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### CONSTRUCTION SPECIFICATION FOR GRANULAR COURSE

### 701. 1 SCOPE

This Specification covers the construction of subgrade, subbase, base, gravel surface, shoulder and backfill including surface preparation, pulverization of existing surface and placement of granular course materials.

### 1.1 Pre-Construction Meeting

The Contractor shall attend a pre-construction meeting with the Contract Administrator, at a mutually agreed upon date, to discuss the project. The meeting shall be initiated by the Contractor and be held in advance of commencing field operations. Topics to be discussed will include, but not limited to, the type and quantity of equipment to be used, sequence of Work, traffic control and other pertinent topics.

### 701. 2 DEFINITIONS

Appeals: Request from the Contractor for retesting of material property 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.

Granular Course: A layer of 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 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.

Layer: Total of all lifts from a Granular Course type.

Mean: Arithmetic average of a set of data representing a Section.

Quality Assurance: Testing and inspection performed by the Contract Administrator to determine 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 project and/or unacceptable quality of placement or workmanship.

Section: One kilometre, or part thereof, portion of Work that is being considered for acceptance.

### 701. 3 MATERIALS

3.1 Aggregate for Granular Course

The Contractor shall supply the required types and quantities of aggregate, as specified in the Contract, in accordance with the requirements of the *Material Specification for Aggregate - Granular Course (No. 901).* 

3.2 Water

The Contractor shall supply and use water for surface preparation, shoulder preparation, pulverization of existing surface and for the construction of Granular Course.

Water shall be free of contaminants that can adversely affect the material and the environment.

No extra payment will be made for the supply of water as this Work will be considered incidental to the Unit Price for surface preparation, shoulder preparation, pulverization of existing surface or Granular Course construction.

3.3 Emulsified Asphalt

The Contractor shall supply and use the emulsified asphalt(s), as specified in the Contract, in accordance with the *Specification for Applying Prime Coat and Tack Coat (No. 806).* 

### 701. 4 CONSTRUCTION

- 4.1 Surface Preparation
- 4.1.1 General

The surface preparation, as specified in the Contract, shall be performed on all existing unpaved surfaces prior to placing Granular Course thereon.

The surface shall be prepared for at least one but not more than three kilometres in advance of placing Granular Course.

Existing material that is blade mixed and watered shall be compacted, as specified in Section 4.6 in maximum Lift thicknesses of 150mm.

The prepared surfaces shall be maintained to the required profile, cross section and Compaction, free from ruts and waves until covered by a Lift of Granular Course.

If soft, spongy or excessively wet material is to be excavated from the embankment or any other specialized procedures are required, Work will be paid for on the basis of Extra Work if approved by the Contract Administrator.

4.1.2 Type "A"

Type A surface preparation shall be performed where no provision is made for Type B, Type C or Type D surface preparation.

The Work shall consist of using motor graders to spread loose gravel that exists on the surface of the roadway or in windrows on the shoulders. The material shall be compacted prior to constructing a Granular Course thereon.

No extra payment will be made for Type "A" surface preparation, as this Work will be considered as an incidental operation to the construction of Granular Course.

4.1.3 Type "B"

Type B surface preparation shall consist of re-shaping the subgrade to proper profile and cross section by sub-cutting the surface to a maximum depth of 100mm. The re-shaped subgrade shall be compacted prior to constructing a Granular Course thereon.

4.1.4 Type "C"

Type C surface preparation shall consist of re-shaping and compacting the subgrade by scarifying the existing surface to a sufficient depth, but not exceeding 250mm, so as to produce a 150mm thick layer of reconstructed subgrade at the required profile and cross-section.

The provisions for "in situ moisture" shall apply to Type C surface preparation for drying out material that is deemed to be excessively wet as defined in *Specifications for Grading (500.2.7.5.2)*.

4.1.5 Type "D"

Type D surface preparation shall consist of sub-cutting the existing surface to a maximum depth of 250mm and windrowing the material. The material below the sub-cut shall be aerated or scarified to a depth of 150mm and compacted. The windrowed material shall then be blade mixed, spread and shaped to the required profile and cross-section and compacted.

In general, Type D surface preparation shall be performed on not more than one-half of the roadway width at any one time with the sub-cut material being placed in windrow on the other portion of the roadway.

The provisions for "in situ moisture" shall apply to Type D surface preparation for drying out material that is deemed to be excessively wet as defined in *Specifications for Grading (500.2.7.5.2)*.

