



PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS
Engineering Division • Division de l'ingénierie

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DIVISION 4

CW 3110 – R22

SUB-GRADE, SUB-BASE AND BASE COURSE CONSTRUCTION

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1. DESCRIPTION

1.1 General

1.1.1 This specification covers pavement removal, excavation, preparation of sub-grade, supply and placement of sub-base and base course materials, ditch grading and boulevard grading for pavements, slab renewals, curbs, miscellaneous concrete slabs, sidewalks and other related works.

1.2 Definitions

1.2.1 Sub-grade – the natural in-situ material or imported material that has been used to build an embankment.

1.2.2 Sub-base layer – the layer of material between the sub-grade and the base course.

1.2.3 Base course layer – the layer of material between the sub-base and the pavement wearing surface.

1.2.4 Levelling course layer – a non-structural layer of base course material, up to 50mm in depth, placed immediately under the pavement wearing surface.

1.2.5 Granular A – open-graded virgin (not recycled) aggregates intended for use as free draining base and sub-base within the pavement structure. Granular A is intended for high traffic volume streets, including expressways, major arterials, minor arterials, industrial/commercial collectors, residential major collectors, residential minor collectors, industrial/commercial locals and associated approaches.

1.2.6 Granular B – well-graded virgin or recycled aggregates intended for use as sub-base within the pavement structure. Granular B is intended for low traffic volume streets including residential local, public lanes, asphalt pathways and associated approaches. Granular A can be used instead of Granular B.

1.2.7 Granular C – dense graded virgin or recycled aggregates intended for use as base and sub-base. Granular C is intended for rehabilitations and other applications. Granular A or B can be used instead of Granular C.

1.2.8 Crushed Recycled Concrete – aggregates obtained by recycling clean, hard, concrete waste. All types of contaminants, such as dirt, plaster, gypsum and other building waste, must be removed.

1.2.9 Deleterious Material – soft material that would decay or disintegrate from weathering, porcelain, vegetation, organic material, wood, glass, plastic, metal, reinforcing steel, building rubble, brick, shale, and friable particles.

1.2.10 Oversize Material – The percent fraction by weight of the aggregate retained on the 19.0 mm sieve.

1.3 Referenced Standard Construction Specifications

1.3.1 CW 1130 – Work Site Requirements.

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1.3.2 CW 3130 – Supply and Installation of Geotextile Fabrics.

1.3.3 CW 3450 – Planing of Pavement.

2. MATERIALS

2.1 General

2.1.1 Effective July 1st, 2020, the City of Winnipeg, Research and Standards Engineer will maintain a list of approved aggregate suppliers. To obtain approval, aggregate suppliers must annually submit the following information to the Research and Standards Engineer prior to April 1st:

2.1.1.1 Aggregate Suppliers Approval Guidelines and Application;

2.1.1.2 Quality control program for all materials, including a proposed sampling and testing plan with minimum sampling and testing frequencies in accordance with Section 4;

2.1.1.3 The laboratory(s) to be used and its credentials;

2.1.1.4 The quality control personnel and their qualifications;

2.1.1.5 Course of action for disposal or rework of materials that do not meet this specification; and,

2.1.1.6 Frequency of production equipment inspection, verification of calibration, and any certification of the production facility.

2.1.2 The Aggregate Suppliers Approval Guidelines and Application and the list of approved aggregate suppliers are available at the City of Winnipeg, Corporate Finance, Material Management Division website at:
<https://www.winnipeg.ca/matmgt/Spec/Default.stm>

2.1.3 The City of Winnipeg, Research and Standards Engineer will conduct inspections at least once a year during production. Samples of materials may be taken and tested.

2.2 Base Course and Sub-Base Materials

2.2.1 Base course and sub-base materials shall conform to the following requirements:

2.2.1.1 Base course and sub-base materials will be of a type approved by the Contract Administrator.

2.2.1.2 Base course and sub-base materials shall be sound, durable particles produced by crushing, screening and grading of recovered materials.

2.2.1.3 Base course and sub-base materials shall conform to the grading requirements in Table CW 3110.1 and the physical requirements in Table CW 3110.2.



