

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials, applications, installation and verification for excavating, trenching and backfilling.

1.2 REFERENCES

- .1 City of Winnipeg (CW)
 - .1 CW3110 – Sub-Grade, Sub-Base, and Base Course Construction.
 - .2 CW3170 – Earthwork and Grading
 - .3 CW3230 – Full-Depth Patching of Existing Slabs and Joints.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - .5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .3 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.
- .4 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
 - .2 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

1.3 DEFINITIONS

- .1 Rock : any solid material in excess of 1 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ 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.
- .3 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .4 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 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 mm in any dimension.
- .5 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .6 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .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 D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136:
 - .2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .8 Sub-grade – the natural in-situ material.
- .9 Sub-base – where required, the layer of material provided between the sub-grade and the base course.
- .10 Base course – the layer of material immediately underlying the pavement

1.4 SUBMITTALS

- .1 Submit shoring design and excavation plans to the Contract Administrator for review at least two (2) weeks prior to commencement of the work. The design drawings shall be sealed by a Professional Engineer registered in the Province of Manitoba, Canada. Also include the design firm's Certificate of Authorization stamp on all documents. The shop drawings shall outline all intermediate steps that may be required to construct the new concrete underground meter chamber structure with the shoring in place.
- .2 Submit shop drawings and materials data sheets for all underground weep tile drainage piping and appurtenances required to complete the drainage system, including piping, fittings, concrete penetrations, filter cloth and washed stone.
- .3 Upon request, submit material test results to the Contract Administrator a minimum of two weeks before excavation begins.

Part 2 Products

2.1 MATERIALS

.1 Sub-Base Materials

- .1 Sub-base material of the type(s) shown on the Drawings or indicated in the Specifications will be supplied in accordance with the following requirements:
- .2 Suitable site sub-base material will be of a type approved by the Contract Administrator.
- .3 Clay borrow sub-base material will be of a type approved by the Contract Administrator.
- .4 Crushed sub-base material will be crushed aggregate, crushed limestone or crushed concrete pavement.
- .5 Crushed sub-base material will be well-graded and conform to the following grading requirements:

Canadian Metric <u>Sieve Size</u>	Percent of Total Dry Weight Passing each Sieve		
	<u>50 mm max.</u>	<u>100 mm max.</u>	<u>150mm max.</u>
150 000			90-100%*
100 000		97-100%	75-90%
50 000	100%		
25 000		30-50%	50% max.
5 000	25-80%		
80	5-18%	5% max.	

* The maximum allowable size is 300mm.

- .6 150 mm crushed limestone material when subjected to the abrasion test will have a loss of not more than 40% when tested in accordance with grading 1 of ASTM C535, Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .7 50 mm crushed limestone material when subjected to the abrasion test will have a loss of not more than 40% when tested in accordance with grading A of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .8 Crushed concrete sub-base material will be a mixture of reclaimed Portland Cement concrete and asphaltic concrete. The contents of the material will be limited to the following percentages based on weight.
 - .1 minimum of 85% recycled Portland Cement concrete
 - .2 maximum of 15% recycled asphaltic concrete
 - .3 maximum of 3% clay
 - .4 maximum of 1% foreign material

.2 Base Course Materials

- .1 Base course material will be approved by the Contract Administrator.
- .2 Base course material will consist of sound, hard, crushed rock or crushed gravel and will be free from organic or soft material that would disintegrate through decay or weathering.
- .3 The base course material will be well graded and conform to the following grading requirements:

Canadian Metric <u>Sieve Size</u>	Percent of Total Dry Weight Passing each Sieve	
	<u>Granular</u>	<u>Crushed Limestone</u>
25 000	100%	
20 000	80-100%	100%
5 000	40-70%	40-70%
2 500	25-50%	25-60%
315	13-30%	8-25%
80	5-15%	6-17%

- .4 Base course material when subjected to the abrasion test will have a loss of not more than 35% when tested in accordance with grading B of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .5 The material passing the 315 sieve will have a liquid limit not greater than 25 and a plasticity index not greater than 6.
 - .6 Where base course is being placed under an asphaltic concrete pavement, the aggregate retained on a No. 5 000 sieve will contain not less than 35% crushed aggregate as determined by actual particle count. Crushed aggregate will be considered as that aggregate having at least one fractured face.
- .3 Asphalt Cuttings for Base Course Material
- .1 Asphalt cuttings produced from planing of asphalt pavements or overlays in accordance with CW 3450 may be used as a base course material where indicated in the Specifications or as approved by the Contract Administrator.
 - .2 Asphalt cuttings will be well graded and have a maximum particle size of 40 mm.
- .4 Lime or Portland Cement
- .1 Use either Lime or Type 10 normal Portland Cement for drying the sub-grade.
 - .2 Supply Lime in accordance with CSA A82.43.
 - .3 Supply Portland Cement in accordance with CSA A5.
- .5 Imported Fill Material
- .1 Imported fill material will consist of low to medium plastic clays or mixtures of sand and clay, uniform in texture.
 - .2 The fill material shall be free of wood, vegetation, concrete rubble or stones larger than 25 mm in diameter.

