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## 2.3 GRADING

### 2.3.1 GENERAL

#### 2.3.1.1 **Description**

Grading shall consist of the excavation of soil materials, the salvage of select soil materials, and the construction of embankment. In general, grading shall include the removal and/or satisfactory placement of all materials necessary for the construction and preparation of embankment, slopes, drainage works and connections to the required alignment, grade and cross-section shown on the plans, or as directed by the Consultant. It shall include the excavation for culverts, underdrains, and foundation pits for bridges, trestles, buildings and other structures.

#### 2.3.1.2 **Dimensions of Excavations and Embankments**

The dimensions of the excavations and embankments shall be, generally, in accordance with the typical sections accompanying these specifications, but the dimensions of any or all excavations and embankments may be increased or decreased at any time by the Consultant as conditions and circumstances may determine.

### 2.3.2 MATERIALS

#### 2.3.2.1 **Approval of Materials**

All materials used in embankments, back-filling, or for any other purpose, shall be subject to the approval of the Consultant. All suitable material from excavations shall be used in forming embankments or shall be otherwise disposed of as the Consultant may direct.

#### 2.3.2.2 **Unsuitable Materials**

Surface soil, vegetation or any other material unsuitable for the construction of the embankment shall be excavated and salvaged or disposed of in accordance with the specifications.

#### 2.3.2.3 **Reservation of Materials**

Whenever gravel, stone or other material suitable for special use by the Department is found, the same shall, if required, be reserved and deposited in suitable places along the right-of-way, or at locations as directed by the Consultant.

#### 2.3.2.4 **Soil Materials**

The uppermost layers of soil both inside or outside the right-of-way may consist of any or all of the following:

- Topsoil is the uppermost layer of soil that:
  - (i) contains the majority of plant roots
  - (ii) is normally referred to as the plough layer in agriculture soils
  - (iii) is typically darker in colour than the subsoil layer.

- Subsoil is the layer of soil directly below the topsoil layer that:
  - (i) contains the lower portion of the root zone
  - (ii) is typically lighter in colour than the topsoil layer.
- Normally, overburden is that portion of soil material that lies between the subsoil and the material generally utilized for road construction purposes.

### 2.3.3 CLASSES OF EXCAVATION

All excavation, for whatever purpose, will be classified as follows:

#### 2.3.3.1 **Solid Rock Excavation**

Solid Rock Excavation shall include the removal from their original position of rock in solid beds or masses, and boulders or detached rock having a volume of one half cubic metre content or more; and placing, disposing or stockpiling of the materials as directed by the Consultant.

#### 2.3.3.2 **Channel Excavation**

Channel Excavation shall include the excavation and placing of material excavated for the improvement of existing water courses, stream diversions, and off-set muskeg drainage ditches located parallel to the roadway and not forming the normal contiguous roadway ditch. Excavation for a ditch section which is adjoining the roadway embankment shall not be classed as channel excavation.

Channel Excavation shall include material excavated for the installation of culverts down to the culvert invert elevation, and will also include sub-excavation for culvert base construction. In cut sections, channel excavation shall only be that material excavated for culvert installation subsequent to undercut excavation as shown on the drawings. In fill sections, channel excavation shall only be that material excavated below original ground unless otherwise directed by the Consultant.

Channel Excavation shall also include any material trench excavated for the installation of perforated pipe sub-drains.

Any material excavated during channel excavation operations which meets the specification for Solid Rock Excavation, as described in Section 2.3.3.1, shall be so classified.

#### 2.3.3.3 **Common Excavation**

Common Excavation shall include the excavation and placing of all material not covered by the specifications for solid rock, borrow, borrow topsoil and channel excavation.

#### 2.3.3.4 **Borrow Topsoil Excavation**

Borrow Topsoil Excavation shall consist of the excavation and salvage of topsoil, subsoil and overburden from borrow areas and borrow pit haul roads. Such material excavated from a stockpile and redistributed on borrow areas and borrow pit haul roads shall also be classified as "Borrow Topsoil Excavation".

**2.3.3.5 Borrow Excavation**

Borrow Excavation shall consist of the excavation and placing of suitable material obtained from locations outside the right-of-way.

Excavation of roadways, roadway ditches and slopes thereof, in accordance with the typical drawings and/or as noted in the Special Provisions, either inside or outside of the right-of-way, will not be classified as Borrow Excavation.

When the Consultant directs that a roadway excavation be widened from that shown on the typical drawings or as noted in the Special Provisions, for the purpose of obtaining additional material, the material excavated outside the right-of-way will be classified as Common Excavation.

**2.3.3.6 Common and/or Borrow Excavation Loaded to Trucks**

Common and/or Borrow Excavation Loaded to Trucks shall consist of the excavating, loading to trucks and placing of material obtained from locations inside the right-of-way or borrow areas.

**2.3.4 CONSTRUCTION****2.3.4.1 General Requirements****2.3.4.1.1 Restraining of Livestock**

The Contractor shall erect and maintain such temporary fences as may be required to prevent livestock or other animals from straying upon the right-of-way or adjoining property or upon borrow area perimeters. He shall at all times provide against the escape of livestock or other animals through openings made by him in right-of-way or other fences.

**2.3.4.1.2 Towing Traffic**

Where necessary during grading operations, the Contractor shall, upon orders in writing from the Consultant, provide sufficient men and equipment to tow vehicular traffic through the Work. The amount and type of equipment to be used in towing traffic will be stipulated and approved in the orders by the Consultant. The Contractor shall be responsible for any damage caused by such towing.

