

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Not applicable

### **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA A23.1-09 Concrete materials and methods of concrete construction.
  - .2 CAN/CSA A3000-A5 Cementitious materials compendium
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 8.2-M88 Sieves, Testing, Woven Wire, Metric
- .3 American Society for Testing and Material (ASTM)
  - .1 ASTM C117-04 Standard Test Method for Materials Finer than 75µm (No. 200) Sieve in Mineral Aggregates by Washing
  - .2 ASTM C131-06 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregates by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136-06 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
  - .4 ASTM D4318-10 Standard Test Method for Liquid, Plastic Limit, and Plasticity Index of Soils.

### **1.3 APPROVAL OF THE SOURCE OF SUPPLY**

- .1 Obtain approval from the Departmental Representative for the aggregates' source of supply.
- .2 Advise the Departmental Representative of the proposed source of supply and, submit samples to him, for approval and allow him to access it at least one (1) week before the start of the aggregates production.
- .3 If, in the opinion of the Departmental Representative, the materials from the proposed source of supply do not meet the specified requirements, the Contractor will have to find another source of supply or demonstrate that the materials from the source of supply in question can be prepared to meet the requirements.
- .4 If a change in source of supply is proposed during the Works, the Contractor shall notify the Departmental Representative two (2) weeks in advance so samples can be taken and tests can be conducted.
- .5 The acceptance of a material at its source of supply does not exclude the possibility that it be subsequently refused if it cannot meet the specified requirements, or if it is judged to lack uniformity or its performance on the job site is not satisfactory.

### **1.4 PRODUCTION SAMPLING**

- .1 The Contractor shall submit samples as specified by laboratory mandated by the Client to test and control the granular materials.
- .2 Aggregate samples will be collected continuously during production by the supplier.
- .3 Ensure the Departmental Representative has free access to the source of supply and the processed materials for sampling and testing.
- .4 The supplier will pay for sampling and testing of materials that do not meet specified standards.

## **PART 2 PRODUCTS**

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## 2.1 MATERIALS

- .1 Characteristics of aggregates: homogeneous, hard, durable, free of platelets, needles, or laminated or soft particles and organic materials or deleterious substances.
- .2 Platelets and needles are particles whose largest dimension is more than five times the smallest.
- .3 Aggregates meeting all requirements will consist of one of the following materials :
  - .1 Crushed Stone;
  - .2 Gravel particles made of natural stone particles.
  - .3 The materials shall conform to the requirements described below.
- .4 Stone, gravel or crushed sand, screened or pit run.
  - .1 When tested in accordance with ASTM C 117-04 and ASTM C 136-06 standards, the size of materials must remain within the limits specified. The dimensions of the sieve openings must conform to the CAN/CGSB-8.2-M88 standard.

### .2 Granular 'A' (Stone 20-0 mm):

MTO Sieve	% passing
26.5 mm	100
19 mm	85-100
13.2 mm	65-90
9.5 mm	50-73
4.75 mm	35-55
1.18 mm	15-40
0.300 mm	5-22
0.075 mm	2-8

- .3 Liquidity limit : at most 25, according to the ASTM D 4318-10 standard.
  - .4 Plasticity index : at most 6, according to the ASTM D 4318-10 standard.
  - .5 Los Angeles Test (resistance to fragmentation) : maximal weight loss of 40 % en poids, according to the ASTM C 131-06 standard.
- .5 Type 3 (Class B) fill material: unfrozen material from the excavation site or other source authorized by the Departmental Representative for the proposed use, and free of stones whose largest dimension exceeds 75 mm, clinker, ashes, sod, waste or other harmful materials.

## PART 3 EXECUTION

### 3.1 AGGREGATE PREPARATION

- .1 Use methods that prevent contamination, segregation and degradation.
- .2 If necessary, combine aggregates to meet the specified requirements for particle size. Use approved methods and equipment.

### 3.2 HANDLING

- .1 Handle and transport aggregate so as to prevent segregation, contamination and degradation.

### 3.3 STOCKPILING

- .1 Stockpile aggregates on the job site, where indicated or designated by the Departmental Representative.
- .2 Stockpile areas shall be level, well drained and stable enough to support the material

### 3.4 CLEANING OF STOCKPILE AREAS

- .1 Remove from the job site all excess aggregates.

END OF SECTION

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## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 31 05 17.02 – Aggregates.

### **1.2 REFERENCES**

- .1 Not applicable.

