

## **Part 1 General**

### **1.1 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
  - .2 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .3 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - .4 ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

### **1.2 DEFINITIONS**

- .1 Corrected maximum dry density is defined as:
  - .1  $D = (F1 \times D1) + (0.9 \times D2 \times F2)$
  - .2 Where: D = corrected maximum dry density kg/m<sup>3</sup>.
    - .1 F1 = fraction (decimal) of total field sample passing 19 mm sieve
    - .2 F2 = fraction (decimal) of total field sample retained on 19 mm sieve (equal to 1.00 - F1)
    - .3 D1 = maximum dry density, kg/m<sup>3</sup> of material passing mm sieve determined in accordance with Method of .
    - .4 D2 = bulk density, kg/m<sup>3</sup>, of material retained on mm sieve, equal to 1000G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.
  - .3 For free draining aggregates, determine D1 (maximum dry density) to ASTM D4253 dry method when directed by Departmental Representative.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Specification 32 11 23 Aggregate Base Courses

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 Manitoba Infrastructure and Transportation
  - .1 Manitoba Infrastructure and Transportation Construction Specification 520 – Specifications for Granular Fill [March 1986]

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Samples:
  - .1 Provide Departmental Representative with access to source and processed material for sampling.
  - .2 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.
  - .3 Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary. Move samples to storage place as directed by Departmental Representative.
  - .4 Supply new or clean sample bags or containers according appropriate to aggregate materials.
  - .5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
  - .6 Provide water, electric power and propane to Departmental Representative laboratory trailer at production site.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.
- .2 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.
- .2 The gradation and physical requirements shall be as follows:
  - .1 Passing 75 mm sieve – 100%
  - .2 Passing 75 um sieve – 0 to 15%
- .3 Flat and elongated particles of coarse aggregate: to ASTM D4791.

### **2.2 SOURCE QUALITY CONTROL**

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 2 weeks minimum before starting production.
- .2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.
- .3 Advise Departmental Representative 2 weeks minimum in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Aggregate source preparation:
  - .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as[approved by authority having jurisdiction.
  - .2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.
  - .3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
  - .4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.
  - .5 Trim off and dress slopes of waste material piles and leave site in neat condition.
  - .6 Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.
- .2 Processing:
  - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

- .2 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.
  - .1 Use methods and equipment approved in writing by Departmental Representative.
- .3 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.
- .4 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.
  - .1 Use only equipment approved in writing by Departmental Representative.
- .5 Stockpiling:
  - .1 Stockpile aggregates on site in locations as indicated. Do not stockpile on completed pavement surfaces.
  - .2 Stockpile aggregates in sufficient quantities to meet project schedules.
  - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
  - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
  - .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
  - .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.
  - .7 Stockpile materials in uniform layers of thickness as follows:
    - .1 Maximum 1.5 m for coarse aggregate and base course materials.
    - .2 Maximum 1.5 m for fine aggregate and sub-base materials.
    - .3 Maximum 1.5 m for other materials.
  - .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
  - .9 Do not cone piles or spill material over edges of piles.
  - .10 Do not use conveying stackers.
  - .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Manitoba Infrastructure and Transportation
  - .1 Manitoba Infrastructure and Transportation Construction Specification 500, Grading [January 2008]

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.2 STRIPPING OF TOPSOIL**

- .1 Ensure that procedures are conducted in accordance with applicable Provincial requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Where clearing and grubbing is required, it shall be performed in advance of topsoil excavation
- .5 Topsoil shall be removed from designated excavation and embankment areas, and shall be excavated not more than two kilometres in advance of the highway embankment being constructed.
- .6 Topsoil shall be stockpiled where it will not interfere with highway construction or drainage. Where no area is available within the right-of-way, the Contractor shall, at his own expense, provide suitable areas for stockpiling on adjacent land.
- .7 Protect stockpiles from contamination and compaction.
- .8 Dispose of unused topsoil off-site.

