

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 31 05 16 - Aggregate Materials
- .2 Section 31 23 10 - Excavating, Trenching and Backfilling
- .3 Section 31 23 13 - Roadway Embankment
- .4 Section 32 11 23 - Aggregate Base Courses

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D422-63(2007), Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D698-2012, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 600kN-m/m³.
 - .6 ASTM D1883-03(R2008), Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-2010, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .8 ASTM D1557-2012, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 27,000 kN-m/m³.
- .2 Canadian General Standard Board (CGSB)
 - .1 CGSB 8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric Series.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Granular sub-base material: in accordance with the following requirements:

2.1 MATERIALS
(Cont'd)

- .1 (Cont'd)
.1 Crushed and screended pit gravel or crushed and screened rock. Material to consist of hard and durable stone particles.
.2 Graduations shall be dense, well-graded and as follows (NSTIR Type 2):

<u>Sieve Size, μm</u>	<u>Percent Passing</u>
80 000	100
56 000	70-100
28 000	50-80
14 000	35-65
5 000	20-50
160	5-12
80	0-5

PART 3 - EXECUTION

3.1 PLACING

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
.2 Construct granular sub-base to depth and grade in areas indicated.
.3 Confirm no frozen material is placed.
.4 Place material only on clean unfrozen surface, free from snow or ice.
.5 Begin spreading sub-base material on crown line or high side of one-way slope.
.6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
.7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
.8 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
.9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

3.1 PLACING
(Cont'd)

- .10 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 100% corrected maximum dry density maximum dry density in accordance with ASTM D 698.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 PROOF ROLLING

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.
- .2 Obtain approval from Departmental Representative to use non standard proof rolling equipment.
- .3 Proof roll at level in sub-base as indicated. If non standard proof rolling equipment is approved, Design Departmental Representative to determine level of proof rolling.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade:
.1 Remove sub-base and subgrade material to depth and extent as directed by Departmental Representative.
.2 Backfill excavated subgrade with common material and compact to 98% corrected maximum dry density.

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| <u>3.3 PROOF ROLLING</u>
(Cont'd) | .6 | Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost. |
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| <u>3.4 SITE TOLERANCES</u> | .1 | Finished sub-base surface to be within 10 mm of dimensions as indicated but not uniformly high or low. |
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| <u>3.5 PROTECTION</u> | .1 | Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Design Departmental Representative. |

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 56 00 - Temporary Barriers and Enclosures
- .2 Section 31 11 00 - Clearing and Grubbing
- .3 Section 31 23 10 - Excavating, Trenching and Backfilling
- .4 Section 31 23 13 - Roadway Embankments
- .5 Section 32 11 16 - Granular Sub-base
- .6 Section 32 11 23 - Aggregate Base Courses

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C117-04, Test Method for Materials Finer than 75- μ m Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-2012, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort 600kN-m/m³.
 - .5 ASTM D4318-2010, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.3 WASTE
MANAGEMENT AND
WASTE DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Excess materials are to be diverted from landfill to site approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Granular base material: to the following requirements:
- .1 Crushed and screended pit gravel or crushed and screened rock. Matreial shall consist of hard and durable stone particles.
 - .2 Graduations shall be dense, well-graded and as follows (NSTIR Type 1):

<u>Sieve Size</u>	<u>Percent Passing</u>
20 000	100
14 000	50-85
5 000	20-50
160	5-12
80	3-5

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

- .1 Scarifying and reshaping:
- .1 Scarify roadbed to width as indicated unless directed otherwise by Departmental Representative and to minimum depth of 150mm.
 - .2 Blade and trim specified material to elevation and cross section dimensions as indicated unless directed otherwise by Departmental Representative.
 - .3 Where deficiency of material exists, add and blend in new granular base material as directed by Departmental Representative. Confirm no frozen material is used.
- .2 Compaction equipment:
- .1 Compaction equipment capable of obtaining required material densities.
- .3 Compacting:
- .1 Compact to 100% corrected maximum dry density in accordance with ASTM D698.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compaction to obtain specified density.
 - .4 Use mechanical tampers, approved by Departmental Representative to compact areas not accessible to rolling equipment to specified density.

3.1 SEQUENCE OF
OPERATION
(Cont'd)

- .4 Repair of soft areas:
.1 Correct soft areas by removing defective material to depth and extent directed by Departmental Representative. Replace with material acceptable to Departmental Representative shape and compact to specified density.
.2 Maintain reshaped surface in condition conforming to this section until succeeding material is applied or until acceptance by Departmental Representative.

