CONSTRUCTION SPECIFICATION FOR INTERLOCKING CONCRETE PAVERS

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TS 3.80.01 SCOPE

This specification covers the requirements for the installation of interlocking concrete pavers on concrete base.

TS 3.80.02 REFERENCES

This specification refers to the following speculations and publications:

Ontario Provincial Standard Specification, General

OPSS 180	-	Management and Disposal of Excess Material	(Jan. 1994)

Ontario Provincial Standard Specification, Material

OPSS 1002	-	Aggregates – Concrete	(May 1993)
OPSS 1004	-	Aggregates – Miscellaneous	(Mar. 1993)

Canadian Standards Association

CAN3 A23.2-11C	-	Water Absorption of Concrete	(Current Edition)
CAN3-A231.2	-	Precast Concrete Pavers	(Current Edition)

City of Toronto Specifications

TS 3.10	-	Construction Specification for General Excavation	(June 2001)
TS 13.00	-	Specification for Non-Structural Concrete	(June 2001)
TS 501	-	Amendments to OPSS 501 – Construction Specification for Compacting	(June 2001)
TS 1003	-	Amendments to OPSS 1003 – Construction Specification for Aggregates – Hot Mixed, Hot Laid, Asphaltic Conrete	(June 2001)
TS 1010	-	Amendments to OPSS 1010 – Material Specification for Aggregates – Granular A, B, M, and Select Subgrade Material	(June 2001)
TS 1860	-	Amendments to OPSS 1860 – Material Specification for Geotextiles	(June 2001)

TS 3.80.03 DEFINITIONS

For the purposes of this specification the following definitions apply:

Bedding Sand: means a layer of uncompacted sand that is screeded smooth prior to placement of the pavers.

Concrete Paver: means a precast concrete paving product conforming to CAN3-A231.2.

Edge Paver: means a precast concrete unit made or field cut with a straight side for placement flush with a concrete curb or other edge restraint.

Edge Restraint: means a curb, edging, building or other appurtenance that is intended to confine the bedding sand and concrete pavers so that the pavers do not spread and lose interlock.

Laying Face: means the exposed vertical face of a row of pavers on the bedding sand.

TS 3.80.04 SUBMISSION AND DESIGN REQUIREMENTS – Not Used

TS 3.80.05 MATERIALS

TS 3.80.05.01 Granular Subbase

Granular subbase shall be 19 mm crusher run limestone meeting the requirements of TS 1010.

TS 3.80.05.02 Concrete Base

The materials for and the production of concrete base shall meet the requirements of TS 13.00 and the following:

(i)	Cement type	Type 10 Normal Portland
(ii)	Minimum 28 day cylinder compressive strength	32 Mpa
(iii)	Class of exposure	C-2
(iv)	Nominal maximum size of coarse aggregate	19 mm
(v)	Slump at point of discharge (formed concrete)	80±30 mm
(vi)	Total air content	5-8 percent
(vii)	Maximum water/cementing materials ratio	0.45
(viii)	Minimum cementing materials content	335 kg/m^3

TS 3.80.05.03 Granular Base

Granular base shall meet the requirements of TS 1010 for 19 mm crusher run limestone, except that the gradation shall be as follows:

Sieve Number	Per Cent Passing
19 mm	100
13.2 mm	80-100
4.75 mm	45-65
2.36 mm	35-50
425 μm	12-26
75 μm	0-8

TS 3.80.05.04 Bedding Sand

Bedding sand shall meet the requirements of OPSS 1002 for fine aggregates, except that the gradation shall be as follows:

Sieve Number	Per Cent Passing
9.52 mm	100
4.75 mm	95-100
2.36 mm	80-100
1.18 mm	50-85
600 µm	25-60
300 µm	10-30
150 µm	5-15
75 µm	0-10

For applications under vehicular traffic, a manufactured sand shall be used.

Limestone screenings or stone dust shall not be used.

