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SECTION 13 – CONCRETE PAVERS DESIGN CRITERIA

13.01 SCOPE

- .1 For the purpose of this specification the following definitions shall apply:
 - (a) Concrete pavers refer to concrete manufactured for the purpose of paving, either roadways, sidewalks or walkways.
 - (b) Stamped Concrete refers to concrete stamped to produce a pattern after pouring.
- .2 Walkways and Roads using concrete pavers shall be designed in accordance with the following design criteria.

13.02 ROADWAY AND SIDEWALK DESIGN

- .1 Roadway design shall conform to Section 9 - Streets, Traffic Signs and Markings.
- .2 Sidewalk and Walkway design shall conform to Section 8 – Curbs, Sidewalks and Walkways.

13.03 EDGE RESTRAINTS

- .1 Edge restraints shall be:
 - (a) Concrete curbs within roadway right-of-ways as required by Section 8 – Curbs, Sidewalks and Walkways.
 - (b) Concrete grade beam inside roadway right-of-ways. Concrete grade beam shall have a minimum width of 200 mm.
 - (c) Concrete grade beams shall conform to the same material specifications as concrete curbs.
 - (d) Injection molded plastic may be used outside roadway right-of-ways. Manufactured edge restraints shall not be used for vehicle traffic areas.
 - (e) Treated Lumber shall be used only if approved by the City Engineer.

13.04 THICKNESS OF CONCRETE PAVERS

- .1 Concrete pavers to be used for sidewalks and walkways outside of the roadway right-of-way, subject to pedestrian traffic only shall have a minimum thickness of 60 mm.
- .2 Concrete pavers to be used for roadways and sidewalks inside the roadway right-of-way, subject to vehicular and pedestrian traffic shall have a minimum thickness of 80 mm.
- .3 Stamped concrete thickness shall conform to Section 8 – Curbs, Sidewalks and Walkways, clause 8.07.

SECTION 13 – CONCRETE PAVERS DESIGN CRITERIA

13.05 ROADWAY, CURB, SIDEWALK, AND WALKWAYS - BASE AND SUB-BASE

- .1 Sub-base beneath concrete pavers shall be crushed or pit-run aggregate compacted as per the standard drawings. Sub-base shall be a minimum thickness of 150 mm or as specified.
- .2 Concrete paver base shall be from one of three categories:
 - (a) FLEXIBLE BASE - consists of compacted crushed stone, gravel or coarse sand. Joint sand shall be used when laying concrete pavers on a Flexible Base.
 - (b) SEMI-RIGID BASE - consists of asphalt. Joint sand shall be used when laying concrete pavers on a Semi-Rigid Base.
 - (c) RIGID BASE - consists of a reinforced or unreinforced concrete slab on grade. Mortar shall be used for any possible vehicular traffic when laying concrete pavers on a Rigid Base.

Base shall be a minimum thickness as specified in Section 13.33. Base must be approved by the City Engineer.

13.06 PATTERNS

- .1 Patterns shall generally conform to Standard Drawing No. BP-1. Alternate patterns or design features require prior approval by the City Engineer.
- .2 Patterns must conform to paver manufacturer's specifications as required by the paver shape(s).
- .3 Soldier course may be used if approved by City Engineer.
- .4 Patterns for non-standard pavers shall conform to manufacturer's specifications.

13.07 UTILITY SURROUNDS

- .1 Metal rims and covers up to 300 mm in diameter shall have a minimum 150 mm thick concrete surround.

13.08 LONGITUDINAL AND CROSSFALL GRADES

- .1 Grades for Sidewalks and Walkways shall conform to Section 8.05 - Standard Longitudinal Grade and Section 8.06 - Sidewalk and Walkway Crossfall Grade.
- .2 Grades for Roadways shall conform to Section 9.07 - Standard Longitudinal Grade and Section 9.08 - Standard Crown and Crossfall Grades.

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13.09 STANDARD DIMENSIONS

- .1 Standard dimensions shall be a 112.5 mm by 225 mm (4.5" by 9") paver. Any different paver size shall require prior approval from the City Engineer.
- .2 Standard paver shape(s) shall be limited by availability from manufacturer.

13.10 STANDARD UNIT PAVING EDGES

- .1 Paving edges generally conform to Standard Drawing No. BP-3 and Standard Drawing No. BP-4. Alternate Unit paving edges or designs require approval by the City Engineer.

