



**CONSTRUCTION SPECIFICATION FOR UNTREATED SUBBASE, BASE, SURFACE,  
SHOULDER, SELECTED SUBGRADE, AND STOCKPILING**

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**314.01 SCOPE**

This specification covers the requirements for the construction of Subbase, Base, roadway surface, Shoulder, and edge ramping for bituminous pavements, selected subgrade and stockpiling at specified sites.

**314.02 REFERENCES**

This specification refers to the following standards, specifications, or publications:

**Ontario Provincial Standard Specifications, Construction**

OPSS 201	Clearing, Close Cut Clearing, Grubbing, and Removal of Surface and Piled Boulders
OPSS 350	Concrete Pavement and Concrete Base
OPSS 501	Compacting

**Ontario Provincial Standard Specifications, Material**

OPSS 1001	Aggregates - General
OPSS 1010	Aggregates - Base, Subbase, Select Subgrade, and Backfill Material

## Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:

LS-282 Method of Test for Quantitative Extraction of Asphalt Cement and Analysis of Extracted Aggregate from Bituminous Paving Mixtures.

LS-706 Moisture - Density Relationship of Soils Using 2.5 kg Rammer and 305 mm Drop

### 314.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

**Selected Subgrade** means a granular material meeting the requirements of Select Subgrade Material (SSM), as specified in OPSS 1010, which is used to replace unsuitable native soils or raise the existing grade or both, in order to meet the final subgrade grading requirements, specified in the Contract Documents.

**Tolerance** means a construction working tolerance only that is considered to be:

a) Minus when it is:

- i. narrower than the Contract standard when pertaining to horizontal dimensions as measured from centreline, or
- ii. lower in elevation than the Contract standard when pertaining to vertical dimensions.

b) Plus when it is:

- i. wider than the Contract standard when pertaining to horizontal dimensions as measured from centreline, or
- ii. higher in elevation than the Contract standard when pertaining to vertical dimensions.

### 314.05 MATERIALS

#### 314.05.01 Aggregates

Aggregates used for Base, Subbase and selected subgrade applications shall be according to OPSS 1010.

#### 314.05.02 Water

Water shall be free of any contaminants that could adversely affect the environment or the placement and compaction of materials for Base, Subbase and selected subgrade applications.

#### 314.05.03 RAP Shouldering

RAP obtained from Contract milling operations may be used for shouldering, as long as the RAP, at the time of use, has:

- a) 100% by mass passing the 26.5 mm sieve and no more than 75% by mass passing the 4.75 mm sieve; and
- b) No visible contamination, as determined by the Contract Administrator.

RAP obtained from any other sources will not be acceptable for shouldering without written consent from the Owner.

## **314.06 EQUIPMENT**

### **314.06.01 Water**

Equipment used for applying water to granular materials in order to meet compaction requirements for Base, Subbase and selected subgrade applications shall be equipped with variable flow control to uniformly and completely wet the material without causing the material to be eroded away. The equipment operator shall also have the capability to monitor and change the flow while the equipment is moving.

## **314.07 CONSTRUCTION**

### **314.07.01 Subbase, Base, Surface, and Selected Subgrade**

All materials shall be kept free from clay and other types of deleterious material. Construction operations shall not disturb underlying work.

All materials shall be placed in uniform lifts without segregation.

Except as provided under the Modified Layer Compaction Method clause:

- a) Granular B, Type II shall be placed in accordance with the compaction methods specified in the Granular B, Type II clause such that the thickness of the compacted layer is not greater than 150 mm.
- b) All other materials shall be placed such that the thickness of the compacted layer is not greater than 150 mm.

In all cases, each lift shall be bladed to a smooth surface according to the required cross-section and maintained until placement of a subsequent lift, when applicable.

Prior to closing down operations for each Day, the Subbase material shall be bladed and compacted and, if necessary, covered with sufficient Base material to carry traffic.

The Base shall be maintained to the tolerances in grade and cross-section and to the specified density until Contract Completion or, if the Contract includes paving, until the Base surface is paved.

### **314.07.02 Winter Grading**

Any areas where materials used for Subbase, Base, selected subgrade or other fill applications are being placed shall be free of ice and snow. Frozen material shall not be incorporated into the Work. Materials used for Subbase, Base, selected subgrade or other fill applications shall not be placed over frozen ground.

### **314.07.03 Edge Ramping of Bituminous Pavement**

A ramp of the specified material shall be built along the outside edges of each bituminous pavement construction course. Such ramps shall be at a height level with the pavement course and fall away from its edge at a slope not steeper than 4H:1V. Care shall be taken to prevent any ramping material from being spilled or pushed onto the pavement. Any material that is spilled shall be removed immediately without damage to the pavement and the surface thoroughly cleaned with the use of a power broom or other suitable means.