**3.3 PREPARATION OF GRADE**

- .1 Verify that grades are correct and notify Departmental Representative. If discrepancies occur do not begin work until instructed by Departmental Representative.

**3.4 PLACING OF TOPSOIL**

- .1 When the ditch bottoms and slopes have been trimmed, the Contractor shall load, haul and uniformly place the lesser of all or a minimum depth of 75 mm of topsoil over the slopes and ditch bottoms to the satisfaction of the Departmental Representative.
- .2 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .3 Cultivate soil following spreading procedures.

**3.5 CLEANING**

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Manitoba Infrastructure and Transportation
  - .1 Manitoba Infrastructure and Transportation Construction Specification 500, Grading [January 2008]

**1.2 EXISTING CONDITIONS**

- .1 Known underground and surface utility lines and buried objects are as indicated on site plan.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for rough grading installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

**3.2 STRIPPING OF TOPSOIL**

- .1 Ensure that procedures are conducted in accordance with applicable Provincial requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Where clearing and grubbing is required, it shall be performed in advance of topsoil excavation
- .5 Topsoil shall be removed from designated excavation and embankment areas, and shall be excavated not more than two kilometres in advance of the highway embankment being constructed.

- .6 Topsoil shall be stockpiled where it will not interfere with highway construction or drainage. Where no area is available within the right-of-way, the Contractor shall, at his own expense, provide suitable areas for stockpiling on adjacent land.
- .7 Protect stockpiles from contamination and compaction.
- .8 Dispose of unused topsoil off-site.

### **3.3 COMMON EXCAVATION**

- .1 Where clearing, grubbing, Waste Excavation and Topsoil Excavation is required, it shall be performed in advance of Common Excavation.
- .2 Ditches shall be excavated to the grades shown on the plans.
- .3 The Contractor shall not excavate beyond the staked backslopes or below the established grade unless so directed by the Departmental Representative. Unauthorized excavations below grade shall be backfilled with suitable material and compacted.
- .4 Surplus material shall be used to widen embankments, flatten slopes, or disposed of if permitted by the Departmental Representative.
- .5 Stones and boulders shall, where possible, be used in the construction of the embankment in accordance with the requirements for Highway Embankment. Where this is not possible, they shall be disposed of in accordance with the requirements for Loose Rock Disposal.

### **3.4 BORROW EXCAVATION**

- .1 Where clearing, grubbing or stripping is required, it shall be performed prior to commencing Borrow Excavation.
- .2 Cross sections will be taken on the borrow area upon completion of the clearing and grubbing operation and before stripping commences.
- .3 Borrow stripping will consist of excavating designated material, from the borrow area, which is unsuitable for construction of the highway embankment. The Departmental Representative will specify whether the stripped material shall be spread uniformly over adjacent land or stockpiled adjacent to the borrow pit. The Contractor shall give the Departmental Representative at least one working day advance notice prior to starting Borrow Excavation, and shall not commence excavation until the Departmental Representative has indicated that the necessary measurements have been taken. No payment will be made for Borrow Excavation removed before the measurements have been taken.
- .4 Haul roads to borrow pits shall be constructed by the Contractor on a location and to a standard approved by the Departmental Representative. when the Borrow Excavation has been completed, the Contractor shall remove the haul road, and trim and clean the haul road area. Material not so utilized shall be disposed of in the borrow pit after final measurements have been taken of the pit area.
- .5 The borrow pit shall be excavated as uniformly as possible to the depths and within the limits as staked by the Departmental Representative. Side slopes shall be maintained at a slope of 4:1, unless otherwise permitted or directed. The Contractor shall level and trim the borrow pit when the excavation has been completed.



