

## 1 GENERAL

- 1.1 The work of this section includes the provision of all design, labour, materials, equipment and services required to fabricate and install pedestrian paving as required for a complete project. The work includes, but is not necessarily limited to, the items referenced herein:
- 1.1.1 Pedestrian Paving Courses.
  - 1.1.2 Flexible Pedestrian Pavement.
  - 1.1.3 Pedestrian Unit Pavers.
  - 1.1.4 Rigid Pedestrian Pavement.
  - 1.1.5 Exterior Steps and Ramps.
  - 1.1.6 Exterior Rails and Guards.
- 1.2 Refer to Section G2020: Parking Lots for curb requirements where pedestrian paving abuts parking lot.
- 1.3 Qualifications:
- 1.3.1 Applicators shall have a minimum of 5 years experience in the successful installation of the systems specified in this section.
  - 1.3.2 Precast manufacturer shall be certified to *[CSA A251-M1982]* - Qualification Code for Manufacturers of Architectural and Structural Precast Concrete.
- 1.4 Quality Control:
- 1.4.1 Pedestrian Paving Courses: Submit reports from independent testing firm certifying material gradation and compaction results obtained on site. Reports to bear the signature and stamp of a Professional Engineer licensed in the Province of Ontario.
  - 1.4.2 Flexible Pedestrian Pavement: Submit reports from independent testing firm certifying material gradation, asphalt cement extraction, and compaction results obtained on site. Reports to bear the signature and seal of a Professional Engineer licensed in the Province of Ontario.
  - 1.4.3 Rigid Pedestrian Pavement and Exterior Steps: Use ready-mix concrete supplied by certified concrete mix batch plant only. Site mixed concrete is not permitted except where noted in this section. Submit reports from independent testing firm certifying concrete results obtained on site when tested in accordance with *[CAN3-A23.2]*.

## 2 DESIGN

- 2.1 The *[Design Builder]* shall engage a qualified Landscape Architect, licensed to practice in the Province of Ontario, to incorporate work of this section into overall landscape design and provide review during its construction. Landscape Architect shall have not less than 5 years of demonstrated experience in projects of similar size. Pedestrian pavement assembly subject to vehicular loading shall be designed by a qualified Civil Engineer licensed to practice in the Province of Ontario.
- 2.2 Barrier Free Design: Pedestrian pavement areas, curbs, ramps and rails to conform with Barrier Free Design requirements of the Ontario Building Code, latest edition except where more stringent requirements are indicated. Comply with Barrier Free Design Guideline for Site Work in *[CAN/CGSB 651-M95]*.
- 2.3 All areas within the site boundaries are to be provided with new work, finished or made good to match in with existing.
- 2.4 Provide new pedestrian paving at the perimeter of the new building as follows:
  - 2.4.1 To all building entrances and service entrances.
  - 2.4.2 Exterior public walkways and plazas.
  - 2.4.3 To connect all building entrances of the proposed building and Building(s) *['N']*.
  - 2.4.4 Provide exterior railings and guards at steps of 3 or more risers and to areas where a drop of 600mm occurs at all building major entrances.
- 2.5 Provide pavement material as follows:
  - 2.5.1 Interlock unit paving to pedestrian areas located at the perimeter of the building and featured landscape areas.
  - 2.5.2 Rigid pavement (cast-in-place concrete, precast concrete or stone units) at all main entrances leading to parking lots or roadways.
  - 2.5.3 Flexible pavement to minor pedestrian paths or landscape areas.
  - 2.5.4 Provide external ramps and adjacent stairs, complete with railings and guards, where slopes are steeper than 1:20 (5%). Ramp surfaces must be slip-resistant.
- 2.6 Pedestrian paths:
  - 2.6.1 15 mm crown, slope to 2% minimum and 5% maximum, cross slope to 2% minimum and 5% maximum. Maximum elevation difference between paving and adjacent grade 150 mm.
  - 2.6.2 Design pedestrian paths in excess of 5% slope as ramps in accordance with Barrier Free requirements of the OBC and Algonquin College accessibility guidelines.