**2.3.4.1.3 Equipment Operation on Paved Surfaces**

Where the location of excavation material necessitates the hauling across or on an existing paved roadway the operation shall be carried out as follows:

- (i) Haul across an existing roadway shall be limited to a single equipment crossing point for each borrow site approved by the Consultant.
- (ii) Where haul across a road is by conventional earth moving equipment, an earth pad or steel plates of sufficient dimensions shall be placed on the existing road surface so that no damage to the highway surface or roadbed is incurred. Steel plates may remain in place throughout the use of the crossings. Earth pads shall be placed no sooner than daybreak and removed no later than sunset each day that haul operations are in progress.
- (iii) Where haul along or across a road is undertaken by trucks, the prevalent load limit restrictions for haul

along roadways or over bridges shall apply. Haul of excavation material on the existing roadway will only be permitted until completion of sufficient new grade.

- (iv) Under no circumstances shall regular grading equipment be allowed to operate on the existing highway surface or use the highway surface as a haul road.
- (v) Dust abatement material shall be applied as directed by the Consultant.

Repair of any damage incurred in the pavement or subgrade structure, as a result of the haul operations, shall be the sole responsibility of the Contractor. The damage shall be repaired and the surface restored to a condition equivalent to that which existed prior to the commencement of haul operations.

#### 2.3.4.1.4 Preservation of Survey Monuments

The Contractor shall preserve all survey monuments and property marks along and adjacent to the roadway. He shall use suitable precautions to protect from damage or disturbance such survey monuments and property marks until their location has been witnessed, or otherwise referenced, and he shall not remove them until directed by the Consultant.

#### 2.3.4.1.5 Slides

All material in slips, slides and subsidences shall be removed by the Contractor and either properly disposed of or used in the Work.

#### 2.3.4.1.6 Construction, Surfacing, Maintenance And Removal Of Staged Construction

Sections of new highway which are used for traffic operation prior to the application of base course shall conform to the permanent grade section, with temporary connections constructed at the end points as required. Immediately upon completion of the grading (or in the case of an alignment revision, immediately prior to instituting traffic thereon), the roadway shall be gravel surfaced and sprayed with asphalt or other dust abatement material. The Contractor shall be responsible for continuously maintaining the surface in a satisfactory bladed and dust-free condition until the application of the base course.

As practical and where directed by the Consultant, the material removed from the temporary connections shall be utilized for grade construction.

#### 2.3.4.2 **Solid Rock Excavation**

##### 2.3.4.2.1 Rock Cuts

All rock cuts shall be excavated to below grade and then backfilled to grade with suitable material, as directed by the Consultant.

In solid rock cuts, where pockets which will not drain are formed below the design roadway elevation by blasting, the Contractor shall, at his own expense, provide drainage by ditching to a free outlet, as ordered, and backfilling both the pockets and the trench to an elevation 0.30 m below profile grade with broken rock or coarse gravel.

##### 2.3.4.2.2 Overbreak

Overbreak will be considered as that portion of rock which is excavated, displaced or loosened outside and beyond the slopes or grade as established by the Consultant, regardless of whether any such overbreak is due to blasting,

to the inherent character of any formation encountered, or to any other cause.

If any rock slide occurs as a result of overbreak, all slide debris will be considered as overbreak.

Overbreak shall be removed by the Contractor at the direction of the Consultant. Such overbreak may, as approved by the Consultant, be used to replace material which would otherwise have to be obtained from other sources.

#### 2.3.4.2.3 Pre-Shearing

Where the Consultant so directs, the Contractor shall pre-shear rock faces to minimize overbreak and produce a stable slope.

#### 2.3.4.2.4 Trimming Rock Slopes

Slopes undercut at the base, or destroyed in any manner by act of the Contractor, shall be resloped by the Contractor at his own expense to the slope as staked by the Consultant.

In solid rock excavation the slopes must be carefully scaled down, and all rocks and fragments likely to slide or roll down the slopes removed to the satisfaction of the Consultant.

#### 2.3.4.3 **Catch Water Ditches**

Catch water ditches shall be constructed in accordance with the typical plans, where shown on the profile drawings and/or where designated by the Consultant. In the case of a catch water ditch along the top of an excavation, the Consultant may require that the catch water ditch be constructed prior to commencement of excavation.

#### 2.3.4.4 **Common Excavation**

All topsoil in disturbed areas or to the limits shown in the special provisions or as directed by the Consultant, shall be salvaged for reuse. Any required stockpiling of topsoil material shall be performed to minimize topsoil losses and contamination of the topsoil and surrounding materials, using methods and at locations as approved by the Consultant.

Subsoil in disturbed areas or to the limits shown in the special provisions or as directed by the Consultant, shall be excavated and salvaged, disposed of or utilized as directed by the Consultant.

Generally, overburden within the right-of-way shall not be salvaged. Such material shall be utilized or disposed of as directed by the Consultant.

All other material shall be excavated to the extent specified herein and as shown on the plans, or as directed by the Consultant; and shall be utilized for embankment or disposed of as directed by the Consultant.

#### 2.3.4.5 **Borrow Topsoil Excavation**

All topsoil, subsoil and overburden materials from borrow and borrow haul road areas shall be separately excavated, salvaged, stockpiled and reused in accordance with the requirements for development and reclamation of borrow areas specified in Section 2.3.4.6, Borrow Excavation.

2.3.4.6 **Borrow Excavation**2.3.4.6.1 General

The borrowing of materials for embankment will be allowed only after all roadway excavations have been completed and hauled into the embankment, or after all the economic possibilities of obtaining further material by the widening of roadway excavations or ditches have been exhausted.

Borrow areas will be entered only with the approval and permission of the Consultant. They shall be regular in width and, if required, shall be connected with ditches and drained to the nearest watercourse. Particular care shall be taken to work the area so as to cause a minimum of damage and inconvenience to the land owner. On completion of the Work, borrow areas shall be trimmed and left in a neat and uniform condition, as directed by the Consultant. The Contractor shall not operate or park equipment in the borrow locations outside of the limits of the actual borrow area, haul roads or stockpile sites. Any areas compacted or otherwise affected by the Contractor's operations shall be restored to original condition.

Borrow areas will be staked out and cross-sectioned by the Consultant before the Contractor begins work therein. Any material excavated from borrow areas previous to measurement will not be paid for.