TS 3.80.05.05 Joint Sand

Joint sand shall meet the requirements of OPSS 1004 for mortar sand, except that the gradation shall be as follows

Sieve Number	Per Cent Passing
1.18 mm	100
75 µm	0-10

TS 3.80.05.06 Concrete Pavers

Concrete pavers shall meet the requirements of CAN3 A231.2.

Concrete pavers shall be uniform in size and texture. Units having imperfections, chipped edges or cracks shall not be used. The colour and finish shall be as specified in the contract or as directed by the Commissioner.

Concrete pavers shall be 200 mm x 200 mm or 200 mm x 100 mm and shall be of the specified depth of 60 mm or 80 mm. The concrete pavers shall not differ in length or width by more than ±1.6 mm and in depth by more than ±3.2 mm.

Concrete pavers shall be tested in accordance with CAN3 A231.2, in sets of 5 units. The number of sets shall be determined by the Commissioner.

Each individual concrete paver shall have a compressive strength of not less than 50 MPa and the average of the 5 units shall not be less than 55 MPa.

Concrete pavers shall be tested in accordance with CAN3 A23.2-11C for water absorption. The average absorption of the test set shall not be greater than 5% and no individual paver shall be greater than 7%.

The average weight loss of a set of concrete pavers subjected to 50 freeze/thaw cycles, while immersed in a 3% sodium chloride solution, shall not exceed 1% of the initial dry weight.

Failure to meet any of the requirements will result in the rejection of all of the concrete pavers represented by the failed set. All rejected pavers shall be replaced, with all associated costs, including the testing of the replacement set, being borne by the Contractor.

TS 3.80.05.07 HL 8 Stone

HL 8 stone shall meet the requirements of TS 1003 for HL 8 coarse aggregate.

TS 3.80.05.08 Geotextile Fabric

Geotextile fabric shall meet the requirements of TS 1860 for a Class I non-woven geotextile.

TS 3.80.06 EQUIPMENT

Concrete pavers shall be set into the bedding sand using a high frequency, low amplitude, mechanical flat plate vibratory compactor having a plate area sufficient to cover a minimum of 12 pavers (200 mm x 200 mm). The compactor shall transmit an effective force of not less than 75 kN per m² of plate area. The frequency of vibration shall be within the range of 75 to 100 Hz.

TS 3.80.07 CONSTRUCTION

TS 3.80.07.01 Excavation

Prior to any excavation, the Contractor shall have all utilities located and clearly marked, including an areaway locate to mark all underground walkways, rooms, coal chutes, etc.

The excavation shall be to the lines and grades shown on the contract drawings or as specified by the Commissioner. All surplus or unsuitable material is to be disposed of, off the site, in accordance with OPSS 180.

The subgrade shall be prepared as per TS 2.10.

As directed by the Commissioner, the Contractor shall be required to make good all damage caused during the course of the construction to any part of the roadway, boulevard, private property, etc. and to restore the same, to as good or better condition as existed prior to commencement of work.

TS 3.80.07.02 Base

The concrete pavers shall be placed using a granular or a concrete base, as specified in the contract or as directed by the Commissioner.

TS 3.80.07.02.01 Granular Base

Granular base shall be placed in depths of 150 mm, for walkways and boulevards, and 200 mm, for pavements and driveways. It shall be compacted to a minimum of 100 percent of the maximum dry density as determined by TS 501.

TS 3.80.07.02.02 Concrete Base

Prior to the placement of the concrete base, the Contractor shall construct a granular subbase. The subbase shall be placed to a depth of 75 mm and shall be compacted to a minimum of 95 percent of the maximum dry density as determined by TS 501.

The concrete base shall be poured to a minimum depth of 100 mm. At the outer limits of the concrete pavers, the concrete depth shall be increased to form a 200 mm wide edge restraint, level with the proposed surface of the pavers. The 200 mm wide edge restraint shall be omitted when the pavers are placed adjacent to a concrete curb.