- .6 Stones and boulders not approved for placement in the highway embankment shall be stockpiled in the borrow pit and subsequently buried.
- .7 Stripping which has been stockpiled adjacent to the borrow pit shall be uniformly placed over the slopes and bottom of the borrow pit.
- .8 In the event that livestock is enclosed in an area from which borrow excavation is to be removed, the Contractor shall be responsible for ensuring that the livestock does not leave the enclosure via his entrance to the borrow area during the period of time that he is hauling material. The Contractor shall re-erect gates or fences in a good and workmanlike manner during each period of time that he ceases hauling operations.

### **3.5 LOOSE ROCK DISPOSAL**

- .1 Stones and boulders in piles or windrows, and surface boulders, shall be disposed of in advance of excavation operations.
- .2 Loose rock shall be disposed of at locations permitted by the Departmental Representative.
- .3 Inside the Right-of-Way
  - .1 When directed by the Departmental Representative the Contractor shall load, haul and uniformly distribute the loose rock as a base for the embankment; otherwise loose rock shall be buried in trenches, preferably not below the proposed ditch bottom nor in areas which will interfere with future highway widening. The Departmental Representative will not direct the Contractor to haul loose rock further than one kilometre beyond its original position.
- .4 In Borrow Pits
  - .1 Loose rock shall be buried in trenches, windrowed in neat uniform piles or covered with topsoil.
- .5 In Disposal Areas provided by the Contractor
  - .1 When there is no practical site available for burying loose rock within the right-of-way, the Contractor shall make provision for disposing of loose rock on adjacent property, at least 30 m beyond the limits of the highway right-of-way. The loose rock shall be buried unless otherwise permitted by the Departmental Representative.
  - .2 Permission to bury loose rock shall be obtained, in writing from the owner of the property. The Contractor shall provide the Departmental Representative with a copy of the written permission.
  - .3 The Departmental Representative will allow the Contractor to haul loose rock a distance greater than one kilometre providing the disposal area is approved.
  - .4 Stones and boulders brought to the surface during excavation operations which can satisfactorily be incorporated into the highway embankment during normal grading operations will not be classified as Loose Rock Disposal.
  - .5 Surplus stones and boulders, which cannot be satisfactorily incorporated into the highway embankment will be classified as Loose Rock Disposal, which will include the removal of stones from slopes and ditch bottoms during trimming operations.

- .6 Surface boulders on excavation areas, and on areas designated by the Departmental Representative, shall be placed in stockpiles or in trenches to facilitate their measurement.

### **3.6 WASTE EXCAVATION**

- .1 Waste shall be removed from excavation and embankment areas in advance of constructing the highway embankment.
- .2 When constructing the highway embankment through the waste section, the Contractor shall have equipment available to remove unsuitable material, which may accumulate or be pushed in front of the embankment as work progresses. The equipment shall be capable of moving the unsuitable material from the waste cut to the spoil banks without trapping any unsuitable material in the highway embankment.
- .3 The excavated waste material shall be piled or windrowed on designated areas within the right-of-way. Stones and boulders excavated from waste areas shall be disposed of in the waste piles. Openings shall be left in the waste piles for all natural drainage, but in no case shall drainage openings be farther than 150 m apart.
- .4 The waste piles shall be levelled, with sides sloped at approximately 3:1, so that the final result is a reasonably smooth pile which blends in well with the surrounding terrain.

### **3.7 OFFTAKE EXCAVATION**

- .1 Where clearing is required it shall be performed prior to commencing offtake excavation.
- .2 The Contractor shall not commence Offtake Excavation in an area until the Departmental Representative has indicated that the necessary measurements have been taken.
- .3 Offtake Excavation shall include the removal of roots, stumps, stones and other objectionable material in the slopes or bottoms of the offtake ditch. Excavated material shall be spread adjacent to the offtake ditch.
- .4 Where backfill is required to obtain the necessary grade or cross-section, only material approved by the Departmental Representative shall be used.