SECTION 13 – CONCRETE PAVERS SPECIFICATIONS

13.20 SCOPE

- .1 This specification refers to streets, sidewalks and walkways paved using either paving bricks or stamped concrete.
- .2 Specifications for stamped concrete, under reinforced or plain concrete works shall be as specified in Section 8 – Curbs, Sidewalks and Walkways.
- .3 Only those products approved by the City Engineer will be accepted for installation.

13.21 CONCRETE PAVERS

- .1 Concrete pavers refer to precast concrete units manufactured and supplied by a member of the Concrete Paver Institute. Concrete pavers must conform to the following requirements.
 - (a) Concrete pavers shall have an average compressive strength of 55 MPa (8000 psi), with no individual paver under 50 MPa (7250psi) in accordance with ASTM C579 or CSA A231.1/A231.2. **(REVISED NOVEMBER 2016)**
 - (b) Concrete pavers shall have an average absorption of 5% with no paver having a greater absorption than 7% when tested in accordance with ASTM C140.
 - (c) Concrete pavers must be shown to be resistant to fifty (50) freeze-thaw cycles when tested in accordance with ASTM C67 or in accordance with CSA A231.1/A231.2. **(REVISED NOVEMBER 2016)**

13.22 COMMON EXCAVATION

- .1 Common excavation is the excavation and removal of all material encountered which is not classified as rock.

13.23 ROCK EXCAVATION

- .1 Rock excavation shall conform to Section 9.25A - Rock Excavation.

13.24 AUTHORIZED OVEREXCAVATION

- .1 Authorized overexcavation shall conform to Section 9.26 - Authorized Overexcavation.

13.25 UNAUTHORIZED OVEREXCAVATION

- .1 Unauthorized overexcavation shall conform to Section 9.26A - Unauthorized Overexcavation.

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13.26 EARTH FILL

- .1 Earth fill shall conform to Section 9.27 - Earth Fill.

13.27 IMPORTED EARTH FILL

- .1 Imported earth fill shall conform to Section 9.27A - Imported Earth Fill.

13.28 ROCK FILL

- .1 Rock Fill shall conform to Section 9.28 - Rock Fill.

13.29 IMPORTED GRANULAR FILL

- .1 Imported granular fill shall conform to Section 9.28A - Imported Granular Fill.

13.30 CONCRETE

- .1 All concrete shall conform to Section 8 – Curbs, Sidewalks and Walkways.

13.31 BEDDING AND JOINT SANDS

- .1 Sands to be used for concrete paving shall be clean, non-plastic and free from deteriorious or foreign matter. Bedding and Joint Sands may be natural or manufactured from crushed rock.
- .2 For Bedding Sand the material shall conform to ASTM C33 as follows:

Grading Requirements for Bedding Sand (ASTM C33)	
Sieve Size	Percent Passing
9.5 mm (3/8 in)	100
4.75 mm (No.4)	95 to 100
2.36 mm (No. 8)	85 to 100
1.18 mm (No. 16)	50 to 85
0.600 mm (No. 30)	25 to 60
0.300 mm (No. 50)	10 to 30
0.150 mm (No. 100)	2 to 10

- .3 For Joint Sand the material shall conform to ASTM C144 as follows:

Grading Requirements for Joint Sand (ASTM C144)	
Sieve Size	Percent Passing
4.75 mm (No.4)	100
2.36 mm (No. 8)	95 to 100
1.18 mm (No. 16)	70 to 100
0.600 mm (No. 30)	40 to 75
0.300 mm (No. 50)	10 to 35
0.150 mm (No. 100)	2 to 15
0.075 mm (No. 200)	0

SECTION 13 – CONCRETE PAVERS SPECIFICATIONS

- .4 Bedding Sand may be used as a replacement for Joint Sand, but Joint Sand shall not be used to replace Bedding Sand as a laying base.

13.32 SELECT GRANULAR SUB-BASE

- .1 Select granular Sub-base shall conform to Section 9.29 – Road Sub-base Gravel Course.

13.33 BASE MATERIALS

.1 Flexible Base

- (a) For vehicular applications including any concrete paving within a roadway right-of-way the base course shall conform to Section 9.30 Road Base Gravel Course. The minimum thickness of a compacted aggregate base is 100 mm. A compacted aggregate base shall have a 25 to 50 mm compacted sand setting bed placed between the base and the pavers. This setting bed must conform to Section 13.31.2 and Standard Drawing No. BP-2.