The borrow locations as shown on the drawings may be subject to revisions, additions or deletions at the discretion of the Consultant. The Contractor shall be prepared to accept such borrow location arrangements as will ultimately be made by the Consultant and shall have no claim against the Department on this account. Changes in borrow locations, as directed by the Consultant, could result in the required use of soil of undetermined characteristics, and may also affect the equipment fleet required to undertake the Work, as well as the quantities associated with the Work.

When the construction of access roads to borrow areas is required, the location and dimensions of the access roads shall be approved by the Consultant.

2.3.4.6.2 Approval, General Operations and Notification Requirements

The Department may obtain the required approval for borrow pit operations associated with the project as shown in the special provisions. Any excavation operations outside the limits of these approvals or when the Department has not obtained approvals, will require the Contractor to obtain all necessary approvals from the local Reclamation Inspector of Alberta Environmental Protection. In that case, all references made in this section to "the Consultant" shall mean "the Reclamation Inspector."

The Contractor shall inform the Consultant at least ten days before starting:

- (i) annual pit activities or operations;
- (ii) any salvage of topsoil or subsoil materials;
- (iii) any replacement of topsoil or subsoil materials; and

shall ensure that an approval amendment from Alberta Environment Protection has been obtained prior to making any major changes or revisions that affect the activities and operations described in the original approval or alternately shall ensure that the Reclamation Inspector has given approval to any minor revisions or changes affecting activities and operations and equivalent land capabilities.

Any agreements between the Contractor and the landowner to modify the approved plan shall be in writing and



a copy provided to the Consultant and the Reclamation Inspector.

#### 2.3.4.6.3 Conservation of Topsoil, Subsoil and Overburden on Borrow Areas and Stockpile Sites

The Contractor shall excavate, salvage and stockpile the topsoil, subsoil and overburden in a manner which prevents contamination of one material with another. A minimum distance of 1 m is required between stockpiles of different materials. The materials shall be stockpiled separately in a safe, stable and accessible location as approved by the Consultant.

If topsoil is to be stockpiled for periods exceeding 3 months or when directed by the Consultant, the Contractor shall protect the stockpile from wind erosion by applying an approved seed mixture or other approved biodegradable soil stabilizer.

The Contractor shall suspend the excavation, salvage and stockpiling of topsoil and subsoil materials when wet, frozen or other adverse conditions are encountered. These operations shall remain suspended until field conditions improve or the Consultant approves alternate procedures.

The Contractor shall not construct stockpiles at locations where they are subject to erosion. He shall maintain erosion and drainage control in the vicinity of all borrow pits and stockpiles to the satisfaction of the Consultant and shall ensure that surface drainage does not adversely affect adjacent lands or future reclamation operations.

#### 2.3.4.6.4 Buffer Zones

The Contractor shall ensure an undisturbed buffer zone exists between the disturbed borrow areas and adjacent land and permanent structures. For property boundaries, road allowances and permanent structures, normal buffer zones shall be 3 m or equal to the depth of excavation whichever is greater.

Dugout borrows shall be a minimum of 40 m from the right-of-way or 70 m from the highway centreline; whichever is greater. For watercourses or waterbodies a minimum 30 m wide buffer is required.

Extended buffers shall be implemented where local conditions dictate.

#### 2.3.4.6.5 Reclamation

##### 2.3.4.6.5.1 General

The Contractor shall reclaim borrow and borrow pit haul road areas in accordance with the applicable legislation, the approval, the requirements of the specifications and as directed by the Consultant.

Borrow reclamation shall be performed as soon as possible after completion of excavation operations in any borrow area and will not be permitted to be carried over into the year of the next growing season. Notwithstanding the requirement for expeditious reclamation of borrows, reclamation shall not be carried out if, in the opinion of the Consultant, there is insufficient time left in the season to allow vegetation to root and minimize soil erosion of the reclaimed areas.

##### 2.3.4.6.5.2 General Reclamation Conditions For Landscape Borrows or Disturbed Areas Around Dugouts, Borrow Haul Roads and Stockpile Sites

Upon completion of the excavation operations, the Contractor shall contour the site to match the surrounding lands and to ensure positive drainage. The entire area shall be scarified to a minimum depth of 0.5 m or to the depth of compaction, whichever is greater, or as directed by the Consultant. Where large clay clumps or ridges

are prevalent, discing shall be performed following scarification. All rocks larger than 70 mm maximum dimension shall be removed. Where overburden has been salvaged, it shall be redistributed uniformly over the entire area and discing as required to break up lumps and level ridges. Overburden material may be used to contour the site, however subsoil material shall only be used for contouring with the approval of the Consultant. Contouring of lands shall not be performed using topsoil materials.

The Contractor shall replace all soil levels uniformly in lifts in the reverse order that they were removed. The Contractor shall disc each replaced soil layer. No work of any kind shall take place on frozen or wet surface areas.

Topsoil shall be evenly redistributed over the entire area and rocks, roots and stumps removed. Redistribution of topsoil shall only be done in weather, which, in the opinion of the Consultant, is suitable. The Consultant will not allow work to proceed when wind conditions are such that material is being carried beyond the designated work areas or that the material is not being uniformly applied.

In areas where dry soils are encountered discing and harrowing may destroy soil structure and lead to loss through wind erosion. When these types of areas are encountered, the Consultant shall be consulted to determine alternative procedures for site reclamation.

For those areas of the province where the topsoil, subsoil and overburden are rocky tills, rock picking will be required to ensure rock content of the reclaimed land does not exceed the rock content prior to disturbance. If rock content prior to disturbance is not known, the Consultant will use adjoining land to determine the extent of rock picking required.

Material salvaged from dugout borrow excavations shall generally not be replaced inside the dugout.