3.2 SITE TOLERANCES

- .1 Reshaped compacted surface within plus or minus 10mm of elevation as indicated.

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 31 05 16 - Aggregate Materials
- .2 Section 31 23 10 - Excavating, Trenching and Backfilling
- .3 Section 32 11 16 - Granular Sub-base

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 75 μm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-2012, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m³).
 - .5 ASTM D1557-2012, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m³).
 - .6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-2010, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standard Board (CGSB)
 - .1 CGSB 8.1-88, Sieves, Testing, Woven Wire, Inch series.
 - .2 CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric Series.

1.3 DELIVERY,
STORAGE, AND
HANDLING

- .1 Deliver and stockpile aggregates in accordance with Section 31 05 16. Stockpile minimum 20% of total aggregate required prior to beginning operation.

1.4 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Crushed and screened pit gravel or crushed and screened rock. Material shall consist of hard and durable stone particles.
- .2 Gradation shall be dense, well-graded and as follows (NSTIR Type 1):

<u>Sieve Size</u>	<u>Percent Passing</u>
20 000	100
14 000	50-85
5 000	20-50
160	5-12
80	3-5

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

- .1 Place granular base after sub-base subgrade surface is inspected and approved by Departmental Representative.
- .2 Placing:
 - .1 Construct granular base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Begin spreading base material on crown line or on high side of one-way slope.
 - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .6 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Design Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:

3.1 SEQUENCE OF
OPERATION
(Cont'd)

- .3 (Cont'd)
 - .1 Compaction equipment to be capable of obtaining required material densities.
- .4 Compacting:
 - .1 Compact to density not less than 100% corrected maximum dry density in accordance with ASTM D698.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .5 Proof rolling:
 - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four (4) tires arranged abreast with centre to centre spacing of 730 mm.
 - .2 Obtain approval from Departmental Representative to use non standard proof rolling equipment.
 - .3 Proof roll at level in granular base as indicated. If use of non standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
 - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with common material and compact in accordance with Section 31 23 10.
 - .3 Replace sub-base material and compact in accordance with Section 32 11 16.
 - .4 Replace base material and compact in accordance with this Section.
 - .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with Section 32 11 16 and this section at no extra cost.

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| <u>3.2 SITE TOLERANCES</u> | .1 | Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low. |
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| <u>3.3 PROTECTION</u> | .1 | Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative. |

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 33 00 - Submittal Procedures

1.2 SUBMITTALS

- .1 Product Data.
 - .1 Submit product data in accordance with Section 01 33 00.
 - .2 Provide product data for:
 - .1 Seed.
 - .2 Mulch.
 - .3 Tackifier.
 - .4 Fertilizer.
 - .3 Submit in writing to Departmental Representative ten (10) days prior to commencing work:
 - .1 Volume capacity of hydraulic seeder in litres.
 - .2 Amount of material to be used per tank based on volume.
 - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

1.3 QUALITY
ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.4 SCHEDULING

- .1 Schedule hydraulic seeding to coincide with preparation of soil surface.
- .2 Schedule hydraulic seeding using grass mixtures and mixtures containing Crownvetch or Trefoil between dates recommended by the Provincial Agricultural Department.

1.5 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 SEED

- .1 Canada No. 1 Grade to Government of Canada Seeds Act and Seeds regulations where applicable having a minimum germination of 80% and minimum purity of 85%. Seed mixture shall consist of 1.5 kg per 100 m² and conform to the the following:

<u>Name</u>	<u>Proportion by Weight</u>
Creeping Red Fescue (Festuca rubra)	40%
Perennial Rye (Lolium perenne)	25%
Canada Bluegrass (Poa compressa)	10%
Redtop (Agrostis alba)	7%
Annual Rye Grass (Lolium multiflorum)	5%
Birdsfoot Trefoil (Lotus corniculatus)	5%
Yarrow (Achillea millefolium)	5%
Colonial Bentgrass (Agrostis capillaris)	3%

2.2 WATER

- .1 Free of impurities that would inhibit plant growth.

2.3 SEED FERTILIZER

- .1 To Canada "Fertilizers Act" and "Fertilizers Regulations."

