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MATERIAL SPECIFICATION FOR AGGREGATES – GRANULAR COURSE

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MATERIAL SPECIFICATIONS FOR AGGREGATE - GRANULAR COURSE

## 901. 1 SCOPE

This Specification covers the requirements for the production and supply of Granular Course materials for use in subgrade, subbase, base, gravel surface course, shoulder work and backfill.

## 901. 2 DEFINITIONS

Appeals: Request from contractor for retesting of material property or attribute for the purpose of resolving disagreement on acceptance test results and Pay Adjustments.

CR- M50: Crushed Rock Minus 50mm, a premium quality granular subbase material for use below the granular base Layer.

CR- M100: Crushed Rock Minus 100mm, a high-quality granular subbase or fill material for use below the CR- M50 or GSB- C Layers.

CR- M125: Crushed Rock Minus 125mm, a granular fill material for use below the CR- M50 or CR- M100 Layers.

Deleterious Material: Material that can affect the performance of the structure and/or cause degradation of the product.

Granular Course: A Layer of borrowed granular material which is placed and compacted on the road or in-situ granular material which is regraded and re-compacted.

Granular Base Course: A Layer of granular material placed below the bituminous, Portland Cement Concrete (PCC), Chip Seal and granular surface Layers or placed as a top Layer of unpaved (shoulders and gravel road) surfaces.

Granular Subbase Course: A Layer of granular material placed below the granular base Layer.

GBC- I: Granular Base Course Type I, a granular base material of premium quality with an excellent balance of drainage, stability and stiffness characteristics, for use below the bituminous, Portland Cement Concrete (PCC) and granular surface Layers.

GBC- II: Granular Base Course Type II, a high-quality granular base material with a very good balance of drainage, stability and stiffness characteristics, for use below the bituminous, Portland Cement Concrete (PCC) and granular surface Layers.

GBC- M: Granular Base Course- Modified, a granular base material with a good balance of drainage, stability and stiffness characteristics, for use below the bituminous and granular surface Layers.

GBC- S: Granular Base Course- Surface, a granular base material with a low permeability characteristics, for use below the AST (Chip Seal) surface or as granular surface Layer material for gravel shoulders and gravel roads.

GSB- C: Granular Subbase Class C, a granular subbase material for use below the granular base Layer.

GSB- F: Granular Subbase Class F, a granular subbase material for use as a fill below the granular base or GSB- C Layers.

Lot: Portion of work that is being considered for acceptance and for the determination of pay adjustments for gradation and physical properties

Lot Mean: Arithmetic average of a set of data representing a lot.

Lot Size: Placement of Granular Course between 1,000 and 5,000 tonnes. The Contract Administrator shall establish the Lot size for each product. For the purpose of sampling, Lots shall be divided into four Sub-Lots of approximately equal tonnage.

Physical Property: Inherent attribute or feature of an aggregate material.

Quality Assurance: Testing and inspection performed by the Contract Administrator to monitor the properties of the materials delivered to the project and the quality of placement and workmanship.

Quality Control: Testing and inspection performed by the Contractor to monitor the properties of the materials produced and incorporated into the Work and the quality of placement and workmanship.

Reject: Unacceptable material for use in the Work and/or unacceptable quality of placement or workmanship.

901. 3 MATERIALS

3.1 General

Aggregate for Granular Course shall meet the requirements for the Granular Course type (granular base and subbase) specified in the Contract.

Aggregate and supplementary granular materials shall consist of sound and durable particles of crushed rock, gravel, stone, sand and fines free from injurious quantities of sod, roots, clay lumps and friable particles, organics or other Deleterious Material.