#### 2.3.4.6.6 Seeding of Reclaimed Areas

Unless otherwise directed by the Consultant, the Contractor shall seed reclaimed sites in accordance with Specification 2.20, Seeding and the following:

- (i) Areas to be seeded shall be fine graded to a uniform surface and be loose to plow depth at the time of seeding. Such fine grading shall be performed in a manner which does not affect the distribution of topsoil or result in excess compaction.
- (ii) All disturbed areas resulting in exposed soils within borrow areas and haul roads shall be seeded.
- (iii) Seed shall consist of a species mixture compatible to adjacent areas unless otherwise directed by the Consultant.

Alternate seeding preparation methods may be necessary for dry soils. Small areas may be seeded by hand. Where necessary, temporary fences along borrow area perimeters may be required to control livestock or to restrict entry.

#### 2.3.4.6.7 Additional Reclamation Requirements

Any additional specific requirements will be shown in the special provisions.

#### 2.3.4.7 **Embankment**

Embankment shall be constructed by depositing, shaping and compacting suitable excavation materials. The embankments shall be constructed in conformity with the lines, grades, and cross-sections shown on the plans,

or staked on the ground by the Consultant.

#### 2.3.4.7.1 Preparation of Existing Ground

##### 2.3.4.7.1.1 Fill Sections

Topsoil and subsoil shall be salvaged to the extent required by the Consultant or as shown in the special provisions. The exposed surface shall then be bladed and compacted, as directed by the Consultant.

Following the excavation and salvage of topsoil and subsoil material and prior to blading and compaction operations, where the exposed surface is less than 0.6 m below the design subgrade surface, excavation shall be carried out to 0.6 m below the design subgrade surface, or to the elevation as directed by the Consultant. The exposed surface shall then be bladed and compacted, and the excavated material shall be utilized or disposed of as directed by the Consultant.

##### 2.3.4.7.1.2 Cut Sections

Where the design subgrade surface is in cut and following the excavation and salvage of topsoil and subsoil material, excavation shall be carried out to a depth of 0.6 m below the design subgrade surface, and the excavated material shall be utilized or disposed of as directed by the Consultant. The exposed surface shall be bladed and compacted, as directed by the Consultant.

##### 2.3.4.7.1.3 Hillside Benching

When embankments are to be made on a hillside of a nature that will, in the opinion of the Consultant, preclude a proper bond between the existing and the newly placed materials, the existing ground on which the embankment is to be placed shall be benched before embankment construction is commenced. Otherwise, before any embankment is placed on a smooth, firm surface, the existing ground shall be scarified to obtain a bonding of the new material with the existing ground.

##### 2.3.4.7.1.4 Grade Widening

Where existing roadbeds are being widened or the existing embankments extended, the sideslopes shall be denuded of all vegetation and benched one level at a time (starting at the ditch bottom) in order to obtain bonding between the existing grade and the new embankment as directed by the Consultant. Attempts to obtain bonding by the use of vertical cuts for the full depth of the embankment will not be permitted. In all cases, cuts shall not be steeper than 0.5 horizontal to 1 vertical.

Where directed by the Consultant, unsuitable material shall be excavated from the existing grade and replaced with material approved by the Consultant. The unsuitable material shall be utilized or disposed of as directed by the Consultant.

##### 2.3.4.7.1.4.1 Surface Cuts

When it is necessary to cut the roadway surface for construction of the last bench, the Contractor shall control traffic such that it is not permitted to travel within 0.5 m of the edge of the surface cut.

The length of surface cut shall not exceed 1 km or a length as established by the Consultant. The Contractor shall promptly backfill sections of exposed vertical cut to provide safe accommodation of traffic.

For any location where surface cutting is required, the Contractor shall erect orange coloured, reflectorized traffic

delineators along the pavement edge at intervals of 20 m, all in a manner acceptable to the Consultant.

When base course construction does not immediately follow grade widening or when the surface cut is longer than 1 km, the Contractor shall promptly place and compact a wedge of suitable material in the cut area adjacent to the roadway surface. This wedge of material shall be tapered to a slope no steeper than 3 horizontal to 1 vertical.

#### 2.3.4.7.1.5 Embankment Placed on Existing Road

Prior to the placement of embankment on an existing roadbed, material within the roadbed designated by the Consultant as unsuitable, shall be excavated and replaced with material approved by the Consultant. The unsuitable material shall be utilized or disposed of as directed by the Consultant.

To obtain bonding between the existing and new embankment materials on sideslopes, the existing roadbed sideslopes shall be denuded of vegetation and where directed, benched as described in the preceding Section 2.3.4.7.1.4.

Where a new embankment of 0.3 m or less is placed on an existing road which is not surfaced with asphalt material, the existing surface shall be scarified to a depth of 0.15 m unless otherwise directed by the Consultant. The moisture content in this scarified material shall be adjusted, as required, and the material shall be compacted to the density requirements in accordance with the Specifications.

#### 2.3.4.7.2 Placing Material

##### 2.3.4.7.2.1 Suitable Material

Embankment shall be formed of suitable material only unless otherwise directed by the Consultant. Stumps, trees, rubbish, sod, topsoil, or other unsuitable material, shall not be placed in the embankment.

##### 2.3.4.7.2.2 Use of Rock Material

Where rock is being used in the embankment, such rock shall be carefully distributed and the interstices filled with finer material or earth, as approved by the Consultant, to form a dense compact mass. Any large rocks encountered during the construction of the embankment in the final finishing operations which constitute a hazard to traffic, due to size or protrusion from the finished embankment surface, shall be removed and disposed of as directed by the Consultant.

##### 2.3.4.7.2.3 Snow, Ice or Frozen Material

Embankment material shall not be placed on frozen earth, snow or ice, nor shall frozen soils, ice or snow be placed in any embankment. However, on approval of the Consultant, embankment material may be placed on the existing ground surface if frost penetration is 0.10 m or less. Any frozen material in the embankment shall be removed and disposed of at the Contractor's expense before proceeding with further embankment construction.