**END OF SECTION**

## **Part 1            General**

### **1.1            REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .2 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.
  - .3 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .4 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .1 Manitoba Infrastructure and Transportation
  - .1 Manitoba Infrastructure and Transportation Construction Specification 510, Specifications for Boulevard Earth Fill [March 1986]
  - .2 Manitoba Infrastructure and Transportation Construction Specification 520, Specifications for Granular Fill [March 1986]

### **1.2            DEFINITIONS**

- .1 Rock Excavation: excavation of solid materials in excess of 1.00 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment.
- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation
- .3 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .4 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .5 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .6 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .7 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .8 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

- .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422: Sieve sizes to CAN/CGSB-8.2.

.2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 – 100
0.02 mm	10 - 80
0.005 mm	0 - 45

- .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

- .9 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Preconstruction Submittals:

- .1 Submit records of underground utility locates, indicating: clearance record from utility authority.

.2 Samples:

- .1 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
- .2 Submit 20 kg samples of fill.

### 1.4 EXISTING CONDITIONS

.1 Examine soil report.

.2 Buried services:

- .1 Before commencing work establish location of buried services on and adjacent to site.
- .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
- .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
- .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
- .5 Prior to beginning excavation Work, notify applicable Departmental Representative and establish location and state of use of buried utilities and structures.
- .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
- .7 Record location of maintained, re-routed and abandoned underground lines.
- .8 Confirm locations of recent excavations adjacent to area of excavation.

.3 Existing buildings and surface features:

- .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
- .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Type 1 and Type 2 fill: properties to the following requirements:
  - .1 Crushed, pit run or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.2.
  - .3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100]	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

## **Part 3 Execution**

### **3.1 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

### **3.2 PREPARATION/PROTECTION**

- .1 Keep excavations clean, free of standing water, and loose soil.

- .2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .4 Protect buried services that are required to remain undisturbed.

### **3.3 COFFERDAMS, SHORING, BRACING AND UNDERPINNING**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Health and Safety Act for the Province of Manitoba.
- .2 During backfill operation:
  - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
  - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
  - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .3 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .4 Upon completion of substructure construction:
  - .1 Remove cofferdams, shoring and bracing.
  - .2 Remove excess materials from site and restore watercourses.

### **3.4 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in manner not detrimental to public and private property, or portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

### **3.5 EXCAVATION**

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Excavation must not interfere with bearing capacity of adjacent foundations.

- .3 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .4 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .5 Restrict vehicle operations directly adjacent to open trenches.
- .6 Dispose of surplus and unsuitable excavated material in approved location on site.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Notify Departmental Representative when bottom of excavation is reached.
- .10 Obtain Departmental Representative approval of completed excavation.
- .11 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .12 Correct unauthorized over-excavation as follows:
  - .1 Fill under areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
- .13 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
  - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

### **3.6 FILL TYPES AND COMPACTION**

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.
  - .1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95% of corrected maximum dry density.
  - .2 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100 %.

### **3.7 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

### **3.8 BACKFILLING**

- .1 Do not proceed with backfilling operations until completion of following:
  - .1 Inspection, testing, approval, and recording location of underground utilities.
  - .2 Removal of concrete formwork.

- .3 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 300 mm.

**END OF SECTION**



## **Part 1 General**

### **1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM D698-[07ea1], Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
- .2 American Association of State Highway and Transportation Officials (AASHTO)
  - .1 AASHTO T99-[10], Standard Method of test for Moisture-Density Relations of Soils Using a 2.5 kg (5.5lb) Rammer and 305 mm (12 in) Drop.
- .3 Manitoba Infrastructure and Transportation
  - .1 Manitoba Infrastructure and Transportation Construction Specification 500, Grading [January 2008]

