

1. GENERAL

1.1 RELATED WORK

- .1 Section 31 23 13 – Subgrade Construction.
- .2 Section 31 24 13 – Roadway Excavation, Embankment and Compaction.
- .3 Section 31 32 13 – Cement Stabilized Subgrade Construction.
- .4 Section 32 12 13 – Asphalt Prime and Tack Coats.

1.2 DEFINITIONS

- .1 Granular base course:
 - .1 An intimate mixture of crushed aggregate and water, which is placed in layers upon a prepared surface, compacted and finished.

1.3 COMPLIANCE REQUIREMENTS

- .1 Contractors are required to comply with applicable legislation, regulations, acts, codes, and policies, including, but not limited to the Alberta and Saskatchewan Occupational Health and Safety, Worker's Compensation Board Standards, industry standards, and municipal requirements while completing granular base operations.
- .2 In any case of conflict or discrepancy, the higher standard shall apply.

1.4 SAMPLES

- .1 At least one (1) week prior to commencing Work, the Engineer shall be advised of the proposed source of granular base course material.
- .2 Sieve analysis of the granular base course material on at least two (2) samples, performed by a qualified materials testing laboratory, shall be submitted by the Contractor to the Engineer for review prior to the material being used.

1.5 MEASUREMENT AND PAYMENT

- .1 Granular base course material will be measured in square metres in place, to the specified thickness and classification of granular material incorporated into the Work and accepted by the Engineer, or measured in cubic metres, as specified in the Bid Forms. The unit price shall include all equipment, tools, labour and supervision required for supplying, hauling, and placing the granular base course material, laying out and shaping the material true to grade and cross-section, moisture adjustments, compacting, proof-rolling, and all other related or incidental tasks.
- .2 Payment will not be made for any material used to repair failures due to faulty workmanship which may occur in the granular base or subbase course. Any expense incurred in the production, hauling, and placement of such material will be the responsibility of the Contractor.

- .3 There shall be no payment for moisture adjustments of materials.
- .4 Wick drain material placed will be measured in lineal metres installed in the locations specified, and accepted by the Engineer. The unit price quoted in the Bid Form shall reflect all costs associated and shall be full compensation for the supply of all tools, material, equipment, labour and supervision, and any other items deemed incidental to place the wick drain in accordance with the Plans and Drawings, including connecting the wick drain to the nearest catch basin.

2. PRODUCTS

2.1 MATERIALS

- .1 Granular Base:
 - .1 Crushed stone or gravel shall consist of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material, and other deleterious materials.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 and to have a smooth curve without sharp breaks when plotted on a semi-logarithmic grading chart.
 - .3 Type I Base Course (20mm or ¾"):

Sieve Designation	% Passing
20mm	100
16mm	84-94
10mm	63-86
5mm	40-67
1.25mm	20-43
0.630mm	14-34
0.315mm	9-26
0.160mm	5-18
0.080mm	2-10

Minimum 60% Fracture by Weight (+5mm, 2 Faces)
Maximum Plasticity Index of 6

- .4 Type II Base Course (25mm or 1"):

Sieve Designation	% Passing
25mm	100
20mm	82-97
16mm	70-94
10mm	52-79
5mm	35-64
1.25mm	18-43
0.630mm	12-34
0.315mm	8-26
0.160mm	5-18
0.080mm	2-10

Minimum 60% Fracture by Weight (+5mm, 2 Faces)
Maximum Plasticity Index of 6

- .5 Type III Subbase Course (40mm or 1 ½”):

Sieve Designation	% Passing
40mm	100
25mm	70-94
16mm	55-85
10mm	44-74
5mm	32-62
1.25mm	17-43
0.630mm	12-34
0.315mm	8-26
0.160mm	5-18
0.080mm	2-10

Minimum 50% Fracture by Weight (+5mm, 2 Faces)
Maximum Plasticity Index of 6

- .6 Type IV Subbase Course (63mm or 2 ½”):

Sieve Designation	% Passing
63mm	100
5mm	25-50
0.080mm	0-10

Minimum 20% Fracture by Weight (+5mm, 1 Face)
No Maximum Plasticity Index

- .7 The Contractor shall submit a complete sieve analysis of two (2) samples of granular base material to the Engineer for approval, prior to delivery on Site.
.8 A qualified materials testing laboratory shall perform the sieve analysis.
A tolerance of 3% in the amount passing the maximum sieve screen size will be allowed provided all oversize material passes the next larger standard sieve size.