##### 2.3.4.7.2.4 Grade Settlement

Embankment shall be constructed so that after settlement is complete the required grade and cross-section is attained at all points. If at any time before final acceptance of the work the embankment settles below the required grade, it shall be brought back to the required grade by the Contractor. This work will be paid for at the applicable unit price bid for the class of material used.

**2.3.4.7.3 Compaction****2.3.4.7.3.1 Layer and Density Requirements**

Unless otherwise specifically permitted by the Consultant, all material placed in embankments shall be spread and bladed smooth in successive layers, not to exceed 0.15 m in depth when compacted and to the full width of the cross-section. Each layer shall be compacted by means approved by the Consultant to a minimum of 95 percent of the maximum dry density established by the Moisture-Density Relation tests using Standard Compaction, with the exception of the upper 0.30 m, which shall be compacted in 0.15 m layers to a minimum of 100 percent. The material in each layer shall be compacted at the optimum moisture content, unless otherwise required by the Consultant. In case of controversy, the degree of compaction and/or moisture content will be determined by a moisture-density test before the succeeding layer is placed.

**2.3.4.7.3.2 Test Methods**

The Consultant or his representative will from time to time take samples and carry out testing and inspection of the 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.

Various alternative test methods may be used by the Consultant or his representative to confirm that specification requirements are being met.

In cases of dispute regarding the degree of compaction and/or moisture contents, all testing to confirm specification requirements will be carried out by the Consultant, using the most recent edition of the following standard test methods.

Test Descriptions		Method No.
1.	Classification of Soils for Engineering Purposes	ASTM Designation D2487
a)	Determining the Liquid Limit of Soils	AASHTO Designation T 89
b)	Determining the Plastic limit and Plasticity Index of Soils	AASHTO Designation T 90
c)	Particle Size Analysis of Soils	AASHTO Designation T 88
2.	Soils Identification, Hand Method	ATT-29
3.	Moisture-Density Relation	
a)	Standard Compaction, - 5 000 $\mu$ m Material	ATT-23
b)	Standard Compaction, + 5 000 $\mu$ m Material	ATT-19
c)	One-Point	ATT-20
4.	Density	
a)	In-Place, Sand Method	ATT-9
b)	In-Place, Balloon Method	ATT-8
c)	In-Place, Nuclear Method	ATT-11
5.	Moisture Content	
a)	Oven Method, Soil and Gravel	ATT-15, Part I
b)	Microwave Oven Method	ATT-15, Part IV
c)	Speedy Moisture Teller	ATT-44
d)	In-Place, Nuclear Method	ATT-11
6.	Correction Factors, Nuclear Moisture-Density Measurements	ATT-48

## NOTES:

- (1) In all Test Methods used as reference in this specification, metric sieves as specified in Canadian General Standards Board specifications 8-GP-2M shall be substituted for any other specified wire cloth sieves in accordance with Specification 3.2, Aggregate Production and Stockpiling.
- (2) In all cases the latest amendment or revision current at the closing date of the tender is implied when reference is made to one of the above standards in the specification.

## 2.3.4.7.3.3 Compaction Operations

Compaction over the entire surface area of each layer shall be obtained by the use of tamping rollers, or other equipment to meet the specified density requirements. Hauling equipment will not be accepted in lieu of compaction equipment. Compaction to the specified density shall be obtained uniformly throughout each layer.

## 2.3.4.7.3.4 Construction on Muskeg or Yielding Ground

Where the embankment to be placed traverses muskeg or yielding ground and it is not possible to place the initial embankment lift in a 0.15 m compacted depth, the Contractor may, upon approval of the Consultant, construct the first embankment lift to a depth sufficient to support the construction equipment. All embankment to be

constructed above this support will be constructed in 0.15 m compacted depths, as hereinbefore specified.

#### 2.3.4.7.3.5 Moisture Content Adjustments For Compaction

##### 2.3.4.7.3.5.1 Drying

Where moisture content tests indicate that material being used for embankment is above optimum moisture, the material shall be thoroughly disced and worked until a uniform optimum moisture content is reached. Wet material shall not be wasted except as authorized in writing by the Consultant.

##### 2.3.4.7.3.5.2 Water for Compaction

Where moisture content tests indicate the material for embankment is below optimum moisture, water shall be added. The material shall be thoroughly disced and broken down, water added in amounts as required, and the material thoroughly worked to mix the water uniformly throughout the soil prior to commencing compaction operations. The type of water hauling and spraying equipment used shall be satisfactory to the Consultant.

#### 2.3.4.7.4 Obliteration Of Existing Roadway

When sections of the existing roadway, accesses and crossings, are obliterated upon completion of the new roads or when approved alternative roads are operational, the material excavated from the obliteration operation shall be utilized for embankment construction or disposed of as directed by the Consultant.

Obliteration of existing roadway also consists of reclamation of the areas to a neat and tidy condition comparable to that of the adjacent ground, and to the satisfaction of the Consultant. Topsoiling of the areas shall be carried out in accordance with Specification 2.6, Topsoil Placement.

#### 2.3.4.8 **Approach Fills for Bridge Structures (Other Than Bridge Culverts)**

##### 2.3.4.8.1 Preparation of Existing Ground

Prior to the placement of embankment on the existing ground where bridge approach fills are to be located, and in order to allow unrestricted structural bearing pile penetration, all areas where piles are to be driven shall be cleared of obstructions such as pavement, granular and soil cement materials, compacted subgrade, boulders or rock of any nature, trees, stumps and any other undesirable debris. Where the subsurface of the area is known to contain boulders, they shall be removed to a minimum depth of two metres below the existing ground surface. All the materials removed shall be utilized or disposed of as directed by the Consultant.

The locations where bridge piling is to be located shall be as shown on the plans or as directed by the Consultant.

##### 2.3.4.8.2 Placing Material

Construction of approach fill embankments shall be undertaken in accordance with Section 2.3.4.7.2, Placing Material, and 2.3.4.7.3, Compaction, excepting that the embankment material shall be free of stones or rocks greater than 150 mm or other solid material.