Prior to paving any section, only sufficient material to construct the ramps shall be placed on the Shoulders. No other Shoulder material shall be placed until the conditions, as detailed in the Shoulders subsection, have been attained.

Edge ramps shall be completed prior to opening adjacent pavement to traffic.

#### **314.07.04                      Shoulders**

Material used for shouldering shall be placed and compacted at locations and to the line, grade, and cross-section specified in the Contract Documents.

Prior to commencing Shoulder construction, all debris and deleterious material shall be removed from the Shoulder area.

Shouldering operations shall commence as soon as, but not before, the following pavement conditions are met:

##### **a) Bituminous Pavements**

Placement of material for shouldering operations shall not commence along any section of pavement, until at least 6 hours have elapsed from the time of completion of the final bituminous pavement course in that section. In addition, for pavement sections that are already open to traffic, all shouldering operations shall be completed within 24 hours of their commencement. In all cases where a pavement section is not yet open to traffic, the shouldering shall be completed prior to opening that pavement section to traffic. The material shall be placed in lifts not greater than 300 mm in thickness prior to compaction.

##### **b) Concrete Pavement and Concrete Base**

Shouldering operations shall commence according to OPSS 350. Shouldering shall be completed prior to opening the concrete base or concrete pavement to traffic.

All Shoulder construction material shall be conveyed from the transport vehicle onto the Shoulder area. End dumping of Shoulder construction material directly on to the adjacent pavement surface or directly on to the Shoulder shall not be permitted. The material shall be uniformly distributed within the specified Shoulder limits without segregation. Grading and shaping operations shall confine all material to within the specified Shoulder limits without overspill.

Any Shoulder construction material deposited, dragged, or inadvertently placed on the pavement surface shall be removed immediately and the pavement surface shall be thoroughly cleaned with the use of a power broom or other suitable means.

#### **314.07.04.01                      RAP Shouldering**

RAP shouldering shall be according to and at the locations specified in the Contract Documents.

#### **314.07.05                      Compaction**

##### **314.07.05.01                      General**

Each lift of material shall be compacted as specified below prior to the placement of the next lift.

The rate of placing material shall be controlled by the adequacy of the compaction obtained.

##### **314.07.05.02                      Compaction Requirements**

###### **314.07.05.02.01                      Granular B, Type II**

Granular B Type II shall be placed and compacted at a moisture content which is no more than 0.5% above and no more than 1.5% below its optimum moisture content according to LS-706.

The material shall not be dumped into position but shall be deposited on and pushed over the end of the lift being constructed by means of bulldozers or other equipment approved by the Contract Administrator.

The placement of the first lift of material over wet or weak subgrade shall be monitored and the placement and compaction procedure modified as required, with the approval of the Contract Administrator, to minimize subgrade disturbance. Localized, unusually wet or weak subgrade areas shall be identified to the Contract Administrator for possible treatment.

In restricted zones as specified in OPSS 501, Granular B, Type II shall be compacted using hand-operated vibratory equipment with a minimum operating mass of 400 kg and a maximum power output between 5.0 and 9.9 kW. Where confined areas are less than the minimum width and where such equipment cannot be used safely, then smaller vibratory hand-operated tampers shall be used. One hundred percent compaction coverage with a minimum of four passes shall be provided in all cases.

In non-restricted zones, Granular B, Type II shall be compacted using single drum, vibratory, smooth steel drum rollers, with a minimum operating mass of 5,000 kilograms and minimum operating dynamic force of 75 kN. One hundred percent roller pass coverage with a minimum number of four passes shall be provided. Each roller pass shall overlap the coverage of the preceding pass by a minimum of 0.5 m.

Regardless of the minimum number of passes being specified, additional passes may be required, at the discretion of the Contract Administrator.

#### **314.07.05.02.02 All Other Granular Materials**

The compaction requirements shall be according to OPSS 501.

#### **314.07.05.02.03 Shoulders**

Where granular material is being placed around guiderail and sign posts at the shoulders, it shall be compacted using hand-operated vibratory equipment according to OPSS 501.

##### **314.07.05.02.03.01 Lift Thicknesses Less than 100 mm**

If the lift thickness for grade correction at the shoulders is less than 100 mm, compaction testing using a nuclear gauge may be waived at the discretion of the Contract Administrator.