TABLE CW 3110.1 - Gradation Requirements

Canadian Metric Sieve Size	Percent Of Total Dry Weight Passing Each Sieve								
	Granular A*			Granular B**			Granular C**		
	Base Course	50 mm	100 mm	Base Course	50 mm	100 mm	Base Course	50 mm	100 mm
125 000			100%			100%			100%
100 000			85% - 100%			85% - 100%			90% - 100%
75 000		100%	70% - 92%		100%	--		100%	--
50 000		97% - 100%	50% - 78%		97% - 100%	50% - 80%		97% - 100%	--
37 500		75% - 95%	--		75% - 95%	--		--	--
28 000	100%			100%					
25 000	97% - 100%	55% - 87%	25% - 58%	97% - 100%	55% - 87%	28% - 60%	100%	--	30% - 60%
20 000	85% - 95%	--	--	85% - 95%	--	--	97% - 100%	--	--
10 000	47% - 70%	25% - 60%	15% - 40%	45% - 75%	28% - 65%	18% - 45%	--	--	--
5 000	32% - 55%	16% - 48%	--	--	--	--	28% - 65%	20% - 60%	--
2 500	18% - 45%	--	--	20% - 48%	--	--	22% - 60%	--	--
1 250	11% - 35%	8% - 30%	5% - 20%	--	10% - 35%	5% - 25%	--	--	--
630	8% - 26%	--	--	8% - 28%	--	--	--	--	--
315	5% - 18%	4% - 18%	3% - 14%	5% - 20%	4% - 22%	4% - 15%	3% - 22%	--	--
80	2% - 8%	2% - 8%	2% - 8%	2% - 8%	2% - 8%	2% - 8%	2% - 10%	3% - 12%	0% - 8%



TABLE CW 3110.2 - Physical Property Requirements

Tests	Testing Method	Granular A			Granular B			Granular C		
		Base Course	50 mm	100 mm	Base Course	50 mm	100 mm	Base Course	50 mm	100 mm
Los Angeles Abrasion, % maximum	ASTM C535 (Grading 1)	--	--	35	--	--	35	--	--	--
Los Angeles Abrasion, % maximum	ASTM C131 (Grading A)	--	35	--	--	35	--	--	--	--
Los Angeles Abrasion, % maximum	ASTM C131 (Grading B)	35	--	--	35	--	--	--	--	--
California Bearing Ratio (CBR)* - 4 days soaked, % minimum @ 2.54 mm	ASTM D1883	80	80	--	60	60	--	--	--	--
Micro-Deval Abrasion, % maximum	ASTM D6928	15	15	15	17	17	17	20	20	20
Percentage of Fractured Particles, minimum two or more fractured faces, % mass**	ASTM D5821	80	80	70	70	70	60	--	--	--
Liquid Limit, % maximum** Plasticity Index, % maximum**	ASTM D4318	20 Non plastic	22 Non plastic	22 Non plastic	22 Non plastic	22 4	25 6	25 6	25 6	25 6
Content Composition, maximum**	Mass %	--			10% asphalt material 3% clay 3% deleterious materials			15% asphalt material 3% clay 3% deleterious materials		

*CBR test shall be performed at 100 % maximum dry unit weight and optimum water content. A shorter immersion period (24 hr) is permissible for virgin aggregates that take up moisture readily if tests show that the shorter period will not affect the results.

**Percentage of Fractured Particles, Atterberg Limits, and Content Composition are not required for crushed limestone materials. Content Composition shall be performed on materials retained on 5000 µm sieve and above.

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2.3 Lime or Portland Cement

- 2.3.1 Use either Lime or General Use Cement for drying the sub-grade.
- 2.3.2 Supply Lime in accordance with CSA A82.43.
- 2.3.3 Supply Portland Cement in accordance with CSA.

2.4 Imported Fill Material

- 2.4.1 Imported fill material will be of a type approved by the Contract Administrator. Saturated clay and organic soils will not be permitted.
- 2.4.2 The fill material shall be free of unsuitable or deleterious materials, such as tree roots, branches, stumps, sludge, metal, trash, wood, vegetation or rubble.

3. CONSTRUCTION METHODS

3.1 Pavement Removal

- 3.1.1 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.
- 3.1.2 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.
- 3.1.3 Saw-cut the existing pavement full-depth along the limits designated for removal.
- 3.1.4 Utilize backhoe type equipment unless approved otherwise by the Contract Administrator.
- 3.1.5 Dispose of material in accordance with Section 3.4 of CW 1130.

3.2 Excavation

- 3.2.1 Excavate site material to the depth that accommodates the pavement structure as shown on the Drawings or as directed by the Contract Administrator.
- 3.2.2 Stockpile suitable sub-grade material and suitable site sub-base material at locations on site as directed by the Contract Administrator.
- 3.2.3 Dispose of surplus suitable site material and unsuitable material such as frost heaving clays, silts, rocks and rubble in accordance with Section 3.4 of CW 1130.
- 3.2.4 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.