##### 2.3.4.8.3 Finishing

Bridge headslopes shall be accurately trimmed, particularly at the intersection of the toe of the headslope with the underpassing roadway or with the bank of a stream, to the lines, grades and cross-sections as shown on the plans or as directed by the Consultant.

Drainage requirements shall be constructed to the lines and grades as shown on the plans or as directed by the Consultant.

#### 2.3.4.9 **Overhaul**

Overhaul will occur when excavated material is hauled (other than by trucks), more than 300 m and placed in embankments or disposed of as directed by the Consultant.

Overhaul will apply to common, solid rock, channel and borrow excavation when material is deposited at locations as provided by the plans, or as designated by the Consultant.

Borrow topsoil, surplus, or unsuitable material, as encountered within the right-of-way or borrow areas, shall be deposited within the 300 m free haul limit where practical to do so, at locations inside or outside of the right-of-way or borrow area, as designated by the Consultant. Where this material is hauled more than 300 m, overhaul will be calculated and paid for at the applicable unit price bid.

#### 2.3.4.10 **Finishing Previous Clearing**

The Contractor shall, as directed by the Consultant, remove and dispose of any stumps, debris and new tree growth within the limits of the previously cleared areas.

### 2.3.5 FINISHING, INTERIM ACCEPTANCE OF ROADWAY SURFACES AND MAINTENANCE

#### 2.3.5.1 **Finishing**

The Contractor shall, as soon as practicable, bring the excavations and embankments to the correct widths, lines and grades, as shown or as directed by the Consultant, and no more than 2 km of grade shall be in the rough at any one time. As soon as the excavations and embankments are completed to the correct widths, lines and grades, the Contractor shall maintain the roadway with a blade machine. Where no traffic accommodation is required through the Work, longer sections of work may be in the rough, as approved by the Consultant.

#### 2.3.5.2 **Interim Acceptance of Roadway Surfaces**

Roadway surfaces which have been entirely completed (constructed and finished) in accordance with the plans and specifications will be eligible for inspection and interim acceptance by the Consultant under the following conditions:

- (i) The roadway surface is not being covered with granular base course under this Contract.
- (ii) The section of roadway surface being considered for interim acceptance is not less than 1 kilometre in length and is contiguous to a section of roadway surface previously accepted.

Interim acceptance shall apply to the roadway surface only, and shall not relieve the Contractor of his responsibility to complete other portions of the roadway (sideslopes, ditches, backslopes, etc.) in accordance with the plans and specifications.

Acceptance of the other portions of the roadway will not be made on an "interim" basis and will only be considered once the entire project is completed and ready for the construction completion inspection as detailed in Specification 1.2, General.

In addition, interim acceptance of a roadway surface shall not relieve the Contractor of his responsibility to repair



any failures occurring in the roadway surface prior to the construction completion inspection which, in the opinion of the Consultant, are workmanship related.

### 2.3.5.3 **Maintenance Requirements and Responsibilities**

#### 2.3.5.3.1 Uncompleted Roadway Surface

Maintenance shall be at the Contractor's own expense and shall continue daily, or at frequent intervals, depending on the effects of traffic and weather upon the uncompleted portion of the roadway. Ditches and culverts shall be kept free from obstructions so that water will flow freely at all times.

For the purposes of determining maintenance responsibilities and requirements, a roadway surface which is being covered by granular base course under this contract will be considered an "uncompleted roadway surface".

#### 2.3.5.3.2 Roadway Surface Accepted on an Interim Basis

Maintenance of roadway surface which has been accepted on an interim basis shall be performed by the Contractor at intervals as determined by the Consultant. Payment for maintenance of a roadway surface which has been accepted on an interim basis, will be made as Extra Work in accordance with Specification 1.2, General.

### 2.3.6 METHOD OF MEASUREMENT AND PAYMENT

#### 2.3.6.1 **General**

The unit of measure of all classes of excavation will be the cubic metre, and the quantity paid for will be the actual number of cubic metres of material excavated, utilized and/or disposed of, as measured in its original position and as accepted and recorded by the Consultant. If so ordered, material suitable for special use, excavated during the progress of the work, shall be reserved and stockpiled in locations as designated by the Consultant. The material reserved will be paid for at the prices bid per cubic metre of excavation for the various classes of material excavated.

No payment will be made for material excavated or placed outside the limits indicated by the construction stakes, unless such work has been authorized by the Consultant. Material placed outside the limits indicated by the construction stakes shall be removed as directed by the Consultant, and this work will not be paid for.

The construction and removal of temporary equipment and haul crossings and the restoration of the surrounding area and the repair of any damage to the pavement or subgrade structure as a result of hauling operations will not be paid for separately but shall be at the Contractor's expense.

No separate payment will be made for the supply, installation and removal of temporary fences other than those associated with borrow areas. All costs will be considered incidental to the Work.

#### 2.3.6.2 **Towing Traffic**

The cost of towing through the Work, except through those portions of the Work which require towing of traffic due to the Contractor's failure to diligently prosecute the work to completion, will be paid for as Extra Work, in accordance with the following conditions:

- (i) Equipment used will be paid for at the approved hourly rate times the actual hours used for towing, as approved by the Consultant.

- (ii) Attachments to the equipment such as scarifiers, dozer blades and winches, will not be paid for unless actually used and previously authorized by the Consultant.
- (iii) Payment for approved standby time will be made only for the equipment operator; no payment will be made for the standby towing equipment.
- (iv) With prior authorization of the Consultant, payment will be made for a vehicle used by the equipment operator when the operator is on standby.

#### 2.3.6.3 Slides

There will be no separate payment made for material from slips, slides and subsidences which is removed and disposed of or used in the Work, unless such occurrences were beyond the control of the Contractor and not preventable by the use of due care and diligence.

Payment for the removal of slides beyond the control of the Contractor will be made at the contract unit price for the class of excavation involved.