- 2.6.3 Minimum widths of pedestrian paths shall be 1500 mm. Minimum widths of pedestrian paving in front of main building entrance shall be 3000 mm.
- 2.6.4 Design pedestrian paving subject to vehicular traffic to support 23000 kg vehicles.
- 2.7 Pedestrian Paving Course:
  - 2.7.1 Design to recommendations contained in geotechnical report.
  - 2.7.2 Specify granular base and sub-base to OPSS standard for commercial sources.
  - 2.7.3 Design base and sub-base courses to suit pavement material and loading. In no case shall depth of base course be less than 100 mm after compaction.
  - 2.7.4 Incorporate geotextiles into paving course design, where necessary, to achieve a stable pavement system.
  - 2.7.5 Design asphalt mix to OPSS standard for commercial sources.
- 2.8 Rigid Pavement:
  - 2.8.1 Rigid pavement shall be a minimum of 100 mm thick.
  - 2.8.2 Where pavement is located adjacent to a building, dowel pavement into adjacent building foundation to prevent uplift and settlement.
- 2.9 Exterior Steps and Ramps:
  - 2.9.1 Exterior steps to be 1500 mm min. wide, rise between 150 and 175 mm, run 300 mm minimum, total rise in any flight not less than 450 mm and not to exceed 2400 mm.
  - 2.9.2 Design ramps in accordance with Barrier Free Design section of the OBC.
  - 2.9.3 Construct exterior steps and ramps of cast-in-place concrete. Provide concrete foundations to support deadload and anticipated live load.
  - 2.9.4 Surface stairs and ramps shall have slip resistant finishes.
  - 2.9.5 Provide prefinished aluminum handrails on both sides of exterior steps and ramps. Provide stainless steel handrails at exterior steps and ramps located at front entrances of building.
- 2.10 Curbs and Edge Restraints:
  - 2.10.1 Provide suitable edge restraint system selected from systems identified in materials section of this specification for all unit paving.
  - 2.10.2 Sidewalks adjacent to asphalt shall have a concrete curb or curb/gutter as required.

2.10.3 Provide depressed curbs at all walkways for wheelchair accessibility.

### 3 MATERIALS

#### 3.1 Pedestrian Paving Courses:

3.1.1 Crushed pit run or screened stone, gravel or sand consisting of hard durable angular particles free of clay lumps, cementation, organic material and other deleterious materials.

3.1.2 Screenings: hard, durable, crushed stone particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

3.1.3 Gradations to be within specified limits when tested to *[ASTM C136]* and *[ASTM C117]*. Sieve sizes to *[CAN/CGSB-8.1]*.

3.1.4 Liquid Limit: to *[ASTM D4318]*, Maximum 25.

3.1.5 Los Angeles Abrasion: to *[ASTM C131]*, Gradation 'A', Maximum % Loss by Mass: 40. Particles smaller than 0.02 mm: to *[ASTM D422]*, Maximum 3%.

3.1.6 Soaked CBR: to *[ASTM D1883]*, Minimum 40.

3.1.7 Cement stabilized base for unit paving subject to vehicular traffic.

3.1.8 Geotextiles: woven or non-woven polypropylene or polyester.

#### 3.2 Flexible Pedestrian Paving:

##### 3.2.1.1 Asphalt Concrete Paving:

3.2.1.1.1 Asphalt Cement: to *[CAN/CGSB-16.3]*.

3.2.1.1.2 Reclaimed Asphalt Pavement: Crushed and screened to 100% passing, 50 mm screen before mixing.

3.2.1.1.3 Asphalt Concrete Aggregates:

3.2.1.1.3.1 Crushed or screened stone, gravel and sand.

3.2.1.1.3.2 Gradations to be within limits specified when tested to *[ASTM C136]* and *[ASTM C117]*. Sieve sizes to *[CAN/CGSB-8.1]*.

3.2.1.1.3.3 Sand equivalent: to *[ASTM D2419]*, Minimum 50.

3.2.1.1.3.4 Magnesium Sulphate Soundness: to *[ASTM C88]*. Maximum % loss by weight: coarse aggregate 12, fine aggregate 16.