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- 3.2.5 The limits of excavation will be taken as a vertical plane 450 millimetres 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 millimetres beyond the limits of the proposed pavement.
- 3.2.6 During excavation, the Contractor will be advised by the Contract Administrator as to which areas have an unsuitable sub-grade.
- 3.2.7 Remove wooden poles, concrete bases, or tree stumps encountered under pavements to the top of subgrade or 1 metre below the bottom of the pavement surface, whichever depth is greater.
- 3.2.8 Backfill and compact over-excavated areas with sub-base material approved by the Contract Administrator.
- 3.2.9 Excavate additional material beyond the boulevard grading and ditch grading limits as directed by the Contract Administrator.

3.3 Preparation of Sub-grade and Placement of Sub-base Material

- 3.3.1 Compact the sub-grade after the bottom of the excavation has been approved by the Contract Administrator.
- 3.3.2 Compact areas of suitable sub-grade material, the full width of the excavation, to a minimum of 95% Standard Proctor Maximum Dry Density.
- 3.3.3 If the sub-grade material cannot be compacted to the required density, the Contractor shall proceed as directed by the Contract Administrator.
- 3.3.4 The stability and uniformity of compaction may be checked by proof rolling the sub-grade. Proof rolling procedures and acceptance shall be in accordance with the following:
 - 3.3.4.1 The roller shall be either a tandem-axle rear dump truck or a tri-axle rear dump truck (with raised third axle) loaded to a minimum gross weight of **25 tonnes**. The Contractor may, with the approval of the Contract Administrator, use alternate equipment that produces similar results;
 - 3.3.4.2 Tire pressure shall be no less than 90 percent of the manufacturer's recommended maximum inflation;
 - 3.3.4.3 Operate the equipment between 4.0 and 8.0 km/hr;
 - 3.3.4.4 Proof rolling must be carried out the same calendar day that compaction is completed; otherwise the surface must be watered and given a minimum of three passes with the roller prior to the commencement of proof rolling; and,
 - 3.3.4.5 Rutting in excess of 40 mm shall not be accepted and the layer shall be reworked and compacted to the required density. Where the rutting exceeds 150 mm, proceed as directed by the Contract Administrator. No substantial surface cracking or lateral movement of the layer shall be allowed.

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- 3.3.5 Sub-base material shall not be placed if there is frost present within 600 mm of the surface upon which it is being placed.
- 3.3.6 Place and compact sub-base material with geotextile fabric and/or geogrid in accordance with Sections 3.4 and 3.5.
- 3.3.7 Place and compact suitable site sub-base material before placing any new sub-base material as directed by the Contract Administrator.
- 3.3.8 Place and compact sub-base materials in layers to a minimum depth of 3 times the maximum aggregate size unless otherwise shown on the Drawings or as directed by the Contract Administrator. Compact to a minimum of 100% Standard Proctor Maximum Dry 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. **Where the Standard Proctor test indicates that 50 mm sub-base contains more than 30% oversize material, the material shall be compacted to a minimum of 98% Standard Proctor Maximum Dry Density.**
- 3.3.9 Where Field Density Tests cannot be performed, check the stability and uniformity of compaction by proof rolling the sub-base. Proof rolling procedures shall be in accordance with Section 3.3.4 of this Specification. Rutting in excess of 15 mm shall not be accepted and the layer shall be reworked and compacted to the required density. Where the rutting exceeds 150 mm, proceed as directed by the Contract Administrator. No substantial surface cracking or lateral movement of the layer shall be allowed.
- 3.3.10 Recompact or replace any layer which has been rejected as directed by the Contract Administrator.
- 3.3.11 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.
- 3.3.12 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).
- 3.3.13 Mixing or blending of sub-base materials will not be permitted.

3.4 Placement of Sub-Base Material with Geotextile Fabric

- 3.4.1 Install separation or separation/filtration or stabilization geotextile fabric in accordance with CW 3130.
- 3.4.2 For sub-grades with CBR \geq 3.0%, place and compact a minimum of 150 mm of sub-base material over the geotextile fabric prior to allowing construction traffic to travel on the sub-base.
- 3.4.3 For subgrades with CBR $<$ 3.0%, place and compact a minimum of 300 mm of sub-base

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material over the geotextile fabric prior to allowing construction traffic to travel on the sub-base unless otherwise shown on the Drawings or as directed by the Contract Administrator. The minimum lift thickness may need to be increased for very weak subgrade material to prevent spreading equipment from damaging the geotextile fabric.