3.2 Granular Course Aggregate Requirements

3.2.1 Granular Base

Table 3.1 Granular Base Requirements

Passing Sieve Size (Note 1)		GBC- I		GBC- II		GBC- M		GBC- S	
Metric, mm	Imperial	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit
25.00	1"	100	100						
19.00	3/4"	80	95	100	100	100	100	100	
16.00	5/8"	70	90	80	95	83	100	85	100
12.50	1/2"	55	83	70	90	70	95	70	95
9.50	3/8"	47	75	60	84	60	87	60	88
4.75	#4	33	60	40	66	40	70	40	70
2.00	#10	20	45	24	48	25	50	25	50
0.85	#20	11	30	14	33	15	35	17	38
0.425	#40	7	21	9	24	10	25	12	30
0.180	#80	5	14	6	16	6	17	8	20
0.075	#200	3 (Note 2)	8 (Note 2)	3 (Note 2)	8 (Note 2)	4	9	6	13
Fractured Faces, Min. %		55		55		40		35	
Plasticity Index, Max. %		3 (Note 2)		3(Note 2)		3		6	
Liquid Limit, Max. %		25		25		25		25	
L.A. Abrasion Loss, Max. %		35 (ASTM C131)		35 (ASTM C131)		35 (ASTM C131)		35 (ASTM C131)	
Total Lightweight Particles Content, Max. %		7		7		7		12	
Clay Lumps and Friable Particles Content, Max. %		2.0		2.0		2.0		3.0	

Note 1: A maximum of three percent (3%) oversize particles will be allowed provided that the maximum dimension of the oversize particles does not exceed 3mm from the specified maximum size.

Note 2: If GBC Type I or Type II is used below concrete pavement, the fine content (material passing the 0.075mm sieve) shall be limited to 2 to 6% for such application and the materials passing #40 sieve shall be non-plastic.

3.2.2 Granular Subbase

Table 3.2 Granular Subbase Requirements

Passing Sieve Size (Note 1)		GSB- C		GSB- F		CR- M50		CR- M100		CR- M125	
Metric, mm	Imperial, in	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit
125.0	5"									100	100
100.0	4"							100	100		
75.0	3"			100	100			60	100	55	90
50.0	2"					100	100				
37.5	1 1/2"	100	100	75	100	65	100	35	80	30	70
25.0	1"										
19.0	3/4"	70	100	55	100	40	75	20	60	15	55
16.0	5/8"										
12.5	1/2"										
9.5	3/8"	50	95	40	100	25	55	15	45	10	40
4.75	#4	35	80	30	90	15	40	10	35		
2.00	#10	25	60	20	70	10	30				
0.850	#20										
0.425	#40										
0.180	#80										
0.075	#200	5	12	5	15	0	8	0	8	0	8
Fractured Faces, Min. %		20		N/A		100%		100%		100%	
Plasticity Index, Max. %		6		6		Non Plastic		Not Applicable		Not Applicable	
Liquid Limit, Max. %		25		25		25		Not Applicable		Not Applicable	
L.A. Abrasion Loss, Max. %		40 (ASTM C131)		40 (ASTM C131)		40 (ASTM C535)		40 (ASTM C535)		40 (ASTM C535)	
Total Lightweight Particles Content, Max. %		12		12		12		12		12	
Clay Lumps and Friable Particles Content, Max. %		3		3		Not Applicable		Not Applicable		Not Applicable	

Note 1: A maximum of three percent (3%) oversize particles will be allowed provided that the maximum dimension of the oversize particles does not exceed 3mm from the specified maximum size.

## 901. 4 QUALITY CONTROL

The Contractor shall meet the minimum requirements of the *Specifications for Quality Control (No.110)*.

## 901. 5 QUALITY ASSURANCE

## 5.1 General

The Contract Administrator will conduct Quality Assurance inspection, sampling and testing to ensure that aggregate used in the Work conform to the Contract.

The Contract Administrator may test for any property outlined in the Contract.

The Contractor will be provided with results from the completed tests.

Quality Assurance inspection and testing will be performed at no cost to the Contractor.

The inability of the Contract Administrator to provide Quality Assurance test results within any time frame provided in the Contract shall not relieve the Contractor of their obligation to remedy any defect.

## 5.2 Sampling

Granular Course samples for Quality Assurance testing, with the exception of CR- M100 and CR- M125, will be taken from the material placed on the road, before the start of grading/compaction as per *MEB P047 Sampling Aggregates Materials for Laboratory Testing*.