4.1.6 New Material

When the Contract Administrator requires new material to be added during surface preparation, it will be paid for at the Unit Price for the type of material specified. Hauling, spreading and

compacting new material will be considered as an incidental operation to the Unit Price for the type of material to be used. Where no Unit Price is provided in the Contract for any new material required, it will be paid for on the basis of Extra Work.

- 4.2 Shoulder Preparation
- 4.2.1 General

Shoulder preparation is required on all Bituminous Pavement projects.

4.2.2 Type I

Type I shoulder preparation shall be performed where no provision is made for Type II shoulder preparation.

Type I shoulder preparation shall involve cutting the surface to remove ridges and undulations, and general levelling and Compaction of the existing gravel shoulders.

No direct payment will be made for Type I shoulder preparation as the Work will be considered an incidental operation to the construction of Granular Course.

4.2.3 Type II

Type II shoulder preparation shall involve cutting the existing shoulder adjacent to the paved surface or lane and blading the resulting material outward to achieve the cross-fall and width as specified in the Contract. If the existing shoulders are not uniform in profile and cross-fall, varying depths of cut may be required to achieve the necessary width and cross-fall.

New Granular Course material shall be added and compacted as specified in Section 4.6 to the level of the existing pavement surface prior to constructing the first Lift of pavement adjacent thereto.

4.3 Pulverization of Existing Surface

Pulverization of existing surface shall not be permitted until frost-free ground conditions exist in the upper 750mm of the work area, the bituminous paving plant is on site, and the conditions as specified in the *Minimum Road Surface Conditions at Seasonal Shutdown* Special Provision can be met by the Contractor.

Pulverized material shall be compacted, as specified in Section 4.6 in maximum Lift thicknesses of 150mm.

The Contractor shall pulverize the existing roadway surface and underlying material to a depth and width as specified in the Contract.

The pulverized material shall be processed such that 97-100% passes a 37.5mm sieve. The remaining loose surface material shall be bladed to achieve depth, width and cross-fall as specified in the Contract. All oversized material shall be removed before paving.

The Contractor shall have the pulverized surface paved within five days and primed within one calendar day, unless otherwise permitted by the Contract Administrator.

The Contractor shall maintain a minimum of one lane traffic at all times which may include preparing half of the surface at a time. All pulverization of existing surface must be re-laid the same day to accommodate two-way traffic at the end of every work shift.

If specified in the Contract, the Contractor shall distribute a Granular Base Course in front of the pulverizing operation in order to blend and to achieve proper width and cross-fall.

## 4.4 Placing and Spreading

Hauling and depositing Granular Course material will not be permitted until frost-free ground conditions exist in the upper 750mm of the work area.

Materials shall not be placed on frozen, wet, muddy or rutted surfaces.

All materials shall be kept clean and free from Deleterious Material.

Operations shall not disturb any underlying Layer or completed Work.

Depositing aggregate on paved surfaces will not be permitted. Granular Course aggregate spilled on paved surfaces shall be removed immediately.

Granular Course material shall be uniformly windrowed along the work area and distributed throughout the width of roadway using appropriate equipment to eliminate Segregation and to uniformly incorporate water for compaction operations.

Granular Course material shall be placed and compacted in such a manner that the aggregate material is not segregated, contaminated or degraded.

## 4.4.1 Granular Subbase Course

The length of exposed Granular Subbase Course in any area shall not be greater than 3km. Granular Subbase aggregate shall not be hauled to the road until sufficient Granular Base Course aggregate is in stockpile to cover the work area of the subbase course.

4.4.2 Granular Base Course

Granular Base Course aggregate shall not be deposited for more than 2.5km in advance of spreading and compacting operations in any work area.

## 4.4.3 Shoulder Operations

Hopper equipped mechanical spreaders shall be used to deposit Granular Course material on the shoulder.

Granular Course aggregate spilled on paved surfaces shall be removed immediately.

4.5 Material Distribution

The Contract Administrator will provide an estimated distribution of quantities in the Contract which is expected to meet the Layer thickness requirements of the structure design.

The Contractor shall be responsible for distributing the Granular Course aggregate on the roadway. The compacted Lift thickness of a Granular Course shall not exceed the limits specified in Table 4.1.

Granular Type	Maximum Thickness, (mm)
GBC- I	125
GBC- II	100
GBC- M	100
GBC- S	100
GSB- C	150
GSB- F	225
CR- M50	200
CR- M100	350
CR- M125	400

Table 4.1 Maximum Lift Thickness of Granular Course

Each Layer of Granular Course shall also meet the grade, cross-slope and width as indicated on the Detailed Design Drawings or as specified in the Special Provisions. The final grade and width of each Granular Course Layer shall meet the tolerances specified in Table 4.2.