3.2.1.1.3.5 Los Angeles Degradation: to *[ASTM C131]*. Maximum % loss by weight: coarse aggregate 35.

- 3.2.1.1.3.6. Absorption: to [ASTM C127]. Maximum % by weight: coarse aggregate 1.75.
- 3.2.1.1.3.7. Lightweight particles: to [ASTM C123]. Maximum % by mass, with less than 1.95 relative density: 1.5.
- 3.2.1.1.3.8. Flat and elongated particles: to [ASTM D4791]. Maximum % by weight: coarse aggregate. 15.
- 3.2.1.1.4 Mineral filler: finely ground particles of limestone, Portland cement or other non-plastic mineral matter.
- 3.2.1.1.5 Tack Coat: to [CAN/CGSB-16.2, grade SS-1].
- 3.2.2 Pedestrian Unit Pavers:
  - 3.2.2.1 Pedestrian Unit Paving: Interlocking or non interlocking, 60 mm thick precast concrete to [CAN3-A231-2]. 80 mm minimum thickness when subjected to vehicular loads.
  - 3.2.2.2 Bedding and Jointing Sand to [CSA A82.56], hard, durable, angular particles, free from clay lumps, cementation, deleterious materials.
  - 3.2.2.3 Edge Restraints: Staked rigid and flexible PVC or aluminum systems, precast concrete, cast-in-place concrete and cut stone.
- 3.2.3 Rigid Pedestrian Pavement:
  - 3.2.3.1 Concrete material to [CAN/CSA-A23.1].
    - 3.2.3.1.1 Portland Cement to [CAN3 CSA-A5], normal, Type 10
    - 3.2.3.1.2 Concrete mixtures to [CAN/CSA-A23.1].
    - 3.2.3.1.3 Class C-1 exposure
    - 3.2.3.1.4 Use ready-mixed concrete only
    - 3.2.3.1.5 Design concrete mix to achieve 80 mm slump at point of discharge, 5% to 8% air content, water/cement ratio according to [Tables 7 & 8 of CSA-A23.1].
    - 3.2.3.1.6 Chemical admixtures to [CAN3 CSA-A266.2-M] and use in accordance with [CAN3 CSA-A266.4-M].
  - 3.2.3.2 Reinforced with 150 x 150 x 6 mm Wire Mesh Epoxy Coated to [CSA G30.5].
  - 3.2.3.3 Joint filler: Sealtight asphalt expansion joint filler.
- 3.2.4 Exterior Steps and Ramps:
  - 3.2.4.1 Cast-in-place concrete:

- 3.2.4.1.1 Materials to [CSA-A23.1] and [CSA-A23.4].
- 3.2.4.1.2 Concrete to achieve minimum compressive strength of 30 MPa at 28-day strength.
- 3.2.4.1.3 Steel anchorages to [CSA-G40.21-M] Grade 300W.
- 3.2.4.1.4 Non shrink grout premixed composition of non-metallic aggregate, cement, water reducing and plasticizing agents, of pouring consistency, capable of developing compressive strength of 50 MPa at 28 days.
- 3.2.4.2 Unit Paver treads to requirements of paragraph 3.3.
- 3.2.5 Exterior Rails and Guards:
  - 3.2.5.1 Steel sections and plates to [CAN/CSA-G40.21], Grade 300W.
  - 3.2.5.2 Steel pipe to [ASTM A53] standard weight. Hot dip galvanize with zinc coating 600 g/m<sup>2</sup> to [CAN/CSA-G164].
  - 3.2.5.3 Welding materials to [CSA W59, CSA Standard S244].
  - 3.2.5.4 Stainless steel tubing to [ASTM A269], Type 302, commercial grade, seamless welded with AISI no. 4 finish.
  - 3.2.5.5 Aluminum structural shapes to Aluminum Association 6351-T6 or 6061-T6.
  - 3.2.5.6 Extruded aluminum to Aluminum Association 6063-T5 for main posts and 6005-T6 for all other components.
  - 3.2.5.7 Fasteners: Type 304 Stainless Steel to [ASTM A276].
  - 3.2.5.8 Anchor bolts: high tensile stainless steel expansion type anchors
  - 3.2.5.9 Finishes:
    - 3.2.5.9.1 Aluminum: Polyester Urethane Powder Coating (for welded construction), fluoropolymer and anodized coating (for welded and interlocked aluminum construction).
    - 3.2.5.9.2 Galvanized steel: Paint in accordance with formulae listed in CPCA manual. Use only products specified in the CPCA manual or specifically approved by the CPCA. Primer - zinc rich ready mix to [CAN/CGSB-1.181-92].
  - 3.2.5.10 Non-shrink grout premixed composition of non-metallic aggregate, cement, water reducing and plasticizing agents, of pouring consistency, capable of developing compressive strength of 50 MPa at 28 days.

#### 4 FABRICATION

- 4.1 Exterior Rails and Guards:
  - 4.1.1 Fabricate steel assemblies to *[CAN/CSA-S16.1]* and welded aluminum assemblies to *[CSA S244]*.
  - 4.1.2 Fabricate assemblies in accordance with approved shop drawings.
  - 4.1.3 Welding:
    - 4.1.3.1 All components to be of welded construction to *[CSA W59-M]* for steel and *[CSA Standard S244]* for aluminum.
    - 4.1.3.2 Welds shall be capable of developing full strength of section.
    - 4.1.3.3 Continuously weld connections between rails and balustrades.
    - 4.1.3.4 File or grind exposed welds smooth and flush.
  - 4.1.4 Fabricate work square, true, straight and accurate to required size within a tolerance of 0.5%.
  - 4.1.5 Fabricate in largest piece possible. Where possible, fit and shop assemble work, ready for erection.
  - 4.1.6 Provide 50 mm nominal outside diameter pipe handrails.
  - 4.1.7 Cap exposed end of handrails and balusters. Terminate at abutting wall with end flange.
  - 4.1.8 Hot-dip galvanize steel components after fabrication. Shop apply zinc rich primer.
  - 4.1.9 Isolate aluminum from contact with dissimilar metals and concrete.
- 4.2 Exterior Stairs and Ramps:
  - 4.2.1 Cast-in-Place Concrete:
    - 4.2.1.1 Fabricate and erect formwork in accordance with *[CSA-S269.3]* to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by *[CSA-S269.1]*.
    - 4.2.1.2 Build in anchors, sleeves, and other inserts required to accommodate Work.
    - 4.2.1.3 Fabricate reinforcing steel in accordance with *[CSA-A23.1]* and *[ANSI/ACI 315]*.