### **1.3 ADJUSTMENTS**

- .1 The Departmental Representative reserves the right to change any proposed level to adjust to site conditions or to improve the character of the project, as long as it does not increase the workload of the Contractor. These changes will be incorporated in the work of the Contractor without additional cost to the Client.
- .2 If the Departmental Representative requested changes which increase the workload of the Contractor, it shall notify the Departmental Representative. Additional costs must be approved before the work is undertaken by the Contractor.

### **1.4 REGULATIONS**

- .1 Brace and support excavations, protect slopes and embankments and perform all work according to the strictest requirements of provincial and municipal regulations in force.

### **1.5 PROTECTION**

- .1 Before starting work, in the presence of Departmental Representative, verify the condition of buildings, trees and other vegetation, lawns, fences, poles connections, cables, rails railway and paved areas, the bollards and existing benchmarks that could be affected by the work.
- .2 Protect existing structures from damage.
- .3 Underground utility networks
  - .1 Perform all work on utility lines buried according to the requirements of the construction specifications.
  - .2 Details regarding size, location and depth of underground structures, piping and other utilities are for illustrative purposes only and are not necessarily accurate or complete.
  - .3 Prior to commencing excavation Work, notify the Departmental Representative or applicable authorities having jurisdiction, establish location and state of use of buried utilities and structures. The Departmental Representative or authorities having jurisdiction shall clearly mark such locations to prevent disturbance during Work.
  - .4 Maintain and protect against damage: water pipes, sewer, gas, electricity and telephone and other pipelines or other structures identified, as indicated.
  - .5 Obtain from the Departmental Representative appropriate guidance before moving or removing a utility line or structure located within the area of excavation. The Client will pay for this work.
  - .6 Note the location of underground pipes to be preserved, displaced or abandoned.
  - .7 Make arrangements with the competent authorities to redirect buried pipes that may interfere with the performance of work and the costs of such work.
- .4 On-site buildings and other elements
  - .1 During the execution of work, protect against damage on-site buildings and other elements. In case of damage, immediately rehabilitate the affected elements to the satisfaction of the Departmental Representative.
  - .2 If it is necessary to cut roots or branches to the execution of earthworks, proceed according to the onsite instructions by the Departmental Representative.
- .5 Keep excavations clean, free of standing water and loose soil.

- .6 Where the soil can vary significantly in volume due to fluctuations in moisture content, cover and protect it, to the satisfaction of the Departmental Representative.
- .7 Protect elements, whether natural or man-made, which must remain intact.
- .8 Protect existing vegetation against any and all damage.
- .9 Protect underground utilities that are to remain in place.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Type 3 (Class B) fill material: According to the requirements of Section 31 05 17.02 – Aggregates.

## **PART 3 EXECUTION**

### **3.1 PREPARATION WORK**

- .1 Remove, within the indicated limits, the existing rock areas such as stones and concrete slabs.
- .2 Carefully remove the materials so that existing surfaces and structures scheduled to be preserved remain in good condition.

### **3.2 GRADING WORKS**

- .1 Perform rough grading works according to the levels, profiles and layout indicated, taking into consideration the type of landscaping to be carried on the surface.
- .2 Installation: All materials constituting the backfill soil must be approved by the Departmental Representative and deposited and spread in uniform layers with a maximum thickness of 150 mm over the full width required.
- .3 Perform grading so that water does not flow toward any walls or paved surfaces, but is instead directed towards the natural direction of flow of the shoreline water. Grade the terrain, giving it a gradual slope so as to connect with the existing levels of constructed elements (stone wall, trees, multi-purpose path, footpath, etc.).
- .4 Before depositing the fill material, loosen the platform to a depth of 150 mm. To facilitate bonding, maintain backfill and existing surface at approximately the same humidity.
- .5 Platform compaction: Compact platform under the existing walkways, paved surfaces and concrete slabs until the specified density for filling materials.
- .6 At all time, the surface must be graded to ensure the flow of water with a minimum slope of 2% in area, unless otherwise indicated.
- .7 Grade slopes and correct defects as directed by the Departmental Representative.
- .8 Provide a continuous slope surfaces as indicated on the plans or as directed on-site by the Departmental Representative. Surfaces must be uniform slopes between points for which finished levels are indicated on the drawings or between such points and existing levels.
- .9 Do not disturb the soil under the branches of trees or shrubs that are to remain in place.

### **3.3 RESTORATION OF JOB SITE**

- .1 Upon completion, remove surplus materials, waste materials and debris according to the requirements of the construction specification.