Table 4.2 Tolerances for Final Grade and Width of Each Granular Course Layer

Type of Surface	Grade Tolerance, (mm)	Width Tolerance, (mm)
Unpaved Surface	Above = 30 Below = 30	Excess = 30 Shorter = 0
Granular Course under Bituminous Pavement	Above = 30 Below = 30	Excess = 30 Shorter = 0
Granular Course under Bituminous Pavement adjacent to existing pavement and curb	Above = 10 Below = 10	Excess = 10 Shorter = 0
Granular Course under Concrete	Above = 10 Below = 10	Excess = 10 Shorter = 0

Notes:

- (1) Above and below with respect to design Granular Course profile.
- (2) Excess and shorter with respect to the design width measured from the centreline.

The Contract Administrator shall be notified after the completion of surface preparation, shoulder preparation, pulverization of existing surface and each Granular Course Layer.

The Contractor shall be responsible to survey grade and width on the completed surface preparation, shoulder preparation, pulverization of existing surface and each Granular Course Layer to ensure tolerances are met, as specified in Table 4.2. Re-survey is required after corrective actions.

The survey for grade and width checks shall be taken at the frequency in the Contract or agreed upon by the Contract Administrator and the Contractor.

Station and offsets shall be recorded for each survey checks concerning grade and width tolerances, including all non-compliances, and shall be submitted to the Contract Administrator within two (2) business days following completion of the grade.

The Contractor shall sign and certify that the components of the Work have been correctly constructed to the grade and width tolerances on the Certification of Grade and Width Template.

The Contract Administrator will endeavor to verify and accept the Certification of Grade and Width Template submitted by the Contractor within 24 hours. The Contractor will not be permitted to place of an overlying lift until the Contract Administrator verifies and accepts the Certification of Grade and Width Template.

4.6 Compaction

The type of compaction equipment used for the construction of Granular Course shall be suited to the material to be compacted, degree of compaction required and the space available.

Water shall be added as required and thoroughly mixed to ensure compaction. The moisture content during compaction shall be within  $\pm 2\%$  of the optimum moisture content (OMC). The maximum dry density (MDD) and OMC shall be determined through *ASTM D698 Laboratory Compaction Characteristics of Soil Using Standard Effort.* 

Density shall be determined as per test methods listed in Table 4.3.

Type of Material	Test Method
Soils	MEB P034 Density of Soils in Place by Nuclear Method
Granular Course	MEB P051 Density of Granular Base Course in Place by Nuclear Method
Pulverization of Existing Surface	MEB P052 Density of Material in Place by Control Strip Method

Table 4.3 Density Test Method

Note: Where impractical, other suitable methods such as control strip or proof rolling may be used at the discretion of the Contract Administrator.

Granular Course shall be compacted to the full width and the compaction of each Lift shall meet requirements specified in Table 4.4.

 Table 4.4 Minimum Compaction Requirements

Construction type	Minimum Compaction
Surface/Shoulder Preparation	95% of MDD
Pulverization of Existing Surface	98% of MDD
Granular Course for Pavement	98% of MDD
Granular Course for Paved Shoulder	98% of MDD
Granular Course for Unpaved Shoulder	95% of MDD

The Contractor shall be responsible to determine the in place density, as per Table 4.3, on surface preparation, shoulder preparation, pulverization of existing surface and on each lift of Granular Course to ensure the minimum compaction requirements are met, as specified in Table 4.4. In place density determination shall be redone after any corrective actions.

The Contractor shall not place additional material on a compacted Lift until the moisture content of the lift is at or below the OMC.

The Contract Administrator shall be notified after the completion of in situ density test and compaction calculations.

Contractor shall sign and certify the density report before submission to the Contract Administrator.

The Contract Administrator will endeavor to verify and accept the density report submitted by the Contractor within 24 hours. The Contractor will not be permitted to place an overlying lift until the Contract Administrator verifies and accepts the density report.

#### 4.6.1 Control Strip Method

Compaction equipment for the control strip method, shall consist of a minimum of two vibratory steel rollers with static weight of not less than 10t, each having a capacity of at least 1500VPM with a minimum dynamic or centrifugal force of 8t operated in the vibratory mode and at a speed not exceeding 8km/h, and/or any other equivalent compaction equipment, as approved by the Contract Administrator, required to achieve the maximum density.

Water shall be added as required and thoroughly mixed to ensure thorough compaction.

