grading of bedding and joint sand.

D. 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 C 936.
4. Manufacturer's catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.
5. LEED v4 submittals according to the following credits:
    a. Sustainable Sites: Solar reflectance per ASTM C1549 for non-roof surfaces.
    b. Sustainable Sites: Solar reflective index per ASTM E1980 for roof surfaces.
    c. Materials and Resources: Manufacturer's Environmental Product Declaration.
    d. Materials and Resources: Sourcing of Raw Materials – Raw Material Source and Extraction Reporting or Leadership Extraction Practices.
    e. Materials and Resources: Material Ingredients – Material Ingredient Reporting or Optimization, or Product Manufacturer Supply Chain Optimization.

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.

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 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 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 sand or pavers during heavy rain or snowfall.
   2. Do not install sand and pavers over frozen base materials.
   3. Do not install frozen sand or saturated sand.
   4. Do not install concrete pavers on frozen or saturated sand.

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 INTERLOCKING CONCRETE PAVERS

A. Manufacturer: Pavestone Company 800-245-7283
   1. Contact: [Specify Pavestone contact and phone number information.].
B. Interlocking Concrete Pavers:
   1. Paver Type: [Specify name of product group, family, series, etc.].
      a. Material Standard: Comply with material standards set forth 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.
      e. Average Compressive Strength (C140): 8000 psi (55 MPa) with non individual unit under 7200 psi (50 MPa) per ASTM C 140.
      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/m^2 of paver surface area or no greater loss than 500 g/m^2 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: Product substitutions shall be submitted and approved in writing 10 days prior to bid date.

2.03 BEDDING AND JOINT SAND

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, stone dust, or sand for the bedding sand material that does not conform to conform to the grading requirements of ASTM C 33.
   3. Do not use mason sand or sand conforming to ASTM C 144 for the bedding sand.
   4. Where concrete pavers are subject to vehicular traffic, utilize sands that are as hard as practically available.
   5. Sieve according to ASTM C 136.
   6. Bedding Sand Material Requirements: Conform to the grading requirements of ASTM C 33 with modifications as shown in Table 1.

Table 1
Grading Requirements for Bedding 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)	80 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	5 to 30
No. 100 (0.150 mm)	0 to 10
No. 200 (0.075 mm)	0 to 1

7. Joint Sand Material Requirements: Conform to the grading requirements of ASTM C 144 as shown with modifications in Table 2 below:

Table 2
Grading Requirements for Joint Sand

	ASTM C 144 Natural Sand	ASTM C 144 Manufactured Sand
Sieve Size	Percent Passing	Percent Passing
No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 to 100	95 to 100
No. 16 (1.18 mm)	70 to 100	70 to 100
No. 30 (0.600 mm)	40 to 75	40 to 100
No. 50 (0.300 mm)	10 to 35	20 to 40
No. 100 (0.150 mm)	2 to 15	10 to 25
No. 200 (0.075 mm)	0 to 1	0 to 10

2.04 EDGE RESTRAINTS

A. Provide edge restraints installed around the perimeter of all interlocking concrete paving unit areas as follows:
   1. Manufacturer: [Specify manufacturer.].
   2. Material: [Plastic] [Concrete] [Aluminum] [Steel] [Pre-cast concrete] [Cut stone] [Concrete.].
   3. Material Standard: [Specify material standard.].

2.05 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.].
   2. [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 subgrade preparation, compacted density and elevations conform to specified requirements.
      b. Verify that geotextiles, if applicable, have been placed according to drawings and specifications.
      c. Verify that [Aggregate] [Cement-treated] [Asphalt-treated] [Concrete] [Asphalt] base materials, thickness, [compacted density], surface tolerances and elevations conform to specified requirements.
      d. Provide written density test results for soil subgrade, [aggregate] [cement-treated][asphalt-treated][asphalt] base materials to the Owner, General Contractor and paver installation subcontractor.
      e. Verify location, type, and elevations of edge restraints, [concrete collars around] utility structures, and drainage inlets.
   2. Do not proceed with installation of bedding sand and interlocking concrete pavers until [subgrade soil and] base conditions are corrected by the General Contractor or designated subcontractor.

3.03 PREPARATION

A. Verify base is dry, certified by General Contractor as meeting material, installation and grade specifications.
B. Verify that base [and geotextile] is ready to support sand, [edge restraints,] and, pavers and imposed loads.
C. Edge Restraint Preparation:
   1. Install edge restraints per the drawings [and manufacturer's recommendations] [at the indicated elevations.].
   2. Mount directly to finished base. Do not install on bedding sand.
   3. The minimum distance from the outside edge of the base to the spikes shall be equal to the thickness of the base.

3.04 INSTALLATION

A. Spread bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 1 1/2 in. (40 mm) thickness. Spread bedding sand evenly over the base course and screed rails, using the rails and/or edge restraints to produce a nominal 1 in. (25 mm) thickness, allowing for specified variation in the base surface.
   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 base surface.
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.
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 ±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.
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 sand.
I. Use a low-amplitude plate compactor capable of at least minimum of 5,000 lbf (22 kN) at a frequency of 75 to 100 Hz to vibrate the pavers into the sand. Remove any cracked or damaged pavers and replace with new units.

J. Simultaneously spread, sweep and compact dry joint sand into joints continuously until full. This will require at least 4 passes with a plate compactor. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.

K. All work within 6 ft. (2 m) of the laying face must be left fully compacted with sand-filled joints at the end of each day or compacted upon acceptance of the work. Cover the laying face or any incomplete areas with plastic sheets overnight if not closed with cut and compacted pavers with joint sand to prevent exposed bedding sand from becoming saturated from rainfall.

L. Remove excess sand from surface when installation is complete.

M. Allow excess joint sand to remain on surface to protect pavers from damage from other trades. Remove excess sand when directed by [Architect]. Do not allow vehicular traffic on pavers with sand on top of the surface.

N. Surface shall be broom clean after removal of excess joint sand.

3.05 FIELD QUALITY CONTROL

A. The final surface tolerance from grade elevations shall not deviate more than ±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.

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