At all maintenance holes, valve boxes, handwells, etc. the surrounding concrete shall be increased to the proposed surface of the pavers. The concrete shall be squared off and the outer edge of the appurtenance shall be encased by a minimum of 50 mm of concrete. The size and location of the raised concrete shall be governed by the alignment of the concrete pavers. No concrete paver shall be cut or trimmed to less than half of its original dimensions.

The slope of the concrete base shall match the final slope of the concrete pavers. Plastic drain pipes (50 mm diameter) shall be placed at the low side of the base, spaced at every 3 metres along the length of the concrete base. The drain shall be a minimum of 250 mm long and shall be flush with the top of the base. A drainage pocket shall be constructed at every drain. The pocket shall consist of HL 8 stone placed 200 mm wide x 200 mm long x 300 mm deep from the bottom of the concrete base. It shall be situated to drain into the granular material at the back of the curb. If the drain cannot be discharged into a well-draining granular material, the drainage pocket shall be increased to 300 mm wide x 300 mm long. Prior to placing the bedding sand, the drain shall be covered by centring a 200 mm x 200 mm piece of geotextile fabric over the opening.

TS 3.80.07.03 Bedding

The bedding sand shall be placed loosely, in a uniform layer with sufficient depth to achieve the final compacted thickness of 20 to 30 mm.

The bedding sand shall be screeded in a loose condition and protected against compaction prior to placement of the concrete pavers. Concrete pavers shall be placed only on loose, moist bedding sand.

TS 3.80.07.04 Concrete Paver Placement

Concrete pavers shall be installed in the specified pattern or as directed by the Commissioner.

Concrete pavers shall be placed uniformly and hand tight, such that all joints are correctly aligned.

Where concrete pavers require trimming, they shall be cut with a quick-cut saw or a guillotine, to give a straight edge.

After placement, compactive effort shall be applied to the concrete pavers until the bedding sand is compacted to achieve the proper grade and the pavers are free of movement. At least three (3) passes of a plate compactor shall be made across the surface of the concrete pavers.

After initial compaction, dry joint sand shall be broomed to fill in the joints and spread uniformly over the concrete pavers to a depth of not less than 5 mm. At least two (2) passes of a plate compactor shall be applied to the surface while simultaneously sweeping the sand into the joints. Water shall be sprinkled over the sand to ensure proper compaction. Joints shall be completely filled at the completion of compaction. Excess sand shall then be removed from the pavement surface by brooming.

TS 3.80.08 QUALITY ASSURANCE

TS 3.80.08.01 Surface Tolerance

The surface of the concrete pavers shall be such that when tested with a 3 m long straightedge, placed in any direction on the surface, the gap between the straightedge and the surface of the pavers shall not be greater than 3 mm, at any point.

TS 3.80.08.02 Acceptance

If any pavers are loose, chipped or unevenly cut pavers will be rejected. Areas failing to meet the requirement for surface tolerance will be rejected.

Any rejected pavers or areas shall be removed and either reinstalled or replaced by the Contractor. All costs associated with the removal, reinstallation and replacement of rejected concrete pavers shall be borne by the Contractor.

TS 3.80.09 MEASUREMENT FOR PAYMENT

TS 3.80.09.01 Interlocking Concrete Pavers

Measurement for the above item(s) shall be of the surface area, including any edge restraint, in m^2. No deduction will be made for poles or utility frames and covers.

TS 3.80.10 BASIS OF PAYMENT

TS 3.80.10.01 Interlocking Concrete Pavers - Item

Payment at the contract price for the above item shall be full compensation for all labour, equipment, materials and incidentals to do the work. Payment shall include, but not be limited to, all excavation, the supply, placing, levelling and compacting of all granular, the supply and placement of concrete base and edge restraints, the supply and placement of drains, the supply and placement of concrete pavers and the filling of all joints.