### **1.2 DEFINITIONS**

- .1 Rock Excavation: excavation of:
  - .1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort with a Caterpillar D9 crawler bulldozer or equivalent to be considered integral with parent mass.
  - .2 Boulder or rock fragments measuring in volume [1] cubic metre or more.
- .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.
- .3 Unclassified Excavation: excavation of whatever character other than stripping encountered in the Work.
- .4 Free Haul: distance that excavated material is hauled without compensation. Free haul distance to be [0.5] km or less.
- .5 Stripping: excavation of organic material covering original ground.
- .6 Over Haul: authorized hauling in excess of free haul distance that excavated material is moved.
- .7 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
- .8 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
- .9 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.
- .10 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

### **1.3 QUALITY ASSURANCE**

- .1 Regulatory Requirements:

- .1 Adhere to regulations of authority having jurisdiction when blasting is required.
- .2 Adhere to Provincial and National Environmental requirements when toxic materials are involved.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work:
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

**3.2 COMPACTION EQUIPMENT**

- .1 The Contractor shall supply at least one appropriate compaction unit and one motor grader in each work area where embankment is being placed. The compaction equipment shall be appropriate for the type and quantity of material being compacted and capable of achieving the specified density.
- .2 The size and number of motor graders shall be sufficient to complement the compaction and earth moving equipment. The equipment shall be on site and in good operating condition before placement of embankment in any work area will be permitted. Hauling equipment will not be accepted as a substitute for compaction equipment on other than Rock Embankments

**3.3 WATER DISTRIBUTORS**

- .1 The Contractor shall supply and spray water on the highway embankment when additional moisture is required to achieve the specified density, and when requested by the Departmental Representative, for other purposes.
- .2 Water shall be supplied in motor propelled units equipped with a spray bar at least 1.8 m long, capable of spraying at a uniform rate. The on-off valve on the spray bar shall be controllable from the operator's position. The number and capacity of watering units shall be sufficient to ensure the required moisture content of the embankment is attained at the time of compaction.

**3.4 PREPARING EXISTING GROUND SURFACE**

- .1 Areas on which preparation is to be performed will be as designated by the Departmental Representative.

- .2 Where clearing, grubbing, removing peat, topsoil and other unsuitable material is required, it shall be performed in accordance with the applicable specifications prior to the placement of embankment material.
- .3 A subcut is an excavation below existing ground level, into which material is backfilled to form the required embankment. Subcuts shall be excavated to the depth staked by the Departmental Representative which shall, in general, be 600 mm below the design grade line. Where unsuitable material is encountered it shall be excavated below the subcut level and disposed of. The Contractor shall ensure that the base of the subcut is sufficiently stable to accommodate compaction of the first lift of fill to a minimum of 95% AASHTO standard dry density. Approved material used to backfill subcuts shall be placed in accordance with the requirements for Placing Embankment Material.
- .4 Material removed from or below the design subcut, if suitable, shall be used for construction of the embankment and will be classified as "Common Excavation". Unsuitable material will be classified as "Waste Excavation".
- .5 Subcut excavation volumes will be determined using the design or revised subcut elevation against construction cross sections taken after stripping.
- .6 Where the proposed embankment crosses an existing road, drainage channel or other unevenness, the Contractor shall perform operations such as waste excavation, benching and subcutting in order to prevent differential settlements and to attain uniform compaction.

### **3.5 WIDENING EXISTING EMBANKMENTS**

- .1 Wherever practical, embankment widening operations shall be restricted to one side of the highway and limited to a construction area of the shortest possible length.
- .2 The Contractor shall take precautions to preserve the existing shoulder gravel so that it is not removed from its original position nor contaminated with non-granular material.
- .3 Prior to commencing grade widening the Contractor shall strip the sod from the existing slopes and windrow it outside of the proposed grade slopes. The sod shall be spread over the slopes upon completion of the widening or disposed of within the right-of-way.
- .4 Where materials are hauled across existing highway pavements or base courses, earth bridges shall be constructed as permitted or directed by the Departmental Representative. The earth bridge shall be constructed of stable material, at right angles to the centerline of the existing road, at least 300 mm in depth, 5 m in width and having traffic ramps flatter than 6:1. The earth bridge shall be maintained so that it remains stable and retains its original constructed shape while in use. Each earth bridge shall be protected by warning signs and two flagmen as long as it is in existence.
- .5 Earth bridges will be permitted only during daylight hours. They shall be removed, and the highway surface cleaned, before sunset.
- .6 Bench Cuts
  - .1 Bench cuts shall consist of excavating horizontal cuts into the slopes of the existing highway embankment prior to placing widening material thereon. Bench cuts shall be made at vertical intervals of 1.0 m, with the base of the initial bench cut being approximately 0.5 m above the toe of the existing slope. The base of each bench cut shall extend into the existing slope a minimum of 2 m. Suitable