The Contract Administrator will locate four (4) test sites in each Lot, as per *MEB P044 Random Sampling for Acceptance Testing*.

The Contractor shall obtain two (2) samples from each sample location, in the presence of the Contract Administrator. One sample will be used for Quality Assurance testing and the other sample will be reserved for the prospective Appeal testing.

The Contract Administrator will visually inspect CR- M100 and CR- M125 materials for distribution of different sizes and physical properties including the Deleterious Material contents. If any quality issue is suspected, samples of CR- M100 and CR- M125 will be collected by the Contractor and tested for gradation and/or any physical properties, as directed by the Contract Administrator.

## 5.3 Testing

The Contract Administrator will test the Granular Course material as per the test methods listed in Table 5.1 to determine the material characteristics.

Table 5.1 Quality Assurance Test Methods

Test	Standard
Gradation	ASTM C136 ASTM C117
Fractured Faces	ASTM D5821
Liquid Limit and Plasticity Index	ASTM D4318
Lightweight Particles Content (Note 1)	ASTM C123
Clay Lumps and Friable Particles Content	ASTM C142
Los Angeles Abrasion	ASTM C131 ASTM C535

Note 1: The heavy liquid used in the test method shall consist of a solution of zinc chloride in water.

**901. 6 APPEALS**

Appeals will be considered by the Contract Administrator if the Contractor can demonstrate that Quality Assurance test results are different from the Quality Control test results.

Quality Control test results for a Lot which are provided to the Contract Administrator subsequent to the Contractor's receipt of the Quality Assurance test results for that Lot will not be considered for an Appeal.

The Contractor shall serve Notice of Appeal to the Contract Administrator, in writing, within five (5) days of receipt of the applicable Quality Assurance test results. Samples collected and retained for Appeal testing will be discarded if notice of Appeal is not requested within the allotted time period.

The Contractor shall bear all costs of Appeal testing unless the new test results indicate an improvement to the pay adjusted unit price of 5% or more. **The cost for Appeal testing will be based on the price that Manitoba pays its Service Provider for the Appeal test in question (including tax) plus 10% for administration. The Appeal testing Service Provider will be selected on the basis of competitively tendered lowest qualified price that is not in a conflict of interest with the Contractor or Manitoba.**

Appeal testing will be done by a 3<sup>rd</sup> party laboratory retained by the Contract Administrator.

The Appeal test results shall replace the appealed Quality Assurance test result and used to calculate the pay adjustment.

The Contract Administrator will not be responsible for any delays including but not limited to Contractor's downtime, or other costs as a results of the Appeal.

**901. 7 ACCEPTANCE CRITERIA**

The Acceptance of the Granular Course material will be based on the material characteristics from the Quality Assurance test results. Pay adjustment will apply if the gradation and physical properties (as applicable) of a Granular Course material from the representative Lot do not meet all the requirements.

The Contract Administrator will accept the material into the Work at a reduced payment to the Unit Price or reject following Tables 7.1 and 7.2. If the total Pay Adjustment exceeds 50%, the representative Lot of the Granular Course will be rejected.

If the acceptance test results for a Lot fall in rejection, corrective actions apply.

7.1 Gradation

Price adjustment for gradation is based on the deviation of the Lot Mean gradation from the specification limits.

The Pay Adjustment for gradation will be calculated using Table 7.1.

Table 7.1 Pay Adjustment for Gradation

Sieve Size	Mean Deviations from the Specification Limit (Dsl), %	Unit Price Adjustment, \$ per Tonne of Granular Course
Max. Size	≤3	0.00
	>3	Reject
75.0 mm and 37.5 mm (Other than max. size)	0	0.00
	0.1 to 8.0	= - 0.75 x (PRTgbc/25) x Dsl
	>8.0	Reject
19.0 mm, 9.5 mm and 4.75 mm (Other than max. size)	0	0.00
	0.1 to 6.0	= - (PRTgbc/25) x Dsl
	>6.0	Reject
2.00 mm	0	0.00
	0.1 to 4.0	= - 1.5 x (PRTgbc/25) x Dsl
	>4.0	Reject
0.075 mm	0	0
	0.1 to 2	= - 3.0 x (PRTgbc/25) x Dsl
	>2	Reject

Where:

PRTgbc = Price per tonne of granular course aggregate, \$

Dsl = Lot Mean deviation (absolute value) of percentage passing from the Specification limits

The pay adjustment for each Lot will be the sum of the pay adjustment for each sieve listed in Table 7.1.