- .2 Replace paved surfaces and sidewalks affected during construction to the state and at the level where they were before the earthworks, taking care to respect the original thickness of these structures.
- .3 Clean and restore areas affected by the work, according to the requirements of the construction specification.

END OF SECTION

## **Part 1 - General**

### **1.1 Related Requirements**

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 35 30 - Health and Safety Requirements
- .3 Section 01 35 43 - Environmental Procedures
- .4 Section 01 45 00 - Quality Control
- .5 Section 01 56 00 - Temporary Barriers And Enclosures And Applicable Local Regulations
- .6 Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .7 Section 02 41 16.01 - Selective Site Demolition
- .8 Section 31 05 17.02 – Aggregates
- .9 Section 31 32 21.02 – Geotextiles

### **1.2 Unit Prices**

- .1 Soil Excavation: Removal of additional soil below the elevation of sub-footing aggregate indicated on drawings. This work will be paid based on the actual quantities measured on site and the unit prices stated in the Bid and Acceptance Form. Excavation to the underside of the aggregate is included in the lump sum price.
- .2 Engineered Fill: Engineered fill providing bearing capacity as recommended in the Geotechnical Report, to fill additional soil and rock excavation to the elevation of the underside of sub-footing aggregate. This work will be paid based on the actual quantities measured on site and the unit prices stated in the Bid and Acceptance Form.
- .3 Weathered Rock Removal: Removal of bedrock classed at or less than 75% of Rock Quality Designation (RQD), per Geotechnical Report. Remove using non-explosive and non-impact means. This work will be paid based on the actual quantities measured on site and the unit prices stated in the Bid and Acceptance Form.
- .4 Non-weathered Rock Removal: Removal of bedrock classed at greater than 75% of Rock Quality Designation (RQD), per Geotechnical Report. Remove using non-explosive and non-impact means. This work will be paid based on the actual quantities measured on site and the unit prices stated in the Bid and Acceptance Form.

### **1.3 References**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1, sieves, testing, woven wire, inch series.
  - .2 CAN/CGSB-8.2, sieves, testing, woven wire, metric.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000-03, cementitious materials compendium (consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001-03, cementitious materials for use in concrete
  - .2 CSA-A23.1/A23.2-04, concrete materials and methods of concrete construction/methods of test and standard practices for concrete.

#### 1.4 Definitions

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
  - .1 Rock: solid material in excess of 1.00 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.
  - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in work.
- .3 Topsoil:
  - .3 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .4 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: sieve sizes to CAN/CGSB-8.1.
    - .2 Table:

Sieve designation	% passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45
    - .3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

#### 1.5 Action and Informational Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control: in accordance with Section 01 45 00 - Quality Control:
  - .1 Submit condition survey of existing conditions as described in existing conditions article of this section.
  - .2 Submit for review by Departmental Representative proposed methods as described in part 3 of this section.
  - .3 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
  - .4 Submit to Departmental Representative written notice when bottom of excavation is reached.



- .5 Submit to Departmental Representative as described in part 3 of this section.
- .3 Preconstruction submittals:
  - .1 Submit construction equipment list for major equipment to be used in this section prior to start of work.
- .4 Submit records of underground utility locates, indicating: location plan of relocated and abandoned services, as required.
- .5 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Inform Departmental Representative at least 4 weeks prior to beginning work, of proposed source of fill materials and provide access for sampling.
  - .3 Submit 70 kg samples of type of fill specified.
  - .4 Ship samples to Departmental Representative, in tightly closed containers to prevent contamination and exposure to elements.
  - .5 At least 4 weeks prior to beginning work, inform Departmental Representative source of fly ash and submit samples to Departmental Representative.
    - .1 Do not change source of fly ash without written approval of Departmental Representative

#### **1.6 Quality Assurance**

- .1 Where Departmental Representative is employee of contractor, submit proof that work by Departmental Representative is included in contractor's insurance coverage.
- .2 Submit design and supporting data at least 2 weeks prior to beginning work.
- .3 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .4 Keep design and supporting data on site.
- .5 Engage services of qualified professional engineer who is registered or licensed in of Ontario, Canada in which work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for work.
- .6 Do not use soil material until written report of soil test results are approve by Departmental Representative.
- .7 Health and safety requirements:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

#### **1.7 Waste Management And Disposal**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Divert excess materials from landfill to local facility for reuse as directed by Departmental Representative
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## 1.8 Existing Conditions