- 3.4.4 Place sub-base material by end-dumping methods and level with equipment as approved by the Contract Administrator to avoid damage to the geotextile fabric and minimize sub-grade failures. No sheep-foot type equipment will be allowed on the first lift. In no case shall material be dropped on uncovered geotextile from a height of more than 1 m.
- 3.4.5 Direct traffic on the geotextile, along with any sudden stops, starts, or turns on the first lift by construction equipment, shall not be allowed.
- 3.4.6 Construction traffic will not be allowed to travel on the placed sub-base material until approved by the Contract Administrator.

3.5 Placement of Sub-base Material with Geotextile Fabric and Geogrid

- 3.5.1 Prepare the subgrade in accordance with Section 3.3 of this Specification.
- 3.5.2 Supply and install geotextile fabric over the subgrade in accordance with CW 3130 and Section 3.4 of this Specification.
- 3.5.3 Supply and install geogrid in accordance with CW 3135.
- 3.5.4 Place sub-base material by end dumping down the centre of the excavation. The sub-base shall be pushed forward and levelled using a track type dozer where possible, to build a thickened section to support the hauling operations and avoid damage to the subgrade, geotextile fabric or geogrid. This procedure shall continue until all sub-base material has been placed down the centre of the excavation.
- 3.5.5 Spread the sub-base material to facilitate final grades utilizing a track type dozer.
- 3.5.6 Initial compaction of the sub-base material shall be completed utilizing vibratory type equipment capable of compacting the material. The additional compaction shall be completed utilizing static type equipment. No trucks, rubber tire loaders or graders will be allowed to travel on the sub-base material until the Contract Administrator has approved the compaction of the sub-base.

3.6 Placement of Base Course Material

- 3.6.1 Base course material shall not be placed if there is frost present within 600 mm of the surface upon which it is being placed.
- 3.6.2 Place and compact base course material to a minimum depth of 3 times the maximum aggregate size unless otherwise shown on the Drawings or as directed by the Contract Administrator. Compact to a minimum of 100% Standard Proctor Maximum Dry Density, for the full width of the excavation, and each layer must be leveled and approved by the Contract Administrator before the succeeding layer may be placed.
- 3.6.3 Level the compacted base course to the finished base course elevation.

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- 3.6.4 Maintain the finished base course until the pavement is placed.
- 3.6.5 Spread base course material uniformly to avoid segregation, free of pockets of fine and coarse material.
- 3.6.6 Place and compact leveling course to a maximum thickness of 50 millimetres for sidewalks, renewal of existing curbs and miscellaneous concrete slabs, to 95% Standard Proctor Maximum Dry Density.
- 3.6.7 Place and compact base course material immediately beneath pavement and forms to provide firm support.

3.7 Placement of Imported Fill

- 3.7.1 Place imported fill materials to satisfy the grading requirements of boulevard and ditches.
- 3.7.2 Supply material in accordance with Section 2.4 of this specification.
- 3.7.3 Compact to a minimum of 95% Standard Proctor Maximum Dry Density.
- 3.7.4 Imported fill shall be free of frozen lumps and shall be placed and compacted in an unfrozen state. Imported fill shall not be placed if there is frost present within 600 mm of the surface upon which it is being placed.

3.8 Grading of Boulevards

- 3.8.1 Grading of the boulevards and medians to receive sod will be understood to mean the required excavation or backfilling to a depth up to 150 millimetres so that the boulevards and medians, after compaction, are at a uniform depth of 100 millimetres below finished boulevard grade, as shown on the Drawings.
- 3.8.2 Remove all debris, stones and concrete rubble from the boulevards and medians before commencing grading.
- 3.8.3 Grade the boulevards and medians to receive sod, unless otherwise shown on the Drawings or as directed by the Contractor Administrator.
- 3.8.4 Remove all debris, stones and concrete rubble from the boulevards and medians before commencing grading.
- 3.8.5 Excavate to a depth of up to 150 millimetres to meet the final grade 100 millimetres below finished boulevard grade.
- 3.8.6 Place and compact suitable backfill material as approved by the Contract Administrator to a depth of up to 150 millimetres to meet the final grade 100 millimetres below finished boulevard grade.
- 3.8.7 Supply backfill material in accordance with Section 2.4 of this specification.
- 3.8.8 Compact backfill materials to a minimum of 95% Standard Proctor Maximum Dry Density.

