

## SECTION 02780 INTERLOCKING CONCRETE PAVEMENTS

*Notes: This guide specification is for interlocking concrete pavement applications in which bedding sand and concrete pavers are installed over a compacted aggregate base; there are similar specification available from Brown's for paver applications installed on cement treated bases, bitumen bases, and mortar bases, as well as for pavement overlays, roof plaza decks, adhesive applications and mechanical installations.*

*Some editing may be required to suit specific project requirements.*

*This Section includes the terms "General Contractor", "Owner", "Owner's Representative" and "Engineer" - edit these terms as necessary to correspond to the individuals listed in the General Conditions of the Contract.*

### PART 1 GENERAL

#### 1.01 SUMMARY

##### A. Description:

The work covered by this section includes the furnishing of all labor, materials, equipment and incidentals for the inspection and construction of an interlocking concrete pavement as shown on the Construction Drawings and as described by the Contract Specifications. The work included in this section consists of, but is not limited to, the following:

1. Furnishing and placement of precast concrete or molded plastic edge restraints.
2. Furnishing and placement of the bedding sand layer.
3. Furnishing and manual placement of the interlocking paver units.
4. Furnishing and placement of jointing sand.

##### B. Definitions

1. Bedding Sand Layer is a layer of coarse, washed sand screeded smooth for bedding of the pavers.
2. Edge Restraint is any curb, edging, building or other stationary object that contains the sand and pavers so that they do not spread and lose interlock. It can be exposed or hidden from view.
3. Installer shall refer to the individual or firm who will be placing the bedding sand, edge restraints, interlocking paving units and jointing sand.
4. Interlocking concrete pavements are a system of discrete concrete paving units placed in an interlocking pattern, compacted into a coarse bedding sand, and completed with joints filled with sand. The outer edges of the pavement are held in place by edge restraints.
5. Interlocking concrete pavers are dry-cast concrete units that meet the surface area, and length to thickness ratio, requirements specified by the Interlocking Concrete Pavement Institute (ICPI).
6. Jointing Sand is sand swept into the joints (openings) between the interlocking concrete pavers to promote proper interlock.

##### C. Related Sections:

1. Section 02315 – Excavating, Trenching and Backfilling
2. Section 02335 – Subgrade and Roadbed

#### 1.02 REFERENCE STANDARDS

##### A. Canadian Standards Association (CSA)

1. CSA- A165 Series-94, CSA Standards on Concrete Masonry Units.
2. CSA-A23.1-FA1, Concrete Materials and Methods of Concrete Construction.
3. CSA-A23.2A, Sieve Analysis of Fine and Coarse Aggregates.

4. CSA-A231.2, Precast Concrete Pavers.
5. CSA-A179, Mortar and Grout for Unit Masonry.

**B. American Society for Testing and Materials (ASTM):**

1. ASTM C 979, Standard Specification for Pigments for Integrally Colored Concrete.
2. ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
3. ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
4. ASTM D 2940, Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.

**C. Interlocking Concrete Pavement Institute (ICPI):**

1. ICPI Tech Spec Technical Bulletins

**1.03 MATERIAL SUBMITTALS**

A. The General Contractor shall submit the following items for approval in accordance with the Conditions of the Contract and the Division 1 Submittal Procedures Section.

1. Design Submittal – Provide three (3) sets of stamped construction drawings, completed and sealed by a Professional Engineer qualified in the area of interlocking pavement design and construction and licensed to practice engineering in the Province that the pavement is to be constructed, indicating: perimeter conditions; relationship to adjoining materials and assemblies; expansion and control joint locations and details; concrete paver layout, laying patterns and colour arrangement; installation and setting details. The construction drawings shall also indicate, at a minimum, the following: required subgrade conditions; base material extent, depth, type and compaction requirements; extent of paver installation; and, geotextile location and details.