#### 2.3.6.4 Maintenance and Traffic Accommodation

Gravel surfacing on the sections of graded highway, staged construction, detours and temporary connections utilized for traffic accommodation shall be performed and paid for in accordance with Specification 3.3, Gravel Surfacing.

The cost of maintenance including the supply and application of asphalt or other dust abatement material will not be paid for separately but shall be incidental to the Work.

The construction and removal of temporary wedges at surface cut areas will not be paid for separately but will be considered incidental to the Work.

Removal of temporary connections will be paid for as "Common Excavation".

#### 2.3.6.5 Solid Rock Excavation

Solid Rock Excavation eligible for payment will be the actual number of cubic metres of solid rock excavated as measured in its original position and accepted and recorded by the Consultant. Payment will be made at the unit prices bid (if any) for the applicable class of excavation being performed at the location where the solid rock is encountered, such as borrow, channel or common, plus an additional payment per cubic metre for "Solid Rock Excavation - Premium".

Pre-shearing, pre-splitting, line drilling, cushion blasting, perimeter blasting, buffer blasting or any such techniques that may be used for excavation by blasting shall not be paid for separately, but shall be included in the unit price bid for "Solid Rock Excavation - Premium".

Overbreak which, with the approval of the Consultant, is used to replace material that would otherwise have to be obtained from other sources, will be paid for on the basis of classification of the replaced material. Any overbreak which is not used to replace other material will not be paid for and shall be removed at the Contractor's own expense. Any additional restoration work required due to overbreak shall be at the Contractor's expense.

**2.3.6.6 Channel Excavation**

Channel Excavation will be paid for at the price bid per cubic metre for "Channel Excavation", which payment shall be compensation in full for all labour, equipment, tools and incidentals necessary to complete the work prescribed.

**2.3.6.7 Common Excavation**

Common Excavation will be paid for at the price bid per cubic metre for "Common Excavation", measured as specified herein, which payment shall be compensation in full for all equipment, tools and incidentals necessary to complete the work prescribed.

The excavation and utilization or disposal of existing surfacing and subgrade materials resulting from obliteration operations will be classified and paid for as "Common Excavation." This payment shall include conditioning of the material as may be required for its satisfactory incorporation into embankment construction, and all work required to complete the restoration of the area except topsoiling.

**2.3.6.8 Borrow Topsoil Excavation**

Borrow Topsoil Excavation will include the total quantity of topsoil, subsoil and overburden excavated in borrow areas following any clearing and grubbing operation which may be required.

Borrow Topsoil Excavation will be paid for at the price bid per cubic metre for "Borrow Topsoil Excavation", measured as specified herein, which shall be payment in full for the excavation and separate stockpiling of the excavated borrow materials in a location or locations as designated by the Consultant.

Payment will also be made at the price bid per cubic metre for "Borrow Topsoil Excavation", for the excavation from the separate overburden, subsoil and topsoil stockpiles and the proper redistribution of such materials over the borrow areas. This payment will be full compensation for rock removal, scarifying, redistribution and discing and any other operations necessary to complete the Work to the satisfaction of the Consultant. If all of the materials from a borrow pit are placed in stockpile and subsequently all redistributed over the borrow area, the measurement for the second operation shall be taken as equal to the quantity originally measured in its original position. If all of the materials are not redistributed over the borrow area, the measurement for the second operation shall be based on measurements of the stockpiles before and after redistribution.

No additional payment will be made for handling material in layers.

**2.3.6.9 Borrow Excavation**

Borrow Excavation will be the quantity of material excavated, measured as specified herein, following the removal of borrow topsoil excavation as directed by the Consultant.

Borrow Excavation will be paid for at the price bid per cubic metre for "Borrow Excavation", measured as specified herein, which payment shall be compensation in full for all equipment, tools and incidentals necessary to complete the work prescribed. Scarifying and trimming of borrow surface and removal of rocks larger than a 70 mm maximum dimension prior to and after the redistribution of topsoil, and the smoothing, trimming and maintenance of borrow haul roads, will not be paid for directly, but will be considered as incidental to borrow excavation.

Borrow Excavation used in the construction of haul roads to borrow areas, as directed by the Consultant, will be paid for at the price bid per cubic metre for "Borrow Excavation". Where, upon completion of haul, the material in the haul road is excavated and deposited as directed by the Consultant, the excavation of this material will be

paid for at the price bid per cubic metre for "Borrow Excavation", measured as specified herein, which payment shall be compensation in full for required restoration of the borrow haul road areas and disposal areas, including all equipment, tools, and incidentals necessary to complete the work prescribed.

When the Contractor has been directed by the Consultant to excavate unsuitable borrow material, including stones or rocks, and not place this material in the embankment, this excavation will be paid for at the price bid per cubic metre for "Borrow Excavation". Subsequent disposal of this unsuitable material, including stones or rocks, as directed by the Consultant, will not be paid for directly, but will be considered as incidental to borrow excavation.

The cost of erecting and removing temporary fences associated with borrow areas will be paid for as Extra Work, in accordance with Specification 1.2, General.

#### 2.3.6.10 **Common and/or Borrow Excavation Loaded to Trucks**

##### 2.3.6.10.1 Excavation, Loading to Trucks and Embankment Construction

The unit of measure of common and/or borrow excavation loaded to trucks will be the cubic metre, and the quantity paid for will be the actual number of cubic metres of material excavated, loaded to trucks, utilized and/or disposed of, in a manner acceptable to the Consultant, as measured in its original position.

Common and/or borrow excavation loaded to trucks and construction of embankment complete will be paid for at the price bid per cubic metre for "Common and/or Borrow Excavation Loaded to Trucks", which payment shall be compensation in full for all labour, tools, equipment and incidentals necessary to complete the work prescribed.

##### 2.3.6.10.2 Truck Haul of Common and/or Borrow Excavation

###### (a) Basic Loading Factor

The basic loading factor will not be paid for as a separate bid item, and shall be included in the unit price bid for "Common and/or Borrow Excavation Loaded to Trucks".