- .2 Water:

- .1 Unless otherwise specified, the Contractor shall, at its own expense, supply and haul all water required. Water shall be clear and free from injurious amounts of oil, acids, alkalis, soluble chlorides, organic matter, sediment, or any other deleterious substances.

- .3 Wick Drain:

- .1 Flat drain material no less than 95mm in width, jacketed in non-woven geotextile and featuring a core that serves as a water conduit.
.1 Wick drain shall be Nilex Mebra TM, or an approved equal.

3. EXECUTION

3.1 EQUIPMENT

- .1 Graders, rollers, and other Equipment of adequate design and capacity to produce a granular base or subbase as specified.

3.2 PREPARATION

- .1 The subgrade shall be prepared in accordance with Section 31 23 13 – Subgrade Construction and Section 31 24 13 – Roadway Excavation, Embankment and Compaction.
- .2 The prepared subgrade shall be inspected by the Engineer, including proof rolling, before placing granular base course or granular subbase course.
- .3 Wick drain is to be placed along the alignment of the back of curb, at the lowest point of the compacted subgrade, in one continuous piece from the high point to the nearest catch basin. Wick drain shall also be placed from the crown of the roadway, perpendicular to the centreline, to the nearest catch basin. Where there are catch basins at the same station on both sides of the road, one continuous wick drain, from catch basin to catch basin, may be used. Wick drains shall be trimmed to extend 100mm into the catch basin barrel. Splicing of wicks shall not be permitted.
- .4 The prepared subbase course shall be inspected by the Engineer, including proof rolling, before placing the granular base course.
- .5 On existing gravel roads or lanes, clean the surface of clay lumps, vegetation, and foreign matter. To assess the condition of the subgrade and the depth of gravel, make exploratory cuts along the third points of road width, or along the centreline of the lane. After assessment, regrade and compact the gravel to prevent water ponding.

3.3 PLACING

- .1 New granular base or subbase course:
 - .1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.
 - .2 Place material to full width in uniform layers not exceeding 150mm compacted thickness. The Engineer may authorize thicker layers if the specified compaction can be achieved.
 - .3 Place using methods that do not lead to segregation or degradation of aggregate. If segregation occurs:
 - .1 In Types I and II Base Course: blade the lift and mix thoroughly before final spreading and shaping to crown and grade.
 - .2 In Types III and IV Subbase Course: remove and replace segregated material.
 - .4 Shape each layer to a smooth contour and compact to 100% Standard Proctor Density before succeeding layers are placed.
- .2 Existing gravel on suitable subgrade:
 - .1 If the subgrade is found to be acceptable to the Engineer and is on the designated grade, and if there is sufficient depth of gravel, scarify the existing gravel to a depth of 75mm and pulverize the material to pieces no larger than 50mm. Remove rocks bigger than 75mm.
 - .2 If there is insufficient depth of gravel and subgrade is on grade, scarify to a depth of 50mm and pulverize the material to pieces no larger than 50mm. Remove rocks bigger than 75mm and add the designated class of imported aggregate. Mix thoroughly with the existing gravel.