.2 Semi-Rigid Base

- (a) For any paving application, semi-rigid bases consist of a minimum 100 mm thickness of asphalt base, with a 19 to 25 mm asphalt setting bed on top. Semi-Rigid bases may be installed using existing asphalt pavement as the base. See Standard Drawing No. BP-2.

.3 Rigid Base

- (a) For pedestrian applications only, mortarless paving may be used. The setting bed shall be compacted sand approximately 13 mm thick.
- (b) Rigid bases shall have a minimum thickness of 100 mm of concrete base. Rigid bases shall be used in areas of heavy traffic and where surface drainage is necessary. A rigid base shall have a 10 to 13 mm mortar setting bed to seat the concrete pavers in accordance with Standard drawing No. BP-2.

SECTION 13 – CONCRETE PAVERS INSTALLATION

13.40 GENERAL

- .1 This section covers the installation of Concrete Pavers, except for the installation of stamped concrete, which shall be as specified under Section 8 – Curbs, Sidewalks and Walkways.
- .2 For all generalized sidewalk and walkway construction see Section 8 - Curbs and Sidewalks except where this Specification differs.
- .3 For all generalized roadway construction see Section 9.0 – Streets, Traffic Signs and Markings except where this Specification differs.

13.41 COMMON EXCAVATION

- .1 Common excavation shall be carried out such that the construction of streets, sidewalks and walkways can be done to the line and grade shown on the design drawings.

13.42 CUTTING AND REMOVAL OF EXISTING MATERIAL

- .1 All cutting and removal of existing material shall conform to Section 8.42 - Cutting and Removal of Existing Asphaltic and Concrete Pavement, Curb and Curb and Gutter.

13.43 SUBGRADE, BASE AND SUB-BASE PREPARATION

- .1 Subgrade, Sub-base and Base installation shall be in accordance with Section 9.0 Streets, Traffic Signs and Markings.
- .2 The Subgrade, Sub-base and Base shall be approved by the Engineer prior to placement of the forms and/or guides.

13.44 CROSS-SECTION

- .1 The cross-sections of the roadway, sidewalk and walkway shall conform to the cross-sections as detailed on the contract drawings.

13.45 CONCRETE PLACEMENT

- .1 Placement of concrete shall conform to Section 8.45 - Placing Concrete.

13.46 EDGE RESTRAINTS

- .1 Concrete edge restraints shall conform to Section 8 – Curbs, Sidewalks and Walkways.
- .2 Concrete edge restraints shall be formed not extruded. Reinforcement shall be used as required.
- .3 Plastic edge restraint installation shall be installed in accordance with paver manufacturer's instructions.

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- .4 Treated lumber edge restraints shall be installed in accordance with paver manufacturer's instructions.

13.47 BEDDING SAND

- .1 Bedding sand shall be spread evenly over the base course and screeded to plan thickness. Screeds shall be standard lumber, having minimum length as required by the edge restraints. Screeded sand shall not be disturbed.
- .2 Depressions in the base course shall be filled with base course material and compacted.
- .3 The maximum thickness of bedding sands shall not be exceeded.

13.48 CONCRETE PAVERS

- .1 Pavers shall be laid in the pattern(s) shown in the plans. The contractor shall maintain straight pattern lines.
- .2 Joints between pavers shall be as per manufacturers specifications and shall not exceed 5 mm.
- .3 Gaps at the edge of the paved area shall be filled with cut or edge pavers.

13.49 COMPACTION

- .1 A low amplitude vibrator capable of 22 kN with 75-100 Hz frequency shall be used to vibrate and compact the pavers into the bedding sand. Vibrators shall not be used within 1 m of an unrestrained edge of the Concrete Pavers.
- .2 Joint sand shall be swept in between the pavers during vibration.
- .3 Mechanical - laying machines require prior approval of the City Engineer.

13.50 TOLERANCES

- .1 Final surface elevation of pavers shall be 3 to 6 mm above adjacent drainage inlets, concrete collars or channels.
- .2 The final surface elevation shall not deviate more than 10 mm under a 3 m long straightedge.

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13.51 MOISTURE PROTECTION

- .1 Stockpiled material shall be covered with a waterproof covering to prevent exposure to rainfall.
- .2 Concrete pavers shall not be installed during heavy rainfall or over wet base and Sub-base materials.

13.52 CLEANUP

- .1 At the end of each day, all work within 1 m of the laying face shall be left fully compacted and shall have sand filled joints.
- .2 All excess sand shall be swept off the laid pavers.