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3.9 Grading of Ditches

- 3.9.1 Grading of ditches will be understood to mean the required excavation or backfilling to a depth up to 300 millimetres so that the ditches, after compaction are at finished grade where no sodding is required or at a uniform depth of 100 millimetres below finished grade where sodding is required.
- 3.9.2 Grade ditches as shown on the Drawings or as directed by the Contract Administrator.
- 3.9.3 Excavate to a depth of up to 300 millimetres to meet the final ditch grade requirements.
- 3.9.4 Place and compact suitable backfill material as approved by the Contract Administrator to a depth of up to 300 millimetres to meet the final ditch grade requirements.
- 3.9.5 Supply backfill material in accordance with Section 2.4 of this specification.
- 3.9.6 Compact backfill materials to a minimum of 95% Standard Proctor Maximum Dry Density.

3.10 Quality Control of Sub-grade, Sub-base and Base Course Layers

- 3.10.1 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.
- 3.10.2 Promptly fill holes made by sampling with appropriate material and thoroughly compact to conform with the adjoining material.

3.11 Removal of Existing Concrete Bases

- 3.11.1 Remove existing concrete bases as shown on the Drawings or as directed by the Contract Administrator.
- 3.11.2 Remove to a depth of 1.0 metre below finished grade.
- 3.11.3 Dispose of material in accordance with Section 3.4 of CW 1130.
- 3.11.4 Backfill holes remaining with base course material and compact to the satisfaction of the Contract Administrator.

4. QUALITY CONTROL TESTING

4.1 All materials supplied under this Specification shall be subject to quality control testing and approval by the City of Winnipeg, Research and Standards Engineer. The testing shall be carried out by qualified and certified testing facilities.

4.2 The City of Winnipeg, Research and Standards Engineer will maintain a list of approved Testing Laboratories. To obtain approval, Testing Laboratories must submit the following information to the Research and Standards Engineer prior to April 1st:

4.2.1 Valid Category "Type C and D" aggregate laboratory certification or higher by

Canadian Council of Independent Laboratories (CCIL); and,

4.2.2 A complete list of testing lab personnel and their qualifications. Testing shall be performed by a certified person.

4.3 The quality control program shall include Gradation, Los Angeles Abrasion, Micro-Deval Abrasion, CBR, Percentage of Fractured Particles, Content Composition, Liquid Limit and Plasticity Index in accordance with Section 2 of this Specification.

4.4 The frequency of quality control testing for base course and sub-base materials during production shall be in accordance with Table CW 3110.3.

TABLE CW 3110.3 – Quality Control Testing Frequency During Production

	Granular A		Granular B				Granular C			
	Gradation	Physical Properties	Virgin Aggregates		Recycled Aggregates		Virgin Aggregates		Recycled Aggregates	
			Gradation	Physical Properties	Gradation	Physical Properties	Gradation	Physical Properties	Gradation	Physical Properties
Base course	2000 tonnes	5000 tonnes	2000 tonnes	5000 tonnes	2000 tonnes	3000 tonnes	2000 tonnes	5000 tonnes	2000 tonnes	3000 tonnes
50 mm	3000 tonnes	10000 tonnes	3000 tonnes	8000 tonnes	3000 tonnes	4000 tonnes	3000 tonnes	10000 tonnes	4000 tonnes	5000 tonnes
100 mm	4000 tonnes	10000 tonnes	4000 tonnes	10000 tonnes	4000 tonnes	5000 tonnes	4000 tonnes	10000 tonnes	5000 tonnes	8000 tonnes

4.5 Quality control information shall be submitted bi-weekly to, and will be monitored by, the City of Winnipeg, Research and Standards Engineer.

5. QUALITY ASSURANCE TESTING

5.1 The Contractor shall not deliver materials to site prior to approval of the Contract Administrator.

5.2 The Contract Administrator shall ensure that a minimum of one sample of base course and sub-base materials are tested prior to starting construction in accordance with Section 2. The Contract Administrator shall ensure that the materials are sampled in accordance with ASTM D75 Standard Practice for Sampling Aggregates.

5.3 If one test fails to meet the requirements of this Specification, the material shall be re-tested. If the material fails again, the Contractor shall designate a new material source. The Contractor shall reimburse the City for any additional costs the City incurs as a result of failed tests.

5.4 The Contract Administrator shall confirm that materials delivered to site are equal to or better

than the materials tested prior to construction by sampling from site and testing in accordance with Section 2. The Contract Administrator shall be present to witness that the sampling is in accordance with ASTM D75 Standard Practice for Sampling Aggregates. Where required, the Contractor shall provide all necessary equipment or personnel to aid in the sampling.

5.5 Where there is insufficient room to sample from site, the Contractor shall submit a request to the Contract Administrator for approval to sample from the quarry.