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| <u>2.3 SEED FERTILIZER</u>
(Cont'd) | .2 | Complete synthetic, slow release with 35% of nitrogen content in water soluble form. |
| | .3 | Ratio spring seeding 1:2:2; ratio fall seeding 1:4:4 or as recommended by the Nova Scotia Agricultural College Soils Department or by an approved soils lab. |
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| <u>2.4 SEED MULCH</u> | .1 | Fibre: wood or wood-cellulose fibres free of germination or growth-inhibiting ingredients and forming blotter like ground cover allowing absorption and percolation of water. |
| | .2 | Capable of dispersing in water to form homogeneous slurry. |
| | .3 | Capable of forming an absorptive mat ground cover allowing water percolation. |
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| <u>2.5 SEED TACKIFIER</u> | .1 | Water diluted liquid dispersion containing polyvinyl acetate polymer emulsion. |
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| <u>2.6 EQUIPMENT</u> | .1 | Truck (hydraulic): |
| | .1 | Slurry tank: approved commercial hydraulic equipment. |
| | .2 | Pumps capable of maintaining continuous non-fluctuating flow of solution. |

PART 3 - EXECUTION

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| <u>3.1 WORKMANSHIP</u> | .1 | Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended. |
| | .2 | Clean-up immediately, any material sprayed where not intended, to satisfaction of Engineer. |
| | .3 | Do not perform Work under adverse field conditions such as wind speeds over 10km/h, frozen ground or ground covered with snow, ice or standing water. |
| | .4 | Protect seeded areas from trespass until plants are established. |
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3.2 PREPARATION OF
SLURRY

- .1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this Work.
- .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
- .3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

3.3 HYDRAULIC
SEEDING

- .1 Seed during local growing season when natural moisture is available and temperature is suitable to ensure germination and growth.
- .2 Measure all quantities of material by weight or by weight-calibrated volume measurement.
- .3 Charge seeder with water, and while agitating, slowly add mulch, seed, fertilizer and lime until all components are thoroughly mixed.
- .4 When required, add erosion control agent to seed and mix thoroughly to complete seeding slurry.
- .5 Slurry application per 100 m²:
 - .1 Seed - 1.5 kg or as recommended by seed supplier.
 - .2 Fertilizer - Not less than 1650 g of phosphorus per 100 m².
 - .3 Mulch - 10 kg.
 - .4 Erosion control agent - as recommended by manufacturer.
 - .5 Water - minimum 100 litres.
 - .6 Lime - as determined by soil analysis.
- .6 Apply slurry uniformly, blending into existing grassed areas. Slurry to be thick enough to prevent grass seed from drying and blowing but not to impact germination and growth. Reshoot areas where application is not uniform.
- .7 Remove slurry from items and areas not designated to be sprayed.

3.4 MAINTENANCE
DURING
ESTABLISHMENT
PERIOD

- .1 Perform the following maintenance operations from time of seeding and or sodding to acceptance:
 - .1 Repair dead or bare spots to allow establishment of seed and sod prior to acceptance.
 - .2 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing shrinkage or erosion.
 - .3 Cut grass to 50 mm, a minimum of twice, when it reaches a height of 70 mm. Remove clippings.
 - .4 Fertilize seeded areas after first cutting in accordance with fertilizing program. Spread half the required amount of fertilizer in one direction and the remainder at right angles.
 - .5 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
 - .6 Where continued maintenance is required after final acceptance, commence maintenance immediately following installation of work. Continue it for one year following final acceptance at Project completion.
 - .7 Notify Departmental Representative upon completion of maintenance period to arrange inspection and transfer maintenance responsibility to Departmental Representative.
 - .8 Where Municipal (By-laws) Regulations prohibit the use of Federally or Provincially approved pesticides, and the available (alternative) non-pesticide controls are not acceptable to the Contractor, the application of pesticides to control weeds, insects, fungus and disease shall be deemed to be removed from Maintenance during Establishment Period.

3.5 ACCEPTANCE

- .1 Grassed areas will be accepted upon completion of the second mowing provided that:
 - .1 Growth is properly established.
 - .2 Area is free of bare and dead spots and 98% weed free subject to section 3.8.9.
 - .3 Minimal surface soil is visible when grass has been cut to a height of 50 mm.
- .2 Areas seeded in the fall will be accepted the following spring, one month after the start of growing season provided that acceptance conditions have been met.
- .3 Continue maintenance and mowing until acceptance.