## 5 INSTALLATION

- 5.1 Pedestrian Paving Courses:
  - 5.1.1 Place and shape granular base course to lines and grades required by design.

- 5.1.2 Place geotextiles and granular material on clean unfrozen surface, free from snow and ice.
- 5.1.3 Spread and compact aggregate in uniform layers not exceeding 150 mm compacted thickness.
- 5.1.4 Compact granular material to 98% corrected maximum dry density in accordance with *[ASTM D698]*.
- 5.1.5 Courses for paving units:
  - 5.1.5.1 Place 25 mm sand course over compacted granular base.
  - 5.1.5.2 Extend compacted granular base to the rear of the edge restraint at minimum.
  - 5.1.5.3 Provide plant mix or mixed-in-place cement stabilized base in areas where paving units will be subject to vehicular traffic.
- 5.2 Flexible Pedestrian Pavement:
  - 5.2.1 Place asphalt pavement with mechanical self-powered pavers, capable of spreading hot mix to lines and grades required.
  - 5.2.2 Compact hot mix with sufficient numbers of rollers of type and weight required to obtain density of 95% of density obtained in accordance with Marshall specimens prepared in accordance with *[ASTM D1559]*.
- 5.3 Pedestrian Unit Pavers:
  - 5.3.1 Install edged restraints true to grade.
  - 5.3.2 Place sand bedding course to a uniform 25 mm thickness
  - 5.3.3 Install unit paving true to grade. Where required cut units accurately without damaging edges.
  - 5.3.4 Average joint width to be 2 to 3 mm.
  - 5.3.5 Tamp down and level pavers into sand with a low amplitude, high frequency plate vibrator until pavers are true to grade and free of movement. For pedestrian pavers subject to vehicular traffic, tamp and level pavers with rubber tired roller.
  - 5.3.6 Fill spaces between pavers by sweeping in sand and compact sand into joints with mechanical plate vibrator on sand cushion.
  - 5.3.7 Surface of finished unit paving shall be free from depressions exceeding 3 mm over 3m.
  - 5.3.8 Backfill around the perimeter of installation.
- 5.4 Rigid Pedestrian Pavement:

- 5.4.1 Do concrete work in accordance with *[CAN/CSA A23.1]*.
  - 5.4.2 Round edges, including edges of joints, with 10 mm radius edging tool.
  - 5.4.3 Broom finish concrete uniformly immediately after floating.
  - 5.4.4 Install tooled transverse contraction joints at intervals of 1.5 m.
  - 5.4.5 Install expansion joints at intervals of 6 m and provide joint filler in expansion joints.
  - 5.4.6 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
  - 5.4.7 Finish surfaces to within 3 mm in 3 m as measured with straightedge placed on surface.
- 5.5 Exterior Steps and Ramps:
- 5.5.1 Cast-in-place Concrete:
    - 5.5.1.1 Do concrete work in accordance with *[CSA-A23.1]*.
    - 5.5.1.2 Do not field bend or weld reinforcement unless authorized by Owner.
    - 5.5.1.3 Cast in sleeves, inserts, and non-slip nosing inserts.
    - 5.5.1.4 Grout or bolt in railings and guards.
  - 5.5.2 Unit Pavers: Set unit pavers into concrete or precast concrete step or ramp frame.
- 5.6 Exterior Rails and Guards:
- 5.6.1 Do steel welding work in accordance with *[CSA W59]* for steel. Touch up galvanized surfaces with zinc rich primer where burned by field welding.
  - 5.6.2 Field welding of aluminum assemblies not permitted.
  - 5.6.3 Field apply paint finish in accordance with CPCA manual.
  - 5.6.4 Use stainless steel anchors, bolts and fasteners.
  - 5.6.5 Grout or anchor posts to concrete.

***End of Section***