###### (b) Haul

The number of cubic metre kilometres of truck haul of common and/or borrow excavation to be paid for will be the product of the number of cubic metres of truck haul material, as measured in its original position, and the actual haul distance in kilometres, or fractions thereof.

The haul distance will be the actual distance between the centres of mass of the truck haul material in its original position and after placing. No free haul distance will be applied.

The haul distance for roadway excavation will be measured along the centreline of the highway. The haul distance for material obtained from borrow pits will be measured along the shortest practical route, as designated by the Consultant.

The quantities of truck haul, determined as provided above, will be paid for at the price bid per cubic metre kilometre for "Truck Haul of Common and/or Borrow Excavation", which price and payment shall be compensation in full for all labour, equipment, tools, and incidentals necessary to complete the work prescribed in this section.

**2.3.6.11 Catch Water Ditches**

Catch water ditches constructed in accordance with the typical plans will be measured for payment by length in metres.

Catch water ditches will be paid for at the price bid per lineal metre for "Catch Water Ditches", which payment shall be compensation in full for all equipment, tools and incidentals necessary to complete the work prescribed.

**2.3.6.12 Embankment**

The placing, compacting, moisture adjustment and finishing of materials in embankments will not be paid for directly, but will be considered part of the work paid for as excavation of the various classes as designated and measured as specified herein.

**2.3.6.12.1 Preparation of Existing Ground**

The cost of preparing the ground following the excavation of unsuitable material, scarifying and compacting the exposed surface, denuding and benching of the existing highway embankment slopes, scarifying hillsides, scarifying and compacting existing road embankment to obtain bond, shall be considered as incidental to the work, and no direct payment will be made.

Where the subgrade is excavated below design subgrade surface, reconstructed in 0.15 m layers and compacted, as directed by the Consultant, the excavation will be paid for at the unit price bid per cubic metre for the class of material excavated.

The required excavation and disposal of unsuitable material encountered in existing roadbeds or encountered in the preparation of the existing ground surface will be paid for at the price bid per cubic metre for "Common Excavation".

Excavation for benching will not be paid for directly, but shall be considered as incidental to the work.

**2.3.6.12.2 Rock Materials Used in Embankment**

Relatively finer material used for filling the interstices in embankments constructed of rock, concrete or other solid material will be paid for at the applicable unit price bid for the class of material used.

Removal and disposal of rock, concrete or other solid material from the finished embankment surface shall be considered incidental to the grading operation, and no direct payment will be made.

**2.3.6.12.3 Compaction**

Compaction will not be paid for directly, but shall be considered part of the work paid for as excavation of the various classes as designated and measured as specified herein. Drying wet material will not be paid for directly, but shall be included in the unit price bid for excavation.

**2.3.6.12.4 Water for Compaction**

Water required for moisture content adjustment of embankment materials will not be paid for separately. Payment for supplying, applying and incorporating water in embankment material will be considered included in the unit prices bid for the various classes of excavation.

**2.3.6.13 Approach Fills for Bridge Structures (Other Than Bridge Culverts)****2.3.6.13.1 Preparation of Existing Ground**

The material excavated for the preparation of existing ground for bridge approach fill construction will be classed according to Section 2.3.3, Class of Excavation. The material excavated will be measured and paid for in accordance with the unit price bid for the applicable class of material excavated in accordance with Section 2.3.6.1, Excavation; Unit and Method of Measurement.

**2.3.6.13.2 Placing Material**

The placing and compacting of material in bridge approach fills will not be paid for directly, but will be considered part of the work paid for as excavation of the various classes as designated and measured as specified herein. Drying wet material will not be paid for directly, but shall be included in the unit price bid for excavation.

Water for compaction will be paid for in accordance with Section 2.3.6.12.4, Water for Compaction.

**2.3.6.14 Overhaul**

When the contract contains a bid item for the payment of overhaul on the cubic metre kilometre basis, overhaul will be measured and determined in the following manner:

The number of cubic metre kilometres of overhaul to be paid for will be the product of the number of cubic metres of overhauled material, as measured in its original position, and the overhaul distance in kilometres.

The overhaul distance will be the distance between the centres of mass of the overhauled material in its original position and after placing, less 300 m free haul.

The haul distance for roadway excavation will be measured along the centreline of the roadway. The haul distance for material obtained from borrow pits or for material hauled to disposal sites will be measured along the shortest practical route, as designated by the Consultant.

The quantities of overhaul, determined as provided above, will be paid for at the price bid per cubic metre kilometre for "Overhaul", which price and payment shall be compensation in full for all labour, equipment, tools, and incidentals necessary to complete the work.

When the Contract does not include a bid item for the payment of overhaul, the prices bid for excavation shall include full compensation for all overhaul of excavated materials, and no additional compensation will be allowed for such work.

**2.3.6.15 Finishing Previous Clearing**

Finishing previous clearing will not be measured and paid for separately, but shall be considered incidental to the work.

**2.3.6.16 Seeding**

Seeding of reclaimed areas shall be measured and paid for in accordance with Specification 2.20, Seeding.

**2.3.7 CONSTRUCTION COMPLETION**

The conditions requisite for the issuance of a Construction Completion Certificate for the work will be a roadway or other work which is smooth and compact over the entire width, firm side slopes with regular shoulder lines, clean side ditches, satisfactory approaches, intersections and entrances, and smooth back slopes. All soft and yielding material in the roadway or other work, if so directed shall be removed and replaced with acceptable material, and all loose stones, clods, weeds, trash, etc., shall be removed from the roadway or other work, side slopes, ditches and back slopes. All improperly compacted material shall be excavated, brought to optimum moisture content if required and recompacted at the Contractor's own expense. On the side slopes and back slopes, and in the bottom of ditches, all projecting boulders shall be removed or broken off at least flush with the lines and grades, and the resultant cavities, if any, backfilled.