*Notes: Installations subject to heavy vehicle traffic loads should be designed in consultation with a qualified civil engineer, and in accordance with established pavement design procedures, ICPI Lockpave software, and ICPI Tech Spec technical bulletins.*

2. Installer Certification – Provide the following:
  - a. A copy of the current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program for the Installer’s field construction supervisor.
  - b. Demonstration that the Installer’s field construction supervisor has the necessary experience for this project by providing documentation showing that they have successfully completed projects of similar design, material and extent.
  - c. Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.
  - d. A letter from the Installer verifying that the field construction supervisor will be onsite throughout the installation.
3. Material Certification – Manufacturer’s certification, for each of the following materials, stating that each meet the requirements of this specification, the Engineer’s design, and the listed standard:
  - a) Bedding Sand – CSA A23.1 (as modified in Table 1 of this specification)
  - b) Jointing Sand – CSA A179 (as modified in Table 2 of this specification)
  - c) Concrete Pavers – CSA A231.2
 Test results must be from an independent testing laboratory.
4. Samples – Four representative samples of each paver type, thickness, colour, and finish. Ensure that the samples indicate the range of colour variation and texture expected in the finished installation.

5. Supporting documentation - Manufacturer's catalog product data, installation instructions, and material safety data sheets for the specified materials and products.
- B. Accepted samples become the standard of acceptance for the work.

#### **1.04 QUALITY ASSURANCE**

- A. Regulatory Requirements and Approvals: [Specify applicable licensing, bonding or other requirements of regulatory agencies].
- B. Mock-Ups:
1. Install a 2 x 2 m paver area.
  2. Use this area to determine surcharge of the bedding sand layer, joint sizes, lines, laying pattern(s), colour(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 or Owner's Representative, 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, ON-SITE HANDLING & STORAGE**

- A. General:
1. Comply with Division 1 Product Requirement Section.
  2. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- B. Delivery:
1. Coordinate delivery and installation schedule to minimize interference with normal use of buildings, roads and structures adjacent to project.
  2. Deliver pavers and edge restraints in manufacturer's original, unopened, undamaged packaging with identification labels intact.
  3. At a minimum, deliver concrete pavers to the site in steel banded, plastic banded or plastic wrapped cubes capable of transfer by a clamp lift. Installer to notify manufacturer at the time of order if pallets are required with the cubes to accommodate onsite handling by a forklift.
  4. Unload materials at job site in the location designated by the Installer and in such a manner that no damage occurs to the product or the site.
  5. Bedding sand and jointing sand piles to be kept sufficiently separated as to prevent mixing.
  6. The Installer shall check all materials delivered to the site to ensure that the correct materials have been received and are in good condition prior to signing off on the manufacturer's packing slip.
- C. On-site Handling and Storage:
1. Installer shall handle and store materials in accordance with manufacturer's recommendations.
  2. Store materials in a manner to prevent deterioration or damage due to moisture, temperature changes, contamination, breaking, chipping or other causes.
  3. Storage areas to be kept free from mud, dirt, and other foreign materials.
  3. 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 MEASUREMENT FOR PAYMENT**

- A. Payment for the supply and placement of the concrete paver system will be based on the unit contract price per square metre as measured in the field by the Engineer. A boundary survey shall be conducted by the Engineer, with the survey results being binding. The total area will be the true area, which accounts for onsite slopes, and not the work area as shown on the construction drawings. The contract unit price shall include the cost of all engineering, labour, materials, and equipment used to install the edge restraints, bedding sand, interlocking concrete pavers, and

jointing sand, and for site clean up. Additional items, as directed and approved in writing by the Owner, or Owner's representative, shall be paid for under a separate pay item.

## PART 2 PRODUCTS

### 2.01 INTERLOCKING CONCRETE PAVERS

- A. Interlocking concrete pavers as manufactured by Brown's Concrete Products Limited to CSA A231.2 of the following nature:
1. Product line: Belgium / Belgium Classic / Duo Stone / Nordic / Pave Lok / Tango / Venetian / Venetian Classic / Vintage Lite.
  2. Colour: Autumn Range / Blackwood Range / Brown / Charcoal / Fairbanks Range / Granite / Laurentian Range / Red / Robinson Range / Salmon / Tan / Timmins Range.
  3. Colour Pigment Material Standard: Comply with ASTM C 979.

