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3.6 GRANULAR BASE COURSE

3.6.1 <u>GENERAL</u>

3.6.1.1 Description

Granular base course shall consist of an intimate mixture of crushed aggregate and water, which is placed in layers upon a prepared surface, compacted and finished, as specified herein.

3.6.1.2 **Definitions**

A "Control Strip" is a lift of granular base course constructed using the equipment and method of compaction as prescribed herein, on a 400 m section of prepared surface selected by the Consultant.

The "Control Density" is the maximum dry density attained on a "Control Strip."

A "Pass" is one complete coverage of the Control Strip area with at least the minimum compaction equipment specified herein.

A "Lot" is defined as the quantity of Granular Base Course placed in one day's production.

A "Visually Failed Area" is an area of any subgrade or base course which fails, loses specified density, becomes too wet or too dry, or becomes rutted, distorted, loose or rough prior to placing subsequent lifts of base course.

3.6.2 MATERIALS

3.6.2.1 Aggregate

The Contractor shall produce crushed aggregate in accordance with Specification 3.2, Aggregate Production and Stockpiling, for the Designation and Class of materials specified. The Contractor shall supply materials in accordance with Specification 5.2, Supply of Aggregate and haul aggregate in accordance with Specification 4.5, Hauling.

3.6.2.2 Water

The Contractor shall supply and haul all water required for the construction and maintenance of this work.

The water shall be free from substances which render it unfit for use.

3.6.2.3 Asphalt

The Contractor shall supply asphalt material for prime coat in accordance with Specification 5.7, Supply of Asphalt.

3.6.3 ACCEPTANCE SAMPLING AND TESTING

All testing will be carried out by an approved laboratory.

The Consultant may at any time take samples, carry out testing and inspection of materials incorporated or being incorporated into the work. The Contractor shall cooperate with the Consultant or his

representative for such sampling, testing and inspection. Such inspection shall not relieve the Contractor from any obligation to perform all the work strictly in accordance with the requirements of the contract.

Sample locations for routine quality testing will be randomly selected as far as it is practical to do so. This will not limit the Consultant from testing at any additional locations deemed necessary.

Results of the tests are available to the Contractor for his information. It is the responsibility of the Contractor to interpret test results and alter his operation if necessary, so that the product meets all required specifications.

3.6.3.1 **Test Methods**

Unless otherwise specified, the following standard Alberta Transportation test methods (ATT) shown in Table 3.6.3.1 will be used to determine the material characteristics.

TEST	STANDARD	FREQUENCY (Minimum)
SAMPLING, Gravel and Sand	ATT- 38	As Required
⁽¹⁾ SIEVE ANALYSIS	ATT-25 or 26	As required in ATT-38
PERCENT FRACTURE	ATT-50	As required in ATT-38
DENSITY, Control Strip Method	ATT-58	⁽²⁾ Control and Test Sections
RANDOM TEST SITE LOCATIONS	ATT-56	Each Test Sections
MOISTURE CONTENT, Oven Method, Soil and Gravel	ATT-15	As required

TABLE 3.6.3.1QUALITY ASSURANCE TEST METHODS

NOTES: ⁽¹⁾In all Test Methods used as reference in this specification, metric sieves as specified in Canadian General Standards Board specification 8-GP-2M shall be substituted for any other specified wire cloth sieves in accordance with Specification 3.2, Aggregate Production and Stockpiling.

⁽²⁾Control Strips are established as specified herein and Density Test Sections are randomly established every 1000 m on all lifts.

3.6.4 CONSTRUCTION

3.6.4.1 Control Strip Construction

The nominal lift thickness of a granular base course shall be determined by the Contractor but shall not exceed 200 mm compacted. The total design granular base course thickness may require that more than one lift be constructed, in which case, a new Control Strip is required for each lift; for a change in designation, class or source of aggregate; or when called for by the Consultant.

Control Strips shall not be constructed during freezing ambient temperatures, with frozen aggregate, or on

frozen subgrades.

Aggregate for construction of a Control Strip shall be spread by means of a motor grader or paver.

The Control Strip moisture content shall be adjusted as directed by the Consultant during spreading of the aggregate. The surface of the granular base course shall be kept moist until testing is completed.

Once the aggregate for the Control Strip lift has been completely spread, the moisture and density measurements for determining the Control Density will commence, and will continue during repeated passes of the specified compaction equipment until the maximum dry density is attained. These measurements will be taken by the Consultant using nuclear testing equipment.

3.6.4.1.1 Control Strip Minimum Compaction Equipment

The Control Strip lift shall be compacted using at least the following equipment:

Two vibratory steel roller weighing not less than 6 t and having a vibratory capacity of at least 1500 VPM with a minimum dynamic or centrifugal force of 8000 kg, operated in the vibratory mode, and at a speed not exceeding 8 km/h; plus one of the following:

- (i) Six wobbly tired rollers with tires inflated to a pressure of 200 kPa plus or minus 35 kPa, ballasted with at least a level load of gravel, and towed at a speed not exceeding 8 km/h; or
- (ii) Two self-propelled pneumatic rollers, each ballasted to its maximum capacity, weighing not less than 10 t, having a minimum tire pressure of 400 kPa plus or minus 35 kPa, and travelling at a speed not exceeding 8 km/h; or
- (iii) A combination of 4 wobbly tired rollers and 1 self-propelled pneumatic roller each of which meets the appropriate criteria described above.