5.6 The Contractor shall provide a weekly estimate of the material supplied to the Contract Administrator.

5.7 The Contract Administrator shall ensure the minimum frequency of quality assurance testing for base course and sub-base materials during construction is in accordance with Table CW 3110.4. Onsite testing shall not begin prior to placing approximately 10% to 20% of the material. Where less than 200 tonnes of base course or 500 tonnes of sub-base materials are expected, quality assurance testing may not be required by the Contract Administrator.

TABLE CW 3110.4 – Quality Assurance Testing Frequency During Construction*

	Granular A	Granular B		Granular C	
		Virgin Aggregates	Recycled Aggregates	Virgin Aggregates	Recycled Aggregates
Base course	3000 tonnes	2500 tonnes	1500 tonnes	3000 tonnes	2000 tonnes
50 mm	5000 tonnes	4000 tonnes	2500 tonnes	5000 tonnes	3000 tonnes
100 mm	10000 tonnes	8000 tonnes	5000 tonnes	8000 tonnes	5000 tonnes

*The minimum testing frequency for each size shall be one sample.

5.8 The quality assurance program shall include Gradation, Los Angeles Abrasion, Micro-Deval Abrasion, Percentage of Fractured Particles, Content Composition, Liquid Limit and Plasticity Index in accordance with Section 2 of this Specification. Los Angeles Abrasion is not required for base course and 50mm materials.

5.9 If the material fails consecutive tests or when a change in the properties of the materials occurs, the use of the materials shall be discontinued until the Contractor proves the source to be satisfactory. The Contractor shall reimburse the City for any costs the City incurs as a result of failed tests.

5.10 The Contract Administrator shall apply a pay adjustment in accordance with Tables CW 3110.5 and CW 3110.6 against the entire quantity represented by the failed test(s) for materials that have already been placed and compacted. The quantity represented by the failed tests is the material supplied after sampling associated with the initial failed test.

5.11 Where the work is not funded or administered by the City of Winnipeg or their representative, the party approved by the City of Winnipeg to execute the work will be responsible for making pay adjustments to the City of Winnipeg in accordance with Clauses 5.9 and 5.10.



TABLE CW 3110.5 - Pay Adjustment for Percent Passing Outside Specified Limits for Gradation Requirements Based on Average of the Failed Consecutive Tests

Percent Passing Outside Specified Limits for Sieves					Percent of Price Reduction %
125000, 100000, 75000, 50000	37500, 25000	20000, 10000	5000, 2500, 1250, 630,	315, 80	
<2	<2	<2	<1	<1	10%
2-3	2-4	2-4	1-2	1-1.5	20%
3-4	4-5	4-5	2-3	1.5-2	30%
>4	>5	>5	>3	>2	Remove materials, including those that have already been placed and compacted.

TABLE CW 3110.6 - Pay Adjustment for Percent Passing Outside Specified Limits for Physical Property Requirements Based on Average of the Failed Consecutive Tests

Los Angeles Abrasion	Micro-Deval Abrasion	Percentage of Fractured Particles	Atterberg Limits	Percent of Price Reduction %
<3	<1	<5	<2	10%
3-4	1-1.5	5-7	2-2.5	25%
4-5	1.5-2	7-8	2.5-3	40%
>5	>2	>8	>3	Remove materials, including those that have already been placed and compacted.

- 5.12 The pay adjustment will be the maximum price reduction or removal requirement identified in accordance with Tables CW3110.5 and CW3110.6
- 5.13 The Contract Administrator shall be allowed access to all sampling locations and reserves the right to take samples for testing at any time.
- 5.14 When more than one source is used for supplying materials, test data from each source and material shall be managed independently. The Contractor shall reimburse the City for any additional costs the City incurs as a result of using multiple sources.
- 5.15 The Contractor shall provide written notification to the Contract Administrator prior to changing the aggregate source or type. The Contractor shall reimburse the City for any additional costs the City incurs as a result of the change.
- 5.16 Determine the Standard Proctor Maximum Dry Density for the sub-grade, sub-base and base course materials at the optimum moisture content in accordance with ASTM Standard D698. The test frequency shall follow the frequency in Section 5.6 and the Maximum Dry Density shall be the average for each material. The field density of each sub-grade, sub-base and base course layer will be a percentage of the Standard Proctor Maximum Dry Density, in Sections 3.3, 3.4, 3.5 and 3.6 of this Specification.