Part 3 Execution

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 PAVEMENT REMOVAL

- .1 Remove existing concrete pavement, including curbs and asphalt overlays at locations as shown on the Drawings or as directed by the Contract Administrator. Remove all pavements to a combined thickness of 300 millimetres, unless otherwise indicated in the Specifications.
- .2 Remove existing asphalt pavement including asphalt curbs at locations as shown on the Drawings or as directed by the Contract Administrator. Remove pavement to a maximum thickness of 150 millimetres, unless otherwise indicated in the Specifications.
- .3 Saw-cut the existing pavement full-depth along the limits designated for removal.
- .4 Utilize backhoe type equipment unless approved otherwise by the Contract Administrator.
- .5 Dispose of material as per the following:
 - .1 Haul and dispose of waste material excavated from the Site including surplus, suitable, unsuitable and other material removed in accordance with the Specifications to a disposal location approved by the Contract Administrator.
 - .2 The City reserves the right to direct material to be hauled to a local site indicated in the Specifications.
 - .3 Clean up material dropped or spilled during hauling operations as directed by the Contract Administrator.

3.3 EXCAVATION

- .1 Excavate in-situ material to the depth to accommodate the pavement structure as shown on the Drawings or as directed by the Contract Administrator.
- .2 Stockpile suitable in-situ material and suitable site sub-base material at locations on site as directed by the Contract Administrator.
- .3 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.
- .4 Dispose of surplus suitable site material and unsuitable material such as frost heaving clays, silts, rocks and rubble as per Section 3.2.5.
- .5 Strip and stockpile topsoil from the site in a manner which will prevent contamination of topsoil with underlying soil materials. Stockpile the stripped topsoil at locations on site for later use.

- .6 The limits of excavation will be taken as a vertical plane 450 mm beyond the limits of the proposed pavement except when slip form paving equipment is specified for placement of the concrete pavement, the limits of excavation will be increased to a vertical plane 750 mm beyond the limits of the proposed pavement.
- .7 During excavation, the Contractor will be advised by the Contract Administrator as to which areas have an unsuitable sub-grade. Extend the excavation either to the lower limit of the unsuitable material or to a depth as directed by the Contract Administrator.
- .8 Remove wooden poles, concrete bases, or tree stumps encountered under pavements to the top of subgrade or 1 m below the bottom of the pavement surface, whichever depth is greater.
- .9 Backfill and compact over-excavated areas with sub-base material approved by the Contract Administrator.
- .10 Excavate additional material beyond the boulevard grading and ditch grading limits as directed by the Contract Administrator.

3.4 PREPARATION OF SUB-GRADE AND PLACEMENT OF SUB-BASE

- .1 Compact the sub-grade after the bottom of the excavation has been approved by the Contract Administrator.
- .2 Compact areas of suitable sub-grade material, the full width of the excavation, to a minimum of 95% Standard Proctor Density.
- .3 Place and compact suitable site sub-base material before placing any new sub-base material, as directed by the Contract Administrator.
- .4 Place and compact crushed sub-base material with or without geogrid as directed by the Contract Administrator in accordance with CW 3135.
- .5 Place and compact sub-base materials in layers to a depth of 3 times the maximum aggregate size or as directed by the Contract Administrator. Compact to a minimum of 100% Standard Proctor Density, for the full width of the excavation, and each layer must be levelled and approved by the Contract Administrator before the succeeding layer may be placed.
- .6 Layering, mixing or blending of crushed concrete with crushed aggregate or crushed limestone sub-base materials is not allowed.
- .7 Recompact or replace any layer, which has been rejected as directed by the Contract Administrator.
- .8 When excess water has been applied, either by sprinkling operations or by precipitation, to cause local or continuous pondage, soil compaction will not be permitted until sufficient soil drying has occurred, creating a condition lending itself favourably to compacting operations. Exercise necessary precautions to protect compacted areas against excess wetting from any natural or artificial sources of water application.

- .9 Should excess moisture from continuous or heavy precipitation threaten to unduly delay the completion of the Contract. Apply in writing to the Contract Administrator requesting permission to use Lime or Portland Cement to dry out the clay sub-grade or sub-base material at specific location(s).