### 2.02 BEDDING SAND

- A. Provide bedding sand as follows:
1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.

*Note: If the pavement will be exposed to heavy traffic with trucks, i.e., a major thoroughfare with greater than 1.5 million 80 kN equivalent single axle loads, contact Brown's for test method and criteria for assessing the durability of bedding sand.*

2. Sieve according to CSA A23.2 and conform to the grading requirements of CSA-A23.1-FA1 as shown with modifications in Table 1 below:

Table 1  
CSA A23.1-FA1 Grading Requirements for Bedding Sand

Sieve Size	Percent Passing
10 mm	100
5 mm	95 to 100
2.5 mm	80 to 100
1.25 mm	50 to 90
0.630 mm	25 to 65
0.315 mm	10 to 35
0.160 mm	2 to 10
0.075 mm	0 to 1

3. Do not use limestone screenings or stone dust for bedding sand unless it is proven to meet the grading requirements outlined in Table 1.
4. Do not use mason sand or sand conforming to CSA A179 for the bedding sand.

### 2.03 JOINTING SAND

- A. Provide jointing sand as follows:
1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
  2. Sieve according to CSA A23.2 and conform to the grading requirements of CSA A179 as shown with modifications in Table 2 below:

Table 2  
CSA A179 Grading Requirements for Jointing Sand

Sieve Size	Percent Passing
5 mm	100
2.5 mm	90 to 100
1.25 mm	85 to 100
0.630 mm	65 to 95
0.315 mm	15 to 80
0.160 mm	0 to 35
0.075 mm	0 to 1

*Note: Coarser sand than that specified in Table 2 may be used for jointing sand including A23.1 material as shown in Table 1. Use material where the largest sieve size easily enters the smallest joints. For example, if the smallest paver joints are 2 mm wide, use sand 2 mm and smaller in particle size. If A23.1 sand is used for jointing sand, extra effort may be required in sweeping material and compacting the pavers in order to completely fill the joints.*

#### 2.04 EDGE RESTRAINTS

- A. Plastic Edge Restraints shall be 2.4 m (8') lengths of Snap Edge. Spikes to be 200 to 300 mm (8 to 12 inch) stainless steel landscaping spikes.
- B. Concrete Edge Restraints as manufactured by Brown's Concrete Products Limited:
  - 1. Product line: Bullnose Curb / 3 ft Curb / 4 ft curb.
  - 2. Colour: Brown / Charcoal / Granite / Red / Salmon.
  - 3. Colour Pigment Material Standard: Comply with ASTM C 979.

*Note: Go to the Technical portion of Brown's website to reference ICPI Tech Spec 3, Edge Restraints for Interlocking Concrete Pavements for guidance on selection and design of edge restraints.*

### PART 3 EXECUTION

#### 3.01 ACCEPTABLE INSTALLERS

- A. Pre-approved installers include:
  - 1. Insert list
- B. The Engineer reserves the right to add additional Installers to the pre-approved list subject to the submission by the Installer, and approval by the Engineer, of the submittals listed in Section 1.04 of this specification.

#### 3.02 EXAMINATION

- A. The Engineer shall inspect, accept and certify in writing to the Installer that site conditions meet the specifications for the following items prior to the Installer commencing with the installation:
  - 1. That the depth of the excavation conforms to the elevations specified on the Design Drawings.
  - 2. That the soil subgrade was compacted to at least 98% standard Proctor density per ASTM D 698 for pedestrian areas and residential driveways, or to at least 98% modified Proctor density per ASTM D 1557 for areas subject to heavy vehicular traffic.
  - 3. That geotextile, if applicable, was placed according to the drawings and specifications
  - 4. That the base material was in accordance with the specifications, or if not specified typical to those used for highway flexible pavements in the general area and conforms to ASTM D 2940.