3.6.4.1.2 Control Strip Compaction

If portions of the lift are being spread using a motor grader, the aggregate shall be compacted so that when the entire lift has been spread, a minimum of 4 complete passes with the specified compaction equipment shall have been completed over all the Control Strip area.

If the aggregate has been spread by means of a motor grader and vibratory compaction causes a loss of density during base course construction, vibratory compactors shall operate in the static mode supplemented with the specified pneumatic rollers. Whenever a granular base course lift is spread by a paver, a vibratory compactor operating in the vibratory mode shall be utilized.

When pneumatic self-propelled rollers or wobbly type rollers are used for compaction the pneumatic self-propelled rollers or wobbly type rollers shall lead the steel vibratory compactor.

3.6.4.2 General Construction of Granular Base Course Using the Control Density

Once the Control Density has been established, the Contractor may choose his own combination of compaction equipment.

The base course shall be uniformly placed at the same lift thickness as the corresponding Control Strip lift thickness.

Each lift of base course shall be constructed true to grade and cross-section and the finished surface shall be smooth and free of loose material.

The Contractor shall compact areas such as entrances, using a vibratory steel-wheeled roller as specified in Section 3.6.4.1.1 to the satisfaction of the Consultant or until 95.0% of the Control Density has been achieved.

Water shall not be added in such quantities that it seeps into the underlying subgrade.

Materials shall be handled so that segregation of the coarser and finer fractions does not occur and the Contractor shall take all necessary precautions to prevent aggregate segregation. Any segregation shall be corrected by reblending as necessary.

Base course shall not be spread on frozen subgrade and compaction shall be completed before freezing.

3.6.4.3 **Finishing Work**

Slopes shall be neatly trimmed, and loose or waste material from the side slopes shall be either neatly bladed against the edge of the base course or spread neatly over the side slope and ditches to the satisfaction of the Consultant.

All rocks larger than 75 mm in diameter shall be removed from the side slopes and ditches and disposed of in a manner satisfactory to the Consultant.

Prime coat shall be placed on the finished final lift of granular base course in accordance with Specification 3.19, Prime, Tack and Fog Coats.

3.6.4.4 Interim Lane Markings

The Contractor shall provide interim lane markings on all newly primed surfaces that are to be exposed to traffic overnight. The Contractor has the option of using paint and glass beads or reflectorized markers. (Davidson Temporary Pavement Markers or equivalent)

When paint is used, all paint spots shall be 100 mm wide and 300 mm long, shall be applied lengthwise to the road surface, shall be spaced 15 m apart on centre in tangent sections and 7.5 m apart on curves, shall employ the same paint colour as the permanent marking to come and shall be completely covered with glass beads at the time of painting.

When reflectorized markers are used, they shall be placed at 25 m intervals on tangent sections and at 15 m intervals on curves and shall be removed immediately prior to being overlaid.

3.6.5 <u>COMPLIANCE TESTING</u>

The Contractor shall, at his own expense, repair and/or restore to specified condition any Visually Failed Areas.

Each lift shall be compacted to an average of 98.0% of the applicable Control Density with no single test less than 95% of the applicable Control Density. Frequency of testing is outlined in ATT 58.

As specified for Control Strip construction, the surface of the granular base course shall be kept moist until testing is completed.

3.6.6 END PRODUCT ACCEPTANCE OR REJECTION

The following requirements apply to granular base course aggregate material placed in all lifts.

Price Adjustments for aggregate gradation for each sieve size will be based on the variation of the Lot Mean Gradation from the limits of the Designation and Class outlined in Table 3.2.3.1. The corresponding adjustment points are shown in Table 3.6A.

When the Lot Mean Gradation is outside the gradation limits of Table 3.2.3.1, the penalty assessment will be \$0.02 per tonne for each Mean Adjustment Point outside those limits. If the maximum deviation shown in Table 3.6 A is exceeded, the lot is rejected.

Price Adjustments for Fractures will be based on the Mean Fracture deviation below the specification minimum shown in Table 3.2.3.1, one adjustment point for each one percent below the specification minimum will occur up to a maximum of ten percent. If the maximum deviation is exceeded, the lot is rejected.

Price Adjustments for Lot Mean Gradation and Fractures will be based on a minimum of three tests each per Lot sampled under a Full Testing Program in accordance with ATT 38, Sampling, Gravel and Sand.

At the discretion of the Consultant a Partial Testing Program in accordance with ATT 38 may be used in determining End Product acceptance subject to other compliance testing. Price adjustments will not apply in cases where the Partial Testing Program is used.

