

SECTION 23 14 13
INTERLOCKING CONCRETE PAVERS
(1995 MasterFormat Section 02780)

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. 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. 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.

1.2 APPLICABLE STANDARDS AND SPECIFICATIONS

- A. American Society for Testing and Materials (ASTM)

1.03 DEFINITIONS

- A. Base Course: Layer of 1” minus or ¾” minus base material beneath the bedding course conforming to ASTM D 2940 – Standard specification for graded aggregate material for bases.
- B. Bedding Course: Layer of sharp washed aggregate beneath the pavers conforming to ASTM C33 – Standard specification for concrete aggregates (sand).
- C. Bundle: Several layers of paver clusters stacked vertically, packaged, and tagged for shipment. Also commonly called a “cube.”
- D. Chamfer: A 45-degree beveled edge around the top of a paver unit, usually 1/8” to ¼” wide. It facilitates snow removal, helps prevent edge chipping, and delineates the paving’s individual units.
- E. Cluster: The group of pavers forming a single layer from a bundle of pavers or the group of pavers held by the clamp of a paver laying machine.
- F. Flats: The portion of the side faces of a paver other than the spacer bars.
- G. Laying Face: The working edge of the pavement where the laying of pavers is occurring.

- H. Mechanical Installation: The use of specialized machines to lift clusters of pavers from the bundles and place them on the prepared bedding course. These specialized machines are designed specifically for this application.
- I. Method Statement: The paver installer's and manufacturer's plan for construction and quality control of the pavers.
- J. Spacer Bars: Small protrusions on each side of pavers which are used to keep them uniformly spaced while minimizing chipping and spalling. Mechanically installed pavers must have spacer bars.
- K. Joint Filler: Sharp washed aggregate conforming to ASTM C33 – Standard specification for concrete aggregates.
- L. Wearing Course: The top surface of the paver surrounded by a chamfer.

1.4 SUBMITTALS

- A. Submit the following in Accordance with Division 1
 - 1. The dimensions of the manufacturer's proposed mold assembly including pattern, dimensions of all cavities including radii, spacer bars and the top portion of the mold known as the head or shoe.
 - 2. The Method Statement.
 - 3. The Quality Control Plan.
 - 4. Material samples of pavers, void filler aggregate, bedding course aggregate, base and sub-base course aggregate, including a current sieve analysis of each showing conformance to the specifications.
 - 5. A detailed description of the manufacturer's quality control procedures.
 - 6. Examples of the manufacturer's record-keeping forms.
 - 7. Examples of the installer's record-keeping forms.

1.2 QUALITY ASSURANCE

A. Quality Control Plan

The installer and manufacturer shall establish, provide and maintain a quality control plan. The quality control plan shall provide reasonable assurance that the materials and completed construction submitted for acceptance will conform to the contract requirements. Although guidelines are established and certain requirements are specified, they are minimal, and the installer and manufacturer shall assume full responsibility for meeting all requirements.

The installer and manufacturer shall agree upon a method for measuring the clusters at the factory and in the field. That method shall be submitted in writing to the owner for approval.

The Quality Control Plan shall contain at a minimum, but not limited to, the following elements:

1. The manufacturer's quality control procedures.
2. The manufacturer's production records showing at a minimum the date of manufacture, a mix design designation, mold number, mold cycles, and sequential pallet numbers. Copies of such records shall be made available to the owner upon request.
3. A description of the anticipated growth in the cluster size and a plan for managing the growth so as to not interfere with placement by paving machine(s), if mechanically installed.
4. The installer's quality control procedures, including but not limited to, dimensional control methods, paving machine(s) head adjustment, typical daily work schedule to insure that all pavers placed on the bedding course on any given day are adjusted as required and vibrated, and installation of void filler completed at the end of that work day.
5. Provision for identifying and recording actual daily production and the bundle numbers of pavers used in each day's installation.

B. Sampling and Testing

The manufacturer shall employ an independent testing company, qualified to undertake tests in accordance with the applicable standards specified herein. Test results shall be provided to the installer and the owner, upon request.

Pavers shall be checked for density and dimensional variation, compressive strength (ASTM C140), density and absorption (ASTM C140) and abrasion resistance (ASTM C418).

1. The initial testing frequency shall be one set of tests for each 100,000 full-sized pavers delivered to the site or at any time a change in the manufacturing process, mix design, cement, aggregate or other material occurs.
2. The following number of full-sized pavers shall be randomly sampled for each test: five (5) for dimensional variation; three (3) for density and absorption; three (3) for compressive strength; and three (3) for abrasion resistance.
3. If all pavers tested pass all requirements for a sequence of 400,000 pavers, then the testing frequency may be relaxed to one set of tests for each 200,000 full-sized pavers. If any pavers fail any of the required tests, then the testing frequency shall revert to the initial testing frequency.
4. When any of the individual test results fail to meet the specified requirements, the cluster of pavers represented by that test sample shall be rejected. The manufacturer shall provide additional testing from both before and after the

rejected test sample to determine the sequence of the paver production run that should be considered unacceptable.