Where compaction testing using a nuclear gauge is waived, the granular material being used shall be placed and compacted at a moisture content which is no more than 0.5% above and no more than 1.5% below its optimum moisture content according to LS-706.

Where the shoulder is wide enough, the granular material shall be compacted using a single drum, vibratory, smooth steel drum roller, with a minimum operating mass of 5,000 kilograms and a minimum operating dynamic force of 75 kN. Where narrower shoulders prevent such equipment from being effectively used, the granular material shall be compacted using hand-operated vibratory compaction equipment with a minimum operating mass of 400 kg and a maximum power output between 5.0 and 9.9 kW.

In either case, wherever compaction testing using a nuclear gauge is waived, a minimum of four passes shall be completed and where possible, each pass shall overlap the coverage of the preceding pass by a minimum of 0.5 m.

Regardless of the minimum number of passes being specified, additional passes may be required, at the discretion of the Contract Administrator.

#### **314.07.05.02.04 RAP Shouldering**

##### **314.07.05.02.04.01 Compaction Acceptance Based on LS-706**

Where 100% RAP is being placed for shouldering, RAP shall be compacted, according to OPSS 501, with the following changes and clarifications:

- a) The RAP shall be considered to be a granular material;
- b) All lots shall be no more than 500 m long and have 4 sublots;
- c) Target densities shall be established, based on LS-706, according to the last paragraph of the Target Density clause in OPSS 501; and
- d) The moisture content readings obtained from a nuclear gauge shall be adjusted by deducting the AC- bias of the gauge for the purpose of calculating the field dry density. The AC-bias of the gauge shall be determined, at the start of the compaction work for the Contract, using the difference between the average moisture content readings measured using the nuclear gauge, at a minimum of 6 random locations and the field moisture content of samples of the RAP taken at the same locations. The moisture content of the RAP samples shall be determined according to the Determination of Moisture Content section of LS-282. A new AC-bias shall be generated whenever a different nuclear gauge is employed for the compaction work carried out on the Contract.

#### **314.07.05.02.04.02      Compaction Acceptance Based on Specified Compaction Methods**

Compaction acceptance, as described in the Compaction Acceptance Based on LS-706 clause, given above, may be waived at Regional discretion.

In this case, the RAP shouldering shall be placed and compacted at a moisture content which is no less than 2% lower than and no more than 1.0% greater than its optimum moisture content, as determined according to LS-706 and the Determination of Moisture Content section of LS-282 for the moisture content of the RAP. However, if the moisture content of the compacted RAP is being measured using a nuclear gauge, then those measurements must be adjusted for the AC-bias of the gauge, as described in part 4 of the list given in the Compaction Acceptance Based on LS-706 clause given above.

Where the shoulder is wide enough, the RAP shouldering shall be compacted using a single drum, vibratory, smooth steel drum roller, with a minimum operating mass of 5,000 kilograms and a minimum operating dynamic force of 75 kN. Where narrower shoulders or guide rails prevent such equipment from being effectively used, then the RAP shall be compacted using hand-operated or excavator-mounted vibratory compaction equipment. Hand-operated equipment shall have a minimum operating mass of 400 kg and a maximum power output between 5.0 and 9.9 kW.

In all cases, a minimum of four passes shall be completed and where possible, each pass shall overlap the coverage of the preceding pass by a minimum of 0.5 m.

Regardless of the minimum number of passes being specified, additional passes may be required, at the discretion of the Contract Administrator.

#### **314.07.05.03                      Modified Layer Compaction Method**

Material may be placed in layers thicker than permitted under the Subbase, Base, Surface, and selected subgrade subsection, subject to the following provisions:

- a) All materials, with the exception of Granular B, Type II shall be placed in uniform layers such that each layer shall have a depth of not more than 300 mm after compaction.
- b) Granular B, Type II shall be placed in uniform layers with a compacted depth not to exceed the values shown in Table 1 for various sizes of single drum, vibratory, smooth wheel drum rollers. Both the minimum operating mass and the minimum operating dynamic force requirements shown in Table 1 shall be met for the roller used. One hundred percent roller pass coverage with a minimum number of four passes shall be provided. Each roller pass shall overlap the coverage of the preceding pass by a minimum of 0.5 m.