3.6.6.1 Methods of Repair of Rejected Areas

All rejected areas shall be repaired by the Contractor to the satisfaction of the Consultant. The following methods of repair are generally acceptable but are subject to the approval of the Department:

- Remove and replace entire depth of rejected lift in failed area.
- Place a remedial lift equal to 30 percent of the depth of the rejected lift thickness or 50 mm, whichever is greater. When remedial lifts are used as a repair method, the surrounding areas/lanes also require additional material to create smooth transitions and acceptable elevation changes between the repaired and approved areas. When a lower lift is repaired using a remedial lift, the repair material will not be considered to take the place of any portion of subsequent lifts.(i.e. the completed structure will be the design depth plus the depth of repair lift)
- Correct aggregate requirements by adding, blending and reworking appropriate materials.

All repairs shall be regular in shape and finished using good workmanship practises to provide an appearance suitable to the Consultant.

All repairs shall be carried out by the Contractor at his expense.

3.6.6.1.1 Payment for Work that had been Rejected, but was Made Acceptable

All repaired areas will be retested and the results of the retest will be used for determining pay adjustments.

When the method of repair is a remedial lift, the remedial lift will be tested and any pay adjustment as determined will be applied to the rejected underlying lift and the additional material will not be paid for.

When the method of repair is adding, blending and reworking materials, the added materials will not be paid for. Only the quantity of material originally constructed will be paid for.

Payment for the additional testing will be charged to the Contractor in accordance with the rates as shown in Section 3.6.7.2, Payment of Appeal Testing Costs.

3.6.7 APPEAL OF ACCEPTANCE TEST RESULTS AND APPEAL TESTING

3.6.7.1 Gradation and Fractures

Appeal testing will be done using appeal sampling method described in ATT 38. The Contractor may appeal the results of acceptance testing of gradation or fractures for any rejected or penalized Lot only once. The Consultant may request that cause be shown for the appeal. The appeal shall be for all tests within the Lot, and there will be no appeal allowed for single tests within a Lot. Priming or placing of additional lifts on the appealed Lot will void any appeal.

The following procedures will apply for an appeal:

- (i) The Contractor shall serve notice of the appeal for Gradation, Fractures or both to the , in writing, within 24 hours of receipt of the test results;
- (ii) The Department will arrange and pay for an independent testing laboratory certified to operate in the Province of Alberta, to perform the appeal testing. The personnel employed or testing laboratory retained by the Contractor for quality control testing on the project will not be used for appeal testing;
- (iii) The Consultant will sample the compacted base and provide the samples to the independent testing laboratory. The Contractor may observe the sampling process. The number of the new tests for the appeal shall be the same as the number used to determine the Lot Mean; and
- (iv) All test results from the old Lot will be retained and averaged with the new appeal tests. A new mean for all tests will be determined and used for acceptance and unit price adjustment.

The new mean, thus determined, in all cases, will be binding on the Contractor and the Department.

3.6.7.2 Payment of Appeal Testing Costs

If the new results show that a penalty no longer applies, then sampling and testing costs incurred during the appeal procedures for that Lot will be borne by the Department.

If the new results verify that any unit price reduction or rejection remains valid for that Lot, then the Contractor will be invoiced by the Department for the sampling and testing costs for the appeal procedures, at the following rates:

Gradation:	\$500
Fracture Count:	\$300

3.6.8 MEASUREMENT AND PAYMENT

3.6.8.1 Granular Base Course

Measurement of granular base course will be in tonnes.

Payment will be made at the applicable unit price bid per tonne for "Granular Base Course" subject to the unit price adjustments specified herein. This payment will be full compensation for processing, hauling and placing the material on the roadway, intersections, entrances and approaches, supplying water and adjusting the moisture content, preparing the surface, applying asphalt material for Prime Coat, supplying and applying blotting sand when required, maintaining the treated surface, interim lane marking and quality control.

Separate payment will not be made for any material required to repair failures which occur in the granular base course. All costs associated with the repair of failed areas will be the responsibility of the Contractor.

Payment for the supply of asphalt for Prime Coat will be in accordance with Specification 3.19, Prime, Tack and Fog Coats.

3.6.8.2 Pay for Acceptable Work

Total Lot Adjustment points will be calculated for each Lot. A Lot Gradation and Fracture Price Adjustment per tonne will be applied based on the following formula, providing the Lot Mean does not exceed the requirements in Table 3.6 A or the maximum deviation for fractures is not exceeded.

Where:

 $PAgf = (PAg + PAf) \times 0.02$

Pagf = Unit Price Adjustment for Gradation and Fractures Pag = Adjustment Points for Gradation

Paf = Adjustment Points for Fractures

The Lot Unit Price Bid per tonne will be calculated as follows:



TABLE 3.6 A MEAN ADJUSTMENT POINTS FOR DEVIATIONS FROM GRADATION LIMITS AND MAXIMUM DEVIATIONS ALLOWABLE

	SIEVE SIZE μm			
LOT MEAN REQUIREMENTS	(1)25000 20000 16000 10000	5000 1250 630 315	160	80
Mean Adjustment Points for Deviations from limits of Table 3.2.3.1	2 for each 1% Deviation	5 for each 1% Deviation	0.5 for each 0.1% Deviation	5 for each 0.1% Deviation
Maximum Allowable Deviation from limits of Table 3.2.3.1	2	3	3	1.5

(1) Note: Include all applicable sieves up to one size smaller than top size.