3.5 PLACEMENT OF SUB-BASE WITH GEOTEXTILE FABRIC

- .1 Install separation or separation/reinforcement geotextile fabric in accordance with CW 3130.
- .2 For stable sub-grades, place and compact sub-base material to a minimum depth of 150 mm.
- .3 For unstable sub-grades, place and compact sub-base material to a minimum depth for 300 mm or greater thickness as directed by the Contract Administrator.
- .4 Place sub-base material by end-dumping methods and level with front-end loader type of equipment as approved by the Contract Administrator to avoid damage to the geotextile fabric and minimize sub-grade failures.
- .5 Layering, mixing or blending of crushed concrete with crushed aggregate or crushed limestone sub-base materials is not allowed.
- .6 Avoid sudden stops or sharp turns by construction equipment during placement of sub-base materials.
- .7 Construction traffic will not be allowed to travel on the placed sub-base material until approved by the Contract Administrator.

3.6 PLACEMENT OF BASE COURSE MATERIAL

- .1 Place and compact base course material to a minimum 75 mm thickness for pavement and approaches to a minimum of 100% Standard Proctor Density for the full width of the excavation unless otherwise shown on the Drawings or as directed by the Contract Administrator.
- .2 Level the compacted base course to the finished base course elevation.
- .3 Maintain the finished base course until the pavement is placed.
- .4 Place and compact base course material as a leveling course to a maximum thickness of 50 mm for sidewalks and miscellaneous concrete slabs, to 90% Standard Proctor Density.
- .5 Place and compact base course material immediately beneath pavement forms to provide firm support.

3.7 PLACEMENT OF IMPORTED FILL

- .1 Place fill materials to satisfy the grading requirements of boulevard and ditches.
- .2 Supply material in accordance with Section 2.5 of this specification.

- .3 Compact to a minimum of 90% Standard Proctor Density.

3.8 GRADING

- .1 Grading of areas to receive sod will be understood to mean the required excavation or backfilling to a depth up to 150 mm so that the areas medians, after compaction, are at a uniform depth of 100 mm below finished grade shown on the Drawings.
- .2 Grade the areas to receive sod, unless otherwise shown on the Drawings or as directed by the Contractor Administrator.
- .3 Remove all debris, stones and concrete rubble from the boulevards and medians before commencing grading.
- .4 Excavate to a depth of up to 150 mm to meet the final grade 100 mm below finished boulevard grade.
- .5 Place and compact suitable backfill material as approved by the Contract Administrator to a depth of up to 150 mm to meet the final grade 100 mm below finished boulevard grade.
- .6 Supply backfill material in accordance with Section 2.1 of this specification.
- .7 Compact backfill materials to a minimum of 90% Standard Proctor Density.

3.9 QUALITY OF SUB-GRADE, SUB-BASE, AND BASE COURSE LAYERS

- .1 Determine the Standard Proctor Density for the sub-grade, sub-base and base course materials at the optimum moisture content in accordance with ASTM Standard D698. The field density of each sub-grade, sub-base and base course layers will be a percentage of the applicable Standard Proctor Density, in accordance with in Sections 3.3, 3.4 and 3.5 of this specification.
- .2 Utilize quality control tests to determine the acceptability of the sub-grade, sub-base and base course layers, as placed and compacted before the succeeding layer may be applied.
- .3 Verify the field density of the compacted layers by Field Density Tests in accordance with ASTM Standard D1556, Test for Density of Soil in Place by the Sand-Cone Method, or ASTM Standard D2922, Test of Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- .4 The frequency and number of tests will be as directed by the Contract Administrator.
- .5 Fill promptly, holes made by the removal of samples from the layers with appropriate material and thoroughly compact so as to conform in every way with the adjoining material.

3.10 DEWATERING AND HEAVE PREVENTION

- .1 Supply and install depressurization well for new excavation to locally reduce the groundwater elevation in advance of driving shoring piles. Maintain depressurization well in continuous operation throughout construction, until the new buried structures have been completely backfilled.

- .2 Keep excavations free of water while Work is in progress.
- .3 Protect open excavations against flooding and damage due to surface run-off.
- .4 Dispose of water in a 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.

3.11 BACKFILLING

- .1 Vibratory compaction equipment is required.
- .2 Do not proceed with backfilling operations until completion of following:
 - .1 The Contract Administrator approved installations construction below finished grade.
 - .2 Inspection, testing, approval, and recording location of underground utilities.
 - .3 Removal of concrete formwork.
 - .4 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. Compact each layer before placing succeeding layer.
- .6 Backfilling around installations.
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 150 mm.
- .7 Install drainage system in backfill as directed by The Contract Administrator.

3.12 RESTORATION

- .1 Prior to construction, inspect the grassed, pavement and gravel surfaces within and adjacent to the Site with the Contract Administrator to record the current condition. After construction and site cleanup is complete, re-inspect the condition with the Contract Administrator.
- .2 Restoration of grassed areas removed or damaged as result of construction activities will be restored in accordance with CW 3510. Restoration of grassed areas will not be measured for payment and shall be included as part of the Work being done.

- .3 Pavement damaged or removed as a result of construction activities will be restored in accordance with CW3230 and CW 3410. Restoration of the pavement will not be measured for payment and shall be included as part of the Work being done.

END OF SECTION