5. Additional testing, as described above, shall be carried out at no additional expense to the owner. The sequence of pavers found to be defective shall, if they have been delivered to the site, be removed from the site promptly at no expense to the owner or installer.
6. Pavers shall be sound and free from defects that would interfere with the proper placing of the pavers or impair the strength or performance of the construction.

C. Method Statement

The installer and manufacturer shall prepare a Method Statement describing the overall plan to complete the work. This plan shall include at a minimum:

1. The quality control plan.
2. A description of the anticipated mold life, rate and effect of mold wear on pavers produced, individual mold runs, and a mold rotation plan.
3. Clear diagrams showing the proposed starting point of the installation, the proposed direction of installation, progress on a week-by-week basis, and the dimensional controls to be used to maintain specified joint width and straight joint lines.
4. A method of measuring the clusters at the factory and in the field.
5. A description of the anticipated growth in cluster size due to mold wear and a plan for dealing with that growth or other dimensional variances.
6. A description and the personnel and equipment to be employed for each portion of the work including manufacture, installation and quality control.
7. The manufacturer's proposed production rate and mold life for this project and supply data demonstrating experience on similar past projects. Installer shall state the proposed installation rate.
8. The installer's intention to machine-lay or hand-lay the pavers and provide qualifying experience to date for the appropriate method of proposed installation.

D. Qualifications

Every manufacturer and installer shall demonstrate that they have supplied and/or installed pavers for projects of a similar nature, with regard to installation and production capacity of at least 300,000 square feet. Qualifications shall be submitted at the time of bid, without exception.

Paver Manufacturer's Qualifications

1. The manufacturer shall demonstrate a minimum of 5 years successful experience in the manufacture of interlocking concrete block pavers.
2. The manufacturer shall have sufficient production capacity and established quality control procedures to produce, transport, and deliver the required number of pavers with the quality specified, without causing a delay to the work.
3. The manufacturer shall have suitably experienced personnel and a management capability sufficient to produce the number of quality pavers as depicted on the contract drawings and as specified herein.

Paver Installer's Qualifications

1. Installers shall be required to provide their installation history, including references in writing with contact information, demonstrating to the satisfaction of the owner their ability to perform the paver installation and related work indicated in the plans and specifications.
2. The installer shall have suitably experienced personnel and a management capability sufficient to execute the work shown on the contract drawings and specified herein.
3. The installer's foreman shall demonstrate, including references, a minimum of 5 years experience in the installation of unit paver systems similar in size and nature to this project.

1.3 DELIVERY, STORAGE AND HANDLING

1. Concrete paving stones shall be delivered to the site, with or without pallets, in such a way that no damage occurs to the product during hauling and unloading.
2. All pavers shall be delivered to the site in approximately the chronological order in which they were manufactured. They shall be staged on site, as per the method statement.
3. Each bundle of pavers shall be marked with a weather-proof tag identifying at a minimum the manufacturer, the date of manufacture, the mold number, the project name and phase for which the pavers were manufactured and the sequential bundle number.

PART 2 – PRODUCTS

2.1 INTERLOCKING CONCRETE PAVERS

PRODUCT: name(s) / color (s) / overall dimensions

MANUFACTURED BY: BORGERT PRODUCTS, INC.

PO BOX 39
ST. JOSEPH, MN 56374
PH 320.363.4671
www.borgertproducts.com

BRANCH OFFICE: BORGERT PRODUCTS, INC.
5151 S BANNOCK ST., Ste 8
DENVER, CO 80110
PH 303.783.3864
www.borgertproducts.com

A. All interlocking paving stones shall comply with the following quality specifications for solid concrete interlocking paving units as required per ASTM C 936.