- .1 Examine soil report.
- .2 Buried services:
  - .1 Before commencing work verify location of buried services on and adjacent to site.
  - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
  - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
  - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .5 Prior to beginning excavation work, notify applicable Departmental Representative establish location and state of use of buried utilities and structures. Departmental Representative to clearly mark such locations to prevent disturbance during work.
  - .6 Confirm locations of buried utilities by careful test excavations.
  - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
  - .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing.
  - .9 Record location of maintained, re-routed and abandoned underground lines.
  - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by work.
  - .2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair as directed by Departmental Representative
  - .3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

## Part 2 - Products

### 2.1 Materials

- .1 Type 1 and type 2 fill: properties to Section 31 05 17.02 - Aggregates and the following requirements:
  - .1 Crushed, pit run or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C 136. Sieve sizes to CAN/CGSB-8.1.
  - .3 Table
 

	Type 1	type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

- .3 Unshrinkable fill: proportioned and mixed to provide:
  - .1 Maximum compressive strength of 0.4 mpa at 28 days.
  - .2 Maximum cement content of 25 kg/m<sup>3</sup> with 40% by volume fly ash replacement: to csa-a3001, type gu.
  - .3 Minimum strength of 0.07mpa at 24 h.
  - .4 Concrete aggregates: to csa-a23.1/a23.2.
  - .5 Cement: type gu.
  - .6 Slump: 160 to 200 mm.
- .4 Shear mat: honeycomb type bio-degradable cardboard 100 mm thick, treated to provide sufficient structural support for poured concrete until concrete cured.
- .5 Geotextiles: to Section 31 32 21.02 – Geotextiles.

### **Part 3 - Execution**

#### **3.1 Temporary Erosion and Sediment Control**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction sediment and erosion control.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal

#### **3.2 Site Preparation**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

#### **3.3 Preparation/Protection**

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures And Applicable Local Regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

#### **3.4 Stripping of Topsoil**

- .1 New topsoil supplied and placed as per Landscape Architecture specifications.

#### **3.5 Stock Piling**

- .1 stockpiling of topsoil as per landscape architecture specifications.

### **3.6 Cofferdams, Shoring, Bracing and Underpinning**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 30 - Health and Safety Requirements.
  - .1 Where conditions are unstable, Departmental Representative to verify and advise methods.
  - .2 Obtain permit from authority having jurisdiction for diversion of water course.
  - .3 Construct temporary works to depths, heights and locations as directed by Departmental Representative.
  - .4 During backfill operation:
    - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
    - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
    - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
  - .5 When sheeting is required to remain in place, cut off tops at elevations as indicated.
  - .6 Upon completion of substructure construction:
    - .1 Remove cofferdams, shoring and bracing.
    - .2 Remove excess materials from site and restore watercourses as indicated by Departmental Representative
    - .3 Stockpiling of topsoil as per landscape architecture specifications.

### **3.7 Dewatering And Heave Prevention**

- .1 Keep excavations free of water while work is in progress.
- .2 Provide for Departmental Representative approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures to approved collection and in manner not detrimental to public and private property, or portion of work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

### **3.8 Excavation**

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated by Departmental Representative.
- .3 Remove paving and other obstructions encountered during excavation in accordance with Section 02 41 16.01 - Selective Site Demolition.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.

- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain.
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .6 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .7 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .8 Restrict vehicle operations directly adjacent to open trenches.
- .9 Dispose of surplus and unsuitable excavated material in approved location on site.
- .10 Do not obstruct flow of surface drainage or natural watercourses.
- .11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .12 Notify Departmental Representative when bottom of excavation is reached.
- .13 Obtain Departmental Representative approval of completed excavation.
- .14 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .15 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with type 2 fill compacted to not less than 100% of corrected standard proctor maximum dry density
  - .2 Fill under other areas with type 2 fill compacted to not less than 95 % of corrected standard proctor maximum dry density.
- .16 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
  - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.
- .17 Install geotextiles in accordance with Section 31 32 21.02 - Geotextiles.

### **3.9 Fill Types and Compaction**

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 698
  - .2 Exterior side of perimeter walls: use type 3 fill to subgrade level. Compact to 95% of corrected maximum dry density.
  - .3 Under concrete slabs: provide 150 mm compacted thickness base course of type 1 fill to underside of slab. Compact base course to 100 %.
  - .4 Retaining walls: use type 2 fill on high side for minimum 500 mm from wall and compact to 9 %. For remaining portion, use type 3 fill compacted to 95 %.
  - .5 Place unshrinkable fill in areas as indicated.
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### **3.10 Bedding and Surround of Underground Services**

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 .place bedding and surround material in unfrozen condition.