material resulting from the bench cut shall be incorporated and compacted into the new embankment. Unsuitable material shall be disposed of offsite.

- .2 The Contractor shall ensure that the base of the bench cut is sufficiently stable to accommodate compaction of the first lift of fill thereon to a minimum of 95% AASHTO standard dry density.

### **3.6 EMBANKMENT MATERIAL**

- .1 The embankment shall be constructed from approved excavation material classified as Common, Borrow, Composite or Solid Rock Excavation.
- .2 Placing Common, Borrow or Composite Excavation Material
  - .1 In general, embankment material shall be placed in uniform full width layers to a maximum depth of 200 mm prior to compaction. Material having less than 20% passing the 75 um sieve may, when approved by the Departmental Representative, be placed in uniform layers up to 500 mm in depth prior to compaction. Non-uniform material shall be blended in each layer by manipulating the material with a motor grader or other approved equipment. Each layer shall be bladed smooth with a motor grader and crowned to permit drainage prior to compaction
  - .2 Each layer shall be compacted until the density has reached a minimum of 95% AASHTO standard dry density.
  - .3 The compaction of silty material shall be performed when its moisture content is at or less than optimum. For the purposes of this Specification, silty material will be considered as that material which has a plasticity index of 20 or less, with more than 20% of the soil particles passing the 75 um sieve.
  - .4 The compaction of other than silty material shall be performed when its moisture content is in the optimum range.
  - .5 The specified moisture shall be achieved by discing or scarifying wet material to reduce the moisture content, or, applying water to dry material to increase the moisture content.
  - .6 Stones and boulders may be used in the embankment, provided they are well distributed and evenly mixed with sufficient other materials so as to produce a compact embankment, subject to the following restrictions:
    - .1 Stones over 100 mm in diameter will not be permitted in the construction of the upper 300 mm of the embankment
    - .2 Below the upper 300 mm of the embankment, stones and boulders shall not have a vertical dimension exceeding one-third the height of the embankment remaining to be constructed.
    - .3 Stones and boulders shall not project beyond the design slope line.
    - .4 Subject to (a) above, shale shall be reduced to a maximum dimension of 150 mm prior to placing it in the highway embankment.
  - .7 When constructing an embankment through a wet unstable area, the Departmental Representative may waive the requirement for layer construction until the height of the embankment is sufficient to bear the weight of the construction equipment. The embankment shall be constructed in such a manner that unstable material is not incorporated into the embankment.

.3 In Situ Moisture

- .1 In the event that the in situ moisture at a depth measured 150 mm below the surface of excavation areas used for embankment material or at the base of subcuts exceeds the
  - .1 Optimum moisture by more than 5% in the case of silty materials or
  - .2 Optimum moisture range by more than 2% for excavation materials having a plasticity index ranging from 21 - 40; or
  - .3 Optimum moisture range by more than 4% for excavation materials having a plasticity index greater than 40,
- .2 The material to be excavated will be considered to be excessively wet and the Departmental Representative may approve one of the following options:
  - .1 Classify the material as Waste Excavation.
  - .2 Incorporation of lime into the embankment.
  - .3 Other methods as may be mutually agreed upon.