The Contractor shall determine the achievable maximum dry density (MDD) at the desirable moisture content, in the presence of the Contract Administrator, as per *MEB P052 Density of In Place Material by Control Strip Method*.

No extra payment will be made to construct the control strips and determine the achievable MDD as the Work will be considered incidental to the compaction operation.

4.7 Controlling and Delineating Drop-off

When two or more lifts of bituminous pavement are to be constructed on the roadway and it is to remain open to traffic, Granular Base Course shoulders shall be constructed to maintain a maximum shoulder drop-off 50mm. A temporary granular fillet can be constructed to meet the shoulder drop-off limit.

When the shoulder drop-off exceeds 50mm, the outside edge of the pavement shall be temporarily delineated until the shoulder has been constructed. Delineation will not be permitted as an alternate to shoulder construction.

Granular Course shoulders shall be constructed with new material by one of the following methods;

- (a) Construct and maintain full width shoulders to the level of the adjacent bituminous pavement; or
- (b) Construct a granular fillet tapering outward for a minimum distance of 1.5 m from the top edge of the pavement. The fillet shall be watered, compacted and maintained.

When the final lift of bituminous pavement has been constructed, the fillet shall be levelled immediately in advance of constructing the final lift of Granular Course shoulders. The length of roadway, on which the fillet is levelled, shall not exceed a distance which is greater than that required for one days shoulder construction operation. When construction ceases for the day, the fillet on uncompleted portions shall be reconstructed or delineated.

A decision will be made at the pre-construction meeting as to what stage and to what depth the Granular Course shoulders shall be constructed. The existing conditions, the depth of levelling course and the depth of pavement to be constructed will be considered in making the decision so as to best minimize the pavement edge drop-off. The decision shall not be changed without the mutual consent of both parties.

4.7.1 Delineators

The Contractor shall supply and maintain approved delineators and install them at 100m intervals on tangents and 50m on curves.

4.8 Prime Coat

If specified in the Contract, prime coat shall be applied on the finished final lift of Granular Course in accordance with the *Specification for Applying Prime Coat and Tack Coat (No. 806)*. Prime Coat shall be applied within 24 hours of finishing the final lift, weather permitting, and after receiving written authorization from the Contract Administrator.

4.9 Trimming of Slopes

As a final operation, the Contractor shall restore the side slopes to a condition equal to that prevailing prior to the commencement of construction. This Work will include bringing up and spreading any material that may have been pushed over the shoulders or down the slopes during construction operations and levelling vehicle tracks made by the Contractor's equipment.

This Work will be incidental to the Contract and no extra payment will be made for this.

4.10 Maintenance of Granular Course

The Contractor shall maintain each lift of Granular Course constructed under the terms of the Contract.

Where inclement weather or traffic necessitates re-shaping, re-laying or re-compaction of a compacted Granular Course, no extra payment will be paid for such Works as they will be considered as incidental to the construction of the Granular Course.

4.11 Seasonal Shutdown

All Granular Course open to traffic that has not been covered by the final wearing course shall be covered with a temporary wearing course, unless otherwise authorized by the Contract Administrator. Acceptable wearing course for Seasonal Shutdown shall be identified in the Contract.

## 701. 5 QUALITY CONTROL

The Contractor shall meet the minimum requirements in accordance with the Specification for *Quality Control (No. 110)*.

## 701. 6 QUALITY ASSURANCE

6.1 General

The Contract Administrator will conduct Quality Assurance inspection, sampling and testing to ensure the Work conforms to the Contract.

The Contract Administrator may test for any property outlined in the Contract. The Contract Administrator may reject any material or Work if it cannot be demonstrated that they are compliant with the Contract.

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

Quality Assurance inspection, sampling and testing will be performed at no cost to the Contractor unless otherwise stated in the Contract.

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

6.2. Quality Assurance Testing and Inspection

Sampling and Quality Assurance testing will be in accordance to the following:

6.2.1 Compaction

The Contract Administrator will locate three test sites in each Section as per *MEB P044 Random Sampling for Acceptance Testing.* 

Each test site will be tested as per test methods listed in Table 4.3.

The Contract Administrator will identify and notify the Contractor of the areas that do not meet the minimum compaction requirements, based on the densities submitted by the Contractor or the verification checks.

6.2.2 Segregation and Surface Defects

Each lane-km including shoulders, will be inspected for Segregation and surface defects.

The Contract Administrator will endeavour to provide the Contractor with the identified Segregation and surface defect locations within 24 hours after receiving notification from the Contractor that the Granular Course is ready for inspection and Quality Acceptance testing.