The pay adjustment for aggregate gradation, as determined in accordance with the gradation pay adjustment table (Table 7.1), shall not exceed 30%. A Lot will be rejected if the pay adjustment for gradation for the Lot exceeds 30%.

7.2 Physical Properties

Price adjustments for physical properties will be based on the deviation of the Lot Mean values from the Specification limit.

The deviation (absolute value) in each property from the specification limit will be calculated using the following formula:

$$Deviation\ from\ the\ Specification\ Limit, Dpp = |PPsl - PPlm|$$

Where:

PPsl = Specification Limit for each physical property, %

PPlm = Lot Mean value for each physical property which falls outside the Specification limit, %

The pay adjustment for physical properties will be determined from Table 7.2.

If the total pay adjustment due to deficiency in physical properties (excluding the gradation) exceeds 40%, the representative Lot of the Granular Course will be rejected.

If the liquid limit exceeds Specification limit and/or the plasticity index exceeds 10%, the applicable Granular Course will be rejected.

Where pay adjustments are made, deductions will be made as a lump sum separately from the Unit Price.

Table 7.2 Pay Adjustments for Deviation in Physical Properties

Unit Price Adjustment, \$ per Tonne of Granular Course	= - 2.5 x (PRTgbc/25)	= - 5 x (PRTgbc/25)	= - 10 x (PRTgbc/25)	Reject
Physical Properties	Deviation of Physical Properties (Dpp), %			
Fractured Faces	≤ 5	6 to 10	11 to 15	> 15
Plasticity Index- Note 1	≤ 2	3 to 4	5 to 6	> 6
Lightweight Particles Content	≤ 2	3 to 5	6 to 8	> 8
Clay Lumps and Friable Particles Content	≤1.0	1.1 to 2.0	2.1 to 3.0	> 3.0
Los Angeles Abrasion	≤ 5	6 to 10	11 to 15	> 15

Where:

PRTgbc = Price per tonne of Granular Course aggregate, \$

Dpp = Lot Mean Deviation (absolute value) in each physical property from the specified limit, %

Note 1: A non-plastic material will be assigned a plasticity index value of zero (0) for the purpose of calculating the deviation.

## 901. 8 CORRECTIVE ACTIONS

## 8.1 Unacceptable Granular Course Aggregate and Repair Requirements

Each Granular Course Lot with unacceptable (rejected) aggregate will be subjected to corrective actions.

All corrective actions shall be performed at the Contractor's expense.

The following corrective actions are generally accepted:

- Remove material from the rejected Lot to its full depth of the rejected lift and replace with new material meeting the Specification requirements.

Any corrective actions proposed by the Contractor shall be subject to approval of the Contract Administrator.

The Contractor shall not undertake any correction on any defective work prior to notifying the Contract Administrator.

All corrected area shall meet the requirements in *Construction Specification for Granular Course (No. 701)*.

## 901. 9 COST OF QUALITY ASSURANCE RE-TEST OR RE-INSPECTION

**The Contract Administrator shall charge the Contractor the cost of re-test or re-inspection for each unacceptable Lot subjected to corrective measures identified through Quality Assurance.**

**The cost of re-testing will be based on:**

- 1. In the event that the re-test was conducted by a laboratory service provider during the contract, the price that Manitoba pays its laboratory service provider (including tax) plus 10% for administration.**
- 2. In the event that the testing is conducted by Manitoba, the cost to Manitoba to conduct the re-test.**

**Manitoba will charge the Contractor for additional staff costs during construction of remove and replace corrective measures at the rate of the daily liquidated damages.**