.4 Placing Solid Rock Excavation Material

- .1 When Solid Rock Excavation material is placed, the requirement for layer construction may be waived by the Departmental Representative. The embankment shall be constructed by end-dumping, which shall consist of dumping material near the end of the grade and pushing the material forward over the end of the embankment with a bulldozer or similar equipment. This procedure shall be performed in such a manner that larger rocks are well distributed and the intervening spaces are filled with smaller sizes and fines to form a stable embankment and provide a dense surface.
- .2 The maximum vertical dimension of rock which may be placed in the embankment shall not exceed one-third the height of the fill remaining to be placed. The embankment shall be constructed to full width and true to cross-section as work progresses. No dumping over the sides of the embankment will be permitted. Rock embankments shall be compacted by routing the loaded construction equipment over the entire width of the embankment.
- .3 Rock embankments placed on an unstable base shall be constructed so that the centre of the advancing end of the embankment fill is out in advance of the shoulders. Slopes shall be constructed to the natural angle of repose.

**3.7 TRIMMING**

- .1 Trimming within the right-of-way prior to final cross sectioning and after placing topsoil shall commence immediately after embankment construction, and completed trimming shall not be more than 3 km behind the constructed embankment.
- .2 Areas within the right-of-way which have been newly constructed, or which have been disturbed due to construction, shall be trimmed to a smooth surface and maintained to the specified elevation and cross-section until final acceptance of the work. As a final trimming operation the areas shall be harrowed. Stumps and foreign debris collected during trimming shall be removed and disposed of by the Contractor.
- .3 Stones collected during trimming shall be disposed of in accordance with the requirements for Loose Rock Disposal.

**3.8 PROTECTION**

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by Departmental Representative.
- .2 Provide silt fences and erosion protection as required to mitigate and prevent impacts to adjacent properties.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Specification 32 11 23 Aggregate Base Courses
- .2 Specification 31 37 00 Rip-Rap

**1.2 REFERENCES**

- .1 Manitoba Infrastructure and Transportation
  - .1 Manitoba Infrastructure and Transportation Construction Specification 1295, Specifications for Supply and Installation of Geotextile Fabric [June 2000]
  - .2 Manitoba Infrastructure Approved Products List for Grading and Surfacing Products - <http://www.gov.mb.ca/mit/mateng/product.html>

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect geotextiles from direct sunlight and UV rays.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 APPROVED PRODUCTS**

- .1 Use only those products found within Manitoba Infrastructure's Approved Products List for Grading and Surfacing Products.

**Part 3 Execution**

**3.1 SEPARATION / REINFORCEMENT GEOTEXTILE**

- .1 Surface Preparation
  - .1 Prepare the surface, in advance of placing the geotextile, achieving a smooth, even surface, clear of any aggregates or debris, and construct to the crosssection and profile indicated.
- .2 Geotextile Placement

- .1 Roll the geotextile onto the roadway free of wrinkles, rolls, or bulges. Sew all seams by an approved method or overlap a minimum of 500 mm.
  - .2 The geotextile shall not be dragged across the roadway. Geotextile shall not be rolled out more than 40 m ahead of the placement of the fill material and shall be overlapped both side to side and end to end in the direction of the fill material placement. Maintain the required width of geotextile and minimum overlap.
  - .3 Should the roadway be required to remain open, installation of the geotextile shall be on one-half of the roadway at a time.
- .3 Damage to Geotextile
- .1 If the geotextile is damaged, torn, or punctured during installation or placement of the fill material, the damaged section shall be repaired. The damaged section shall be exposed and a patch of geotextile placed over the damaged section. Where the patch is not sewn it shall be large enough to overlap 500 mm onto the undamaged geotextile. Any fill material on the damaged area shall be replaced and compacted to the required standard.
  - .2 Fill material shall be placed, spread, and compacted on the geotextile. End-dump fill material onto the ground in front of the leading edge of the geotextile and level using a track type dozer to a uniform lift thickness of no less than 150 mm. Achieve initial compaction by walking a track dozer over the lift. Subsequent loads shall be dumped onto previously spread fill material. Dumping of fill material directly on the geotextile will not be permitted. The use of “bellydump” type trucks or any other vehicles will not be allowed on the geotextile.