6.2.3 Material Distribution

The Contract Administrator may check the profile, thickness and width of each Granular Course, at any time, to verify the grade checks submitted by the Contractor.

The Contract Administrator will identify and notify the Contractor of the areas that do not meet the grade and width tolerances, based on the grade checks submitted by the Contractor or the verification checks.

## 6.2.4 Discretionary Section

The Contract Administrator can designate any portion of the completed Work as a discretionary section if operational issues, workmanship or quality indicate deficient material or Work.

The Contract Administrator will locate test sites for additional Quality Assurance testing.

# 701. 7 ACCEPTANCE CRITERIA

The acceptance of the Granular Course construction shall be based on the compliance with the Contract and the following criteria from the Quality Assurance test results:

a) Compaction

- b) Segregation and Surface Defects
- c) Material Distribution

If acceptance test results for a Section fall in rejection, corrective actions shall apply.

7.1 Compaction

The Mean percent compaction per Section per Lift of Granular Course will be determined by the Contract Administrator for acceptance.

If any compaction test results are less than the minimum requirements in any specific test site, the Section will be rejected.

7.2 Segregation and Defects

If the Contractor conducts the Work in such a manner that the Granular Course materials in a localized area has defects or become segregated, that area will be rejected.

Defects include but are not limited to potholing, surface failures, ravelling, rutting, bumps or dips, irregular cross- slope and soft spots.

7.3 Material Distribution

Where the grade or width tolerances are exceeded, the Contract Administrator may;

- 1) Direct the Contractor to remove the excess materials.
- 2) Cross-section the area that exceed in grade or width tolerances and deduct the excess quantity from payment. A density of 2.2t/m<sup>3</sup> for compacted area, and 2.0t/m<sup>3</sup> for partially compacted areas will be used to calculate the excess quantity. The Contractor shall be responsible for any costs to survey excess material.

Correction will apply if the Granular Course grade and width are below tolerances.

## 701 8 CORRECTIVE ACTIONS

8.1 Unacceptable Granular Course and Repair Requirements

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

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

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 areas shall have a smooth transition to the surrounding Granular Course.

## Table 8.1 Unacceptable Granular Course and Required Corrective Actions

Deficiency/Distress	Required Corrective Measure
Compaction	Re-compact or regrade and re-compact
Segregation and Surface Defects	Regrade and re-compact or remove and replace
Distribution	Scarify and regrade with addition of material, and re-compact

## 701. 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 Section subjected to corrective measures identified through Quality Assurance.

The cost of re-test and re-inspection will be \$500 per Section or part thereof.

### 701. 10 METHOD OF MEASUREMENT

10.1 Surface Preparation Type "B," "C" and "D"

Surface preparation Type B, Type C and Type D will be measured in stations of 100m in length along the centreline of the roadway.

The measurement for each station will include all surface preparation within that station whether full or partial roadway width.

10.2 Shoulder Preparation Type II

Shoulder preparation Type II will be measured in stations of 100m in length along the centreline of the roadway.

The measurement for each station will include all shoulder preparation within that station whether full or partial shoulder width on one or both shoulders or any combination of these.

10.3 Pulverization of Existing Surface

Pulverization of Bituminous Pavement will be measured in stations of 100m in length along the centreline of the roadway and will be based on the total length actually prepared in the field.

10.4 Granular Course

Granular Course will be measured by weight in tonnes of material delivered on the road.

### 701. 11 BASIS OF PAYMENT

11.1 Surface Preparation Type "B," "C" and "D"

Surface preparation Type B, Type C and Type D will be paid for at the Unit Price per station, as set forth in the Contract, and will be payment in full for performing all operations described herein

and those incidental to the Work, except for drying of excessively wet material during surface preparation Types "C" and "D" (see clauses 701.4.1.4 and 701.4.1.5).

11.2 Shoulder Preparation Type II

Shoulder preparation Type II will be paid for at the Unit Price per station, as set forth in the Contract, and will be payment in full for performing all operations described herein and those incidental to the Work.

11.3 Pulverization of Existing Surface

Pulverization of existing surface will be paid for at the Unit Price per Station, as set forth in the Contract, and will be payment in full for performing all operations described herein and those incidental to the Work.

11.4 Granular Course

Granular Course will be paid for at the Unit Price per tonne, as set forth in the Contract, and will be payment in full for supplying materials and performing all operations pertaining or incidental thereto, as herein described, except for surface preparation Type B, Type C and Type D.