1. Portland Cement: Conform to ASTM C 150.
2. Aggregates: Conform to ASTM C 33 for normal weight concrete aggregate (no expanded shale or lightweight aggregate, including limestone) except that grading requirements shall not necessarily apply. Manufacture's integral mix design shall consist of Class A aggregates per MN Dot Manual #3127.
3. Water: Clean and free from any deleterious matter.
4. Other Constituents: Air-entraining admixtures, integral water repellents and finely ground silica shall have a proven record of performance and shall conform to the relevant ASTM standards.
5. Compressive Strength: At the time of delivery to the work site, the average compressive strength of the pavers shall not be less than 8,000 psi, with no individual unit less than 7,200 psi. Testing procedures shall be in accordance with ASTM C 140 specifications.
6. Absorption: The average absorption shall not be greater than five percent (5%), with no individual unit result greater than seven percent (7%) per ASTM C 140 specifications.
7. Resistance to Freezing and Thawing: The manufacturer shall satisfy the purchaser by laboratory testing that the paving units have adequate resistance to freezing and thawing per ASTM C 67-83 specifications. The specimens shall have no breakage and not greater than one percent (1%) loss in dry weight of any individual unit when subjected to 50 cycles of freezing and thawing.
8. Dimensional Tolerances: Pavers shall be prismatic in plan and formed with straight, uniform edges. The tolerance for the flat portions of the sides shall not exceed 1/32" as measured with a steel straight edge. "Slumped" pavers exceeding this tolerance will be rejected. The length, width and thickness of the paving stones shall meet the allowable tolerances specified in ASTM C 936.

9. *Color*: Monochromatic colors from standard range of colors and/or natural gray.
10. No paver shall be used for this project which has been manufactured in a mold that exceeds the mold life specified in the Method Statement, without written approval of the installer and owner.
11. The measurement across a cluster for any mold shall not increase more than ½” for the entirety of the use of the mold for this project.
12. Manufacturer must supply a 3 year product warranty on commercial projects.
13. *Deicer*: The use of deicer on the pavers shall not void the manufacturer’s warranty.

2.2 VISUAL INSPECTION

All units shall be sound and free of defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction. Minor cracks incidental to the usual methods of manufacture, or minor chipping resulting from customary methods of handling in shipment, delivery and installation, shall not be deemed grounds for rejection.

2.3 AGGREGATE 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, stone dust, or sand for the bedding sand material that does not 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 & 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

Note: Extra effort may be required in sweeping material and compacting the pavers in order to completely fill the joints.

PART 3 EXECUTION

3.01 EXAMINATION

Note: Compaction of the soil subgrade is recommended to at least 98% standard Proctor density per ASTM D 698 for pedestrian areas and residential driveways. Compaction to at least 98% modified Proctor density per ASTM D 1557 is recommended for areas subject to heavy vehicular traffic. Stabilization of the subgrade and/or base material may be necessary with weak or saturated subgrade soils.

Note: Local aggregate base materials typical to those used for highway flexible pavements are recommended, or those conforming to ASTM D 2940. Compaction of aggregate is recommended to not less than 98% Proctor density in accordance with ASTM D 698 is recommended for pedestrian areas and residential driveways. 98% modified Proctor density according to ASTM D 1557 is recommended for vehicular areas. Mechanical tampers are recommended for compaction of soil subgrade and aggregate base in areas not accessible to large compaction equipment. Such areas can include that around lamp standards, utility structures, building edges, curbs, tree wells and other protrusions.

Note: Prior to screeding the bedding sand, the recommended base surface tolerance should be $\pm 3/8$ in. (± 10 mm) over a 10 ft. (3 m) straight edge.

Note: The elevations and surface tolerance of the base determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies in 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 sand and concrete pavers.

- 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 base materials, thickness, compacted density, surface tolerances and elevations conform to specified requirements.
 - d. Provide written density test results for soil subgrade, 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.

3.02 PREPARATION

- A. Verify base is dry, certified by General Contractor as meeting material, installation and grade specifications.
- B. Verify that base is ready to support sand, edge restraints, pavers and imposed loads.
- C. Edge Restraint Preparation:
 1. Install edge restraints per the drawings [and edge restraint manufacturer's recommendations] [at the indicated elevations].

Note: Retain the following two subparagraphs if specifying edge restraints that are staked into the base with spikes.

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.

3.03 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.

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 paragraph 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 sand.
- 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 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 to 6 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 shall 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.

Note: Excess joint sand can remain on surface of pavers to aid in protecting their surface especially when additional construction occurs after their installation. If this is the case, delete the article above and use the article below. Designate person responsible for directing timing of removal of excess joint sand.

- M. Allow excess joint sand to remain on surface to protect pavers from damage from other trades. Remove excess sand when directed by [Architect].
- N. Surface shall be broom clean after removal of excess joint sand.

3.04 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.

Note: For installations on a compacted aggregate base and soil subgrade, the top surface of the pavers may be 1/8 to 1/4 in. (3 to 6 mm) above the final elevations after compaction. This helps compensate for possible minor settling normal to pavements.

- 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. Use only cleaners and sealers that are made for interlocking concrete paving stones.

3.05 CLEANING / SEALING]

- A. Clean and/or seal concrete pavers in accordance with the manufacturer's written recommendations.

3.06 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