### **3.2 GEOTEXTILE UNDER RIP-RAP**

- .1 Surface Preparation
  - .1 The ground surface shall be shaped neatly and trimmed to the lines as shown.
- .2 Geotextile Placement
  - .1 The geotextile shall be placed and temporarily anchored in such a manner that placement of the riprap will not excessively stretch or tear the fabric and such that seam overlaps will be maintained. Stones, staples or steel pins with washers shall be used as necessary to temporarily anchor the geotextile.
  - .2 All seams shall be sewn by an approved method or overlapped a minimum of 500 mm in the direction of the flow of water (shingle style).
  - .3 Terminal sides and ends of the geotextile shall be anchored as shown.
  - .4 Riprap shall be placed on the geotextile in such a manner that the geotextile is not damaged, torn, excessively stretched, or punctured. Any geotextile damaged during installation or placement of the riprap shall be repaired. The damaged section shall be exposed and a patch of geotextile placed over the damaged section. The patch shall be large enough to be sewn, or, overlapped 500 mm onto the undamaged geotextile.
  - .5 Riprap placement shall begin at the toe and shall proceed up the slope.

**END OF SECTION**



## **Part 1 General**

### **1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C535, Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - .2 ASTM C88, Standard Specification for Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- .2 Manitoba Infrastructure and Transportation
  - .1 Manitoba Infrastructure and Transportation Construction Specification 1297, Specifications for Stone Rip-Rap [July 2003]

## **Part 2 Products**

### **2.1 STONE RIP-RAP QUALITY**

- .1 The Contractor shall supply field stone, quarried rock, or quarried limestone which is dense, durable, sound, resistant to the action of water and frost, and suitable in all respects for the purpose intended. Stone rip-rap shall be free from sod, roots, organic material and debris prior to placement. Individual pieces of stone shall be free of defects such as seams or cracks that would cause rapid or excessive deterioration or degradation.
- .2 Quarried limestone shall have a maximum Los Angeles Abrasion Loss of 32% (ASTM C535) and a maximum Magnesium Sulphate Soundness Loss of 13% (ASTM C88).
- .3 Representative sample limestone, from the intended source, crushed to maximum 75 mm aggregate size, shall be supplied by the Contractor to the Departmental Representative for approval a minimum of two weeks prior to its use

### **2.2 STONE RIP-RAP GRADATION**

- .1 The stone rip-rap shall be well graded having a full range and even distribution of sizes and shall conform to the following gradation:

SIZE Smaller than (mm)	CLASS 600	CLASS 450	CLASS 350
600	100%		
450		100%	
350	15-50%		100%
250		15-50%	
200	0-15%		15-50%
150		0-15%	
100			0-15%

TABLE 1: STONE RIP-RAP GRADATION

- .2 Dependent on conditions and provided there is no additional cost to the department, the Departmental Representative may accept a larger size of stone rip-rap than what is called for on the tender bid page.

**Part 3            Execution**

**3.1                PREPARATION OF BED**

- .1        The ground surface shall be excavated and neatly shaped to the lines as shown on the plans prior to the placing of any rip-rap.
- .2        The supply and installation of any geotextile, granular filter, and/or bedding material shown on the plans shall be according to their respective specifications.

**3.2                PLACING OF STONE RIP-RAP**

- .1        The stone rip-rap shall be dumped or placed in such a manner that the larger stones are uniformly distributed, the smaller rocks serve to fill the spaces between the larger stones, and that excessive segregation of the various stone sizes does not occur.
- .2        Sufficient placing and leveling shall be done to produce a firmly bedded neat and uniform surface conforming to the thickness, shape, and dimensions shown on the plans

**END OF SECTION**