### **3.11 Backfilling**

- .1 Vibratory compaction equipment:
- .2 Do not proceed with backfilling operations until completion of following:
  - .1 Departmental Representative has inspected and approved installations.
  - .2 Departmental Representative has inspected and approved of construction below finish grade.
  - .3 Inspection, testing, approval, and recording location of underground utilities.
  - .4 Removal of concrete formwork.
  - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 Backfilling around installations:
- .7 Place bedding and surround material as specified elsewhere.

### **3.12 Restoration**

- .1 Upon completion of work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as indicated by Departmental Representative.
- .3 Reinstate lawns to elevation which existed before excavation or as indicated.
- .4 Reinstate pavements disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Not applicable.

### **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA G40.20-04 (R2009) General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 4.2 No. 11.2-M89 Textile Test Methods - Bursting Strength - Ball Burst Test (Reaffirmation of September 1989)
  - .2 CAN/CGSB 148.1-M Methods of Testing Geosynthetics - (Complete Set)
  - .3 No. 2 M85, Methods of Testing Geotextiles and Geomembranes – Mass per Unit Area.
  - .4 No. 3 M85, Methods of Testing Geotextiles and Geomembranes – Thickness of Geotextiles.
  - .5 No. 6.1 93, Methods of Testing Geotextiles and Geomembranes – Bursting Strength of Geotextiles Under No Compressive Load.
  - .6 No. 7.3 92, Methods of Testing Geotextiles and Geomembranes – Grab Tensile Test for Geotextiles.
  - .7 No. 10 94, Methods of Testing Geosynthetics – Geotextiles – Filtration Opening Size.
- .3 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM D4491-99a(2009) Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .2 ASTM D4595-09 Standard Test Method for Tensile Properties of Geotextiles by the Wide Width Strip Method.
  - .3 ASTM D4716-08 Test Method for Determining the (In Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  - .4 ASTM D4751-04 Standard Test Method for Determining Apparent Opening Size of a Geotextile.

### **1.3 DOCUMENTS AND SAMPLES TO SUBMIT**

- .1 At least four (4) weeks before the start of the works, submit to the Departmental Representative the following items :
  - .1 A data sheet of each type of product.
  - .2 A sample of one (1) m<sup>2</sup> of geotextile.

### **1.4 TRANSPORTATION, STORAGE AND HANDLING**

- .1 During transportation and storage, protect geotextiles from direct sunlight, ultraviolet radiation, excessive heat, mud, dust, debris and rodents.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 The geotextiles must conform to the above-mentioned References.
- .2 Geotextiles: composed of synthetic fabrics. Non-woven product, needle-punched, with short mono-filament. Available in rolls of 150m x 4,57m.
  - .1 Physical properties
    - .1 Thickness: at least 0.9mm.
  - .2 Mechanical properties
    - .1 Tensile strength 550 N

- .2 Elongation at break: minimum 45% - maximum 105%
- .3 Tear strength 250 N
- .4 Bursting strength: at least 1585 kPa when humid
- .3 Hydraulic Properties
  - .1 Filtration openings diameter (dry sieving): 81 à 150 micrometer
  - .2 Permittivity: at least 1.34 s-1
  - .3 Permeability: 0.23 cm per second
- .3 Thread for sown joints: having a resistance to chemical and biological agents equal or greater than the geotextile.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 On levelled surfaces, place the geotextile by unrolling them in the direction, location and manner indicated.
- .2 Install geotextiles so as to obtain a smooth surface, free of folds, bulges and stretched areas.
- .3 On sloping surfaces, place the geotextile by continuous bands, from the toe of the slope to the planned top of the slope,
- .4 Overlap each geotextile band atop the previously installed band, by a width of 600mm.
- .5 Fasten successive bands of geotextile using anchors placed at intervals as specified by the manufacturer.
- .6 Prevent the movement of the geotextile and protect against damage or deterioration before, during and after the stone spreading.
- .7 Spread the stones within four (4) hours following the installation of the geotextile.
- .8 Replace damaged or deteriorated geotextiles to the satisfaction of the Departmental Representative.

### **3.2 PROTECTION MEASURES**

- .1 Prohibit vehicular traffic directly on geotextiles.

END OF SECTION