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- 5.17 Verify the field density of the compacted layers by Field Density Tests in accordance with ASTM Standard D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).
- 5.18 The Contract Administrator shall ensure the frequency of field density tests during construction is as follows:
- 5.16.1 For projects less than 2000 square meters: one field density test every 300 square meters with a minimum of three (3) tests per material.
- 5.16.2 For projects greater than 2000 square meters: one field density test every 500 square meters per material.
- 5.19 The Contract Administrator shall offset the field density tests as appropriate to provide coverage across the full width of the construction area.
- 5.20 If a density test result is less than the required density, the area shall be reworked and retested. The Contractor shall reimburse the City for any additional costs the City incurs as a result of failed tests.
- 5.21 Field density tests must be carried out the same calendar day that compaction is completed; otherwise the surface must be watered and given a minimum of three passes with the roller prior to testing.
- 5.22 Testing in addition to the requirements of this Specification shall be as directed by the Contract Administrator.
- 5.23 There shall be no charge for any materials taken for testing purposes.

6. MEASUREMENT AND PAYMENT

6.1 Pavement Removal

- 6.1.1 Pavement removal will be measured on an area basis and paid for at the Contract Unit Price per square meter for the "Items of Work" listed here below. The area to be paid for will be the total number of square metres of existing pavement removed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Pavement Removal

- i.) Concrete Pavement
- ii.) Asphalt Pavement

- 6.1.2 Disposal of material will be included in the payment for the "Items of Works" listed for pavement removal.
- 6.1.3 Curb and asphalt overlay will be included in the payment for the Item of Work if both are removed in one operation with the pavement.
- 6.1.4 Payment for pavement over 300mm in thickness will be paid in ratio to the thickness over

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300mm.

6.2 Stripping and Stockpiling Topsoil

6.2.1 Stripping and stockpiling topsoil will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for “Stripping and Stockpiling Topsoil”. The volume to be paid for will be the total number of cubic metres of existing topsoil stripped and stockpiled in accordance with this specification, accepted and measured by the Contract Administrator.

6.3 Excavation

6.3.1 Excavation will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for “Excavation”. The volume to be paid for will be the total number of cubic metres excavated in accordance with this specification, accepted and measured by the Contract Administrator.

6.3.2 The volume of excavation will be measured by cross-sections in its original position and computed by the method of Average End Areas.

6.3.3 Only material excavated within the limits of excavation will be included in the payment for “Excavation”.

6.3.4 Disposal of material, removal of miscellaneous trees, shrub and concrete bases unless otherwise indicated in the Specifications, will be included in payment for “Excavation”.

6.3.5 Excavation of solid bedrock, glacial till, boulders, loose rock, concrete rubble and foundations which are located within the limits of excavation and which require the use of additional or unconventional excavation equipment will be measured and paid for in addition to the unit price for excavation.

6.4 Sub-grade Compaction

6.4.1. Sub-grade compaction will be measured on an area basis and paid for at the Contract Unit Price per square metre for “Sub-Grade Compaction”. The area to be paid for will be the total number of square metres of sub-grade compacted in accordance with this specification, accepted and measured by the Contract Administrator.

6.5 Sub-grade Material

6.5.1 Suitable Site Sub-grade Material

6.5.1.1 The supplying, placing and compaction of suitable site sub-grade material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for “Supplying and Placing Suitable Site Sub-grade Material”. The volume to be paid for will be the total number of cubic metres of material compacted in place in accordance with this specification, accepted and measured by the Contract Administrator.

6.5.1.2 The volume of suitable site sub-grade material will be measured by cross-sections and computed by the method of Average End Areas.

6.5.1.3 Only material placed within the limits of excavation will be included in the payment

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6.5.1.4 for “Supplying and Placing Suitable Site Sub-grade Material”.
No measurement or payment will be made for materials rejected by the Contract Administrator.

6.5.2 Imported Fill Material

6.5.2.1 Imported fill material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for “Imported Fill Material”. The volume to be paid for will be the total number of cubic metres of imported fill material supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

6.5.2.2 The volume of imported fill material will be computed from cross-sections by the method of Average End Areas.

6.5.2.3 No measurement or payment will be made for materials rejected by the Contract Administrator.

6.6 Sub-base Material

6.6.1 Suitable Site Sub-base Material

6.6.1.1 The reloading, hauling, placing and compaction of suitable site sub-base material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for “Placing Suitable Site Sub-base Material”. The volume to be paid for will be the total number of cubic metres of suitable site sub-base material placed in accordance with this specification, accepted and measured by the Contract Administrator.

6.6.1.2 The volume of suitable sub-base material will be measured by cross-sections and computed by the method of Average End Areas.

6.6.1.3 Only material placed within the limits of excavation will be included in the payment for “Placing Suitable Site Sub-base Material”.