- .3 Spread and shape to crown and grade in lifts not exceeding 150mm compacted thickness.
- .3 Existing gravel on subgrade to be reworked:
 - .1 If the subgrade is found to be unsuitable or not on designated grade, windrow the existing gravel to one half of the road or lane and rework the exposed subgrade as required.
 - .2 When required by the Engineer, excavate and remove unsuitable subsoil and backfill with approved material according to Section 31 24 13 – Roadway Excavation, Embankment and Compaction.
 - .3 Prepare the subgrade to a depth of 150mm according to Section 31 24 13 – Roadway Excavation, Embankment and Compaction.
 - .4 If the subgrade is found to be too low as compared to the Drawings, scarify and blend with approved imported fill, and compact in 150mm lifts according to Section 32 24 13 - Roadway Excavation, Embankment, and Compaction or Section 31 32 13 – Cement Stabilized Subgrade Construction.
 - .5 If the subgrade is found to be too high, remove excess soil, scarify to a depth of 150mm, and compact according to Section 32 24 13 – Roadway Excavation, Embankment, and Compaction or Section 31 32 13 – Cement Stabilized Subgrade Construction.
 - .6 Rework the subgrade on the other half of the road or lane.
 - .7 After reworking the subgrade, follow the process for existing gravel on suitable subgrade to prepare the gravel for compaction.

3.4 COMPACTING

- .1 Bring the moisture content of the aggregate to within $\pm 3\%$ of optimum.
- .2 Compact each lift of granular course to an average of one hundred percent (100%) of Standard Proctor Density (ASTM D698).
- .3 Shape and roll alternately to obtain a smooth, even, and uniformly compacted base.
- .4 Apply water as necessary during compacting to obtain the specified density. If the material is excessively moist, aerate by scarifying with suitable equipment until the moisture content is corrected.
- .5 In areas not accessible to rolling equipment, compact to the specified density with approved mechanical tampers.
- .6 The top of the finished base shall exhibit a smooth, continuously dense surface.
- .7 The quality assurance laboratory will take a minimum of three field density tests on the compacted granular lift for each 1000m², according to ASTM D1556, ASTM D2167, or ASTM D6938 for comparison with a maximum density determined in the laboratory according to ASTM D698.
- .8 If a density test result is below the required density, one more test shall be taken for the area represented by the failed test. If the re-test is below the required density, the area represented by the failed test shall be reworked to the full depth of the lift, the aggregate moisture altered as necessary, and recompacted to the required density.

- .9 The Contractor shall assume the risk of uncovering and reworking the granular base if it is covered before the Engineer has accepted test results thereof (including proof-rolling).

3.5 PROOF-ROLLING

- .1 For proof-rolling use a roller of 45,400kg gross mass with four (4) pneumatic tires each carrying 11,350kg and inflated to 620kPa. Four (4) tires arranged abreast with centre to centre spacing of 915mm maximum.
- .2 The Engineer may authorize the use of other acceptable proof-rolling equipment. Alternately, use a single axle dual wheeled truck with a load of 9,100kg on the rear axle with tires inflated to a minimum of 27kPa.
- .3 Proof-roll the top of the subgrade upon completion of fine grading and compaction. Make sufficient passes to uniformly subject the surface to a loaded tire. Proof-rolling shall be carried out in the presence of the Engineer.
- .4 Where proof-rolling reveals defective subgrade, remove the defective materials to the depth and extent directed by the Engineer. Replace with new material at no extra cost to the Owner.

3.6 FINISH TOLERANCES

- .1 Surface: 15mm maximum variation under a 3.0m straight edge.
- .2 Grade: 10mm maximum variation above or below the established grade but not uniformly high or low.
- .3 Correct any surface irregularities by loosening and adding or removing material until the surface is within the specified tolerance.
- .4 When the tolerance is exceeded:
 - .1 Trim high spots and refinish the surface to within tolerance.
 - .2 Add approved aggregate to low areas, scarify, blend, re-spread, and re-compact to the required density, and refinish the surface. Alternately, compensate low areas with extra thickness of subsequent layers of granular base course or asphalt concrete pavement, at the Contractors sole expense.

3.7 MAINTENANCE

- .1 If the granular base floods, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches.
- .2 Maintain finished surfaces in a condition conforming to this section until acceptance.
- .3 The Contractor shall, at its own expense, repair any damages to a prepared granular base surface as well as repair damages done by its equipment, and shall remove any obstructions it may have placed which will interfere with the normal function of a drainage system.

- .4 The Contractor shall, at all times and at its entire cost, be responsible for protecting the Work site against the entry of surface water into the Work area, including, as may be required, the pumping and removal of such surface water with the discharge of such surface water to a location and in a manner acceptable to the Engineer.

END OF SECTION