5. That the aggregate was compacted to at least 98% standard Proctor density in accordance with ASTM D 698 for pedestrian areas and residential driveways, or at least 98% modified Proctor density in accordance with ASTM D 1557 for vehicular areas.
  6. The surface elevation of the base material is within +19 mm to -13 mm (+ ¾ to -½ inches) of the specified grades on the design drawings.
  7. The base surface tolerances do not exceed ± 10 mm (+¾ inch) over a 3 m (10 foot) straight edge.
2. The Installer shall not proceed with installation until deficiencies of the subgrade soil or base conditions are corrected by the General Contractor or designated subcontractor.
  3. The Installer is to satisfy himself with the presence, location, type and elevations of edge restraints, utility structures, drainage inlets and other appurtenances in the general vicinity of the construction area.

### 3.03 CURB INSTALLATION

- A. General
  1. To provide adequate lateral support for the paver installation, the minimum distance from the outside edge of the curb to the outer extent of the base shall be no less than the thickness of the base.
  2. Mark off the proposed location of the curbing, and then verify with the Owner / General Contractor before proceeding.
- B. Concrete Curbing
  1. Trenching and backfilling for the concrete curbs, when required, shall be done in accordance with Section 02315 – Excavating, Trenching and Backfilling
  2. Place the Concrete Curbs on the prepared base, taking care to ensure that the units are aligned properly, level from side to side, and in complete contact with the base material.
  3. Where excavation into the base was conducted, backfill on both sides of the Curb to the original base grade with the same aggregate used for the base, and compact to the specified Proctor density. Backfill and compact evenly on both sides of the curb to avoid any displacement. When completed, check the level and condition of the Curbs to ensure that the units did not move or were not damaged.
- C. Plastic Curbing
  1. Mount curbing directly to finished base. Do not install on bedding sand.
  2. Cut the outside face of the curbing as required to accommodate curves or bends.
  3. Ensure the plastic curbs are properly interlocked. Connections are located at both ends of each 2.4 m (8') section.
  4. To secure the curbing in place, install landscaping stakes at the Manufacturer's recommended interval.

### 3.04 INSTALLATION

- A. Do not install:
  1. Sand or pavers during heavy rain or snowfall.
  2. Sand and pavers over frozen base materials.
  3. Frozen sand or saturated sand.
  4. Pavers on frozen or saturated sand.
- B. Spread bedding sand evenly over the base course and screed to a nominal 25 mm thickness, not exceeding 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 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.
- C. 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.

- D. Joints between pavers to be 3 mm wide. No more than 5% of the joints shall exceed 5 mm wide to achieve straight bond lines.
- E. Joint lines shall not deviate more than  $\pm 10$  mm over 15 m from string lines.
- F. Fill gaps at the edges of the paved area with cut pavers or edge units.
- G. Cutting of pavers to be conducted using a double blade paver splitter or masonry saw.
- H. All cut pavers exposed to vehicular tires shall be no smaller than one-third of a whole paver.
- I. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and joint sand.
- J. Use a low-amplitude plate compactor capable of at least minimum of 18 kN at a frequency of 75 to 100 Hz to vibrate the pavers into the bedding sand. Remove any cracked or damaged pavers and replace with new units.
- K. 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 2 m of unrestrained edges of paving units.
- L. All work within 2 m of the laying face must be left fully compacted with sand-filled joints at the end of each day. Cover the laying face and any incomplete areas with plastic sheets overnight to prevent exposed bedding sand from becoming saturated from rainfall.
- M. Remove excess sand from surface when installation is complete.
- N. Surface shall be broom clean after removal of excess joint sand.

### **3.05 FIELD QUALITY CONTROL**

- A. Check final surface elevations for conformance to drawings. It is recommended that the surface elevation of pavers be 3 to 6 mm above adjacent drainage inlets, concrete collars or channels to allow for minor settlement normal to pavement installations.
- B. The final surface tolerance from grade elevations shall not deviate more than 10 mm under a 3 m straightedge.
- C. Lippage shall be no greater than 3 mm difference in height between adjacent pavers.

### **3.06 PROTECTION**

- A. During installation, Installer is responsible for taking whatever actions are required to protect the work from damage.
- B. After work in this section has been approved by the Engineer, the General Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.

END OF SECTION