6.6.1.4 No measurement or payment will be made for materials rejected by the Contract Administrator.

6.6.2 Sub-base Material

6.6.2.1 The supplying, placing and compaction of sub-base material will be measured on a weight basis and paid for at the Contract Unit Price per tonne for the “Supplying and Placing Sub-base Material*” listed here below. The weight to be paid for will be the total number of tonnes of sub-base material supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

- i.) 50 mm Granular A*
- ii.) 50 mm Granular B*
- iii.) 50 mm Granular C*
- iv.) 100 mm Granular A*

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- v.) 100 mm Granular B*
- vi.) 100 mm Granular C*

*Sub-base material may be specified.

- 6.6.2.2 The weight to be paid for will be the total number of tonnes of sub-base material as measured on a certified weigh scale.
- 6.6.2.3 Only material placed within the limits of excavation will be included in the payment for the “Items of Work” listed for sub-base material.
- 6.6.2.4 No measurement or payment will be made for materials rejected by the Contract Administrator.

6.7 Base Course Material

- 6.7.1 The supplying, placing and compaction of base course material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for the “Supplying and Placing Base Course Material*”. The volume to be paid for will be the total number of cubic metres of base course material supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

- i.) Base Course Material - Granular A*
- ii.) Base Course Material - Granular B*
- iii.) Base Course Material - Granular C*

*Base course material may be specified.

- 6.7.2 The volume of base course material will be measured by cross-sections and computed by the method of Average End Areas.
- 6.7.3 Only material placed within the limits of excavation will be included in payment for “Supplying and Placing Base Course Material”.
- 6.7.4 No measurement or payment will be made for materials rejected by the Contract Administrator.

6.8 Leveling Course

- 6.8.1 No payment will be made for leveling course.

6.9 Grading of Boulevards

- 6.9.1 The grading of boulevards will be measured on an area basis and paid for at the Contract Unit Price per square metre for “Grading of Boulevards”. The area to be paid for will be the total number of square metres of boulevards graded in accordance with this specification, accepted and measured by the Contract Administrator.
- 6.9.2 Additional excavation over 150 millimetres in depth required to complete boulevard grading

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will be paid for as “Boulevard Excavation”.

- 6.9.3 Additional placement of backfill material over 150 millimetres in depth required to complete boulevard grading will be paid as “Imported Fill Material”.

6.10 Ditch Grading

6.10.1 Ditch grading will be measured on an area basis and paid for at the Contract Unit Price per square metre for “Ditch Grading”. The area to be paid for will be the total number of square metres of ditch graded in accordance with this specification, accepted and measured by the Contract Administrator.

6.10.2 Additional excavation over 300 millimetres in depth required to complete the ditch grading will be paid for as “Ditch Excavation”.

6.10.3 Additional placement of backfill material over 300 millimetres in depth required to complete the ditch grading will be paid as “Imported Fill Material”.

6.11 Boulevard Excavation

6.11.1 Boulevard excavation will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for “Boulevard Excavation”. The volume to be paid for will be the total number of cubic metres of boulevard excavated in accordance with this specification, accepted and measured by the Contract Administrator.

6.11.2 The volume of excavation will be as measured by cross-sections in its original position and computed by the method of Average End Areas.

6.12 Ditch Excavation

6.12.1 Ditch excavation will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for “Ditch Excavation”. The volume to be paid for will be the total number of cubic metres of ditches excavated in accordance with this specification, accepted and measured by the Contract Administrator.

6.12.2 The volume of excavation will be as measured by cross-sections in its original position and computed by the method of Average End Areas.

6.13 Removal of Existing Concrete Bases

6.13.1 Removal of existing concrete bases will be measured on a unit basis and paid for at the Contract Unit Price per unit for the “Items of Work” listed here below. The number of units to be paid for will be the total number of existing concrete bases removed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

Removal of Existing Concrete Bases

- i.) 600 mm Diameter or Less
- ii.) Greater than 600 mm Diameter

6.13.2 No measurement or payment will be made for concrete bases removed for parking metres

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and precast concrete bases for traffic signs.

6.14 Lime or Portland Cement

- 6.14.1 Lime for drying the sub-grade will be measured on a weight basis and paid for at the Contract Unit Price per tonne for “Supplying and Placing Lime”. The weight to be paid for will be the total number of tonnes of Lime supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.
- 6.14.2 Portland Cement for drying the sub-grade will be measured on a weight basis and paid for at the Contract Unit Price per tonne for “Supplying and Placing Portland Cement”. The weight to be paid for will be the total number of tonnes of Portland Cement supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.
- 6.14.3 The weight to be paid for will be the total number of tonnes of Lime or Portland Cement as measured on a certified weigh scale.