- c) Prior to placing material in layers as described in a) or b) above depending on the type of granular material used, the ability of the proposed method to achieve satisfactory compaction shall be demonstrated to the satisfaction of the Contract Administrator by means of a two-lane trial area. The trial area location shall be approved by the Contract Administrator. At least 48 hours prior to any work commencing on the trial area, full details of the proposed placing and compacting system or systems, including the rate of placing, depth of layer, number and type of compaction units, and number of passes shall be submitted to the Contract Administrator. The areas designated to evaluate each system shall be of sufficient length to be representative of the proposed method and shall normally be approximately 150 m in length. Approval will follow within one Business Day after satisfactory completion of the compaction trial area.
- d) When the Contract Administrator, approves a system of placing and compacting, the system shall be used for the remainder of the work to which it is applicable, except that:
  - i. Should it be necessary at any time to change the system or any part of it, including the source of material or the rate of placing the material, approval to change the system shall be obtained from the Contract Administrator, who may require a further trial area.
  - ii. If, at any time, tests show that a previously-approved system is no longer producing the required degree of compaction, changes shall be made as necessary to satisfy the requirements of this specification.

#### **314.07.06 Tolerances**

The surface of the uppermost layer of granular material and each granular course shall be bladed, shaped, and compacted to produce the grade and cross-section specified in the Contract Documents, within the tolerances shown in Table 2.

In the event of a conflict between meeting horizontal grading tolerances and meeting vertical grading tolerances, the vertical grading tolerances shall take precedence.

#### **314.07.07 Stockpiling of Granular Material**

Sites for stockpile construction, specified in the Contract Documents, shall be cleared and grubbed, regardless of stockpile height, according to OPSS 201. Organic soil underlying the stockpile location shall be removed and the site cleaned up prior to stockpile construction. Stockpiles shall be constructed, including the supply and placement of a pad upon which the materials are to be stockpiled, according to OPSS 1001.

#### **314.07.08 Grade Checks**

The Contract Administrator shall be notified within 12 hours when each Subbase or Base course has been completed, including Shoulders, and prior to the next course being placed.

The Contractor shall be responsible for carrying out all grade checks to ensure that horizontal and vertical grading tolerances are met.

Grade checks shall be carried out on all finished granular surfaces. Grade checks of granular grading surfaces shall be based on horizontal and vertical grading tolerances, as specified in the Tolerances subsection. The grade shall be certified at the stations and offsets shown in the grading templates, or when grading templates are not available, at the frequency requirements shown for the layout specified elsewhere in the Contract Documents.

#### **314.07.09 Submission of Grade Checks**

All grade checks concerning horizontal and vertical grading tolerances, including all non-compliances, shall be submitted to the Contract Administrator within 2 Business Days following completion of the grade.

When grading templates are available, the Contractor shall sign and certify on the grading template that the components of the work indicated on that template have been correctly constructed to the specified line and

grade tolerances. If a template is not available, then the Contractor shall complete, sign, and submit MTO form PH-CC-820 to the Contract Administrator.

#### **314.07.10 Management of Excess Material**

Management of excess material shall be according to the Contract Documents.

### **314.08 QUALITY ASSURANCE**

#### **314.08.01 General**

The Owner may conduct random QA grade checks to verify that the grade and cross-section are within the specified tolerances.

#### **314.08.02 Acceptance**

If the Contract Administrator chooses not to take QA grade checks or if the QA grade checks conform to those determined by the Contractor, the work shall then be accepted.

However, if any discrepancies between the QA and the Contractor's grade checks are found, then, at the discretion of the Owner, additional QA grade checks may be carried out in any other location.

If the finished grade or cross-section or both are not within the tolerances specified in the Tolerances subsection, then:

- a) The Contract Administrator shall notify the Contractor and advise where the tolerances have not been met, including overbuilding of the width of a granular course.
- b) The Contractor shall be charged for each station where the tolerances have not been met, at the rate specified in the Basis of Payment section.
- c) The Contractor shall bring the granular surface to within the specified tolerances for grade, at no additional cost to the Owner.

### **314.09 MEASUREMENT FOR PAYMENT**

#### **314.09.01 Actual Measurement**

##### **314.09.01.01 Granular A, B Type I, B Type II, B Type III, M and O Granular A, B Type I, B Type II, B Type III, M, and O Stockpiled Granular A, B Type I, B Type II, B Type III, M, and O from Stockpile Select Subgrade Material, Compacted RAP Shouldering**

##### **314.09.01.01.01 Tonne**

When payment is by the tonne:

- a) When the Contractor supplies Granular A and M composed of air-cooled iron blast-furnace slag or nickel slag, the payment quantities shall be determined by applying the following factors:
  - i. The total measured mass of air-cooled iron blast-furnace slag incorporated into the work shall be multiplied by a factor of 1.116.
  - ii. The total measured mass of nickel slag incorporated into the work shall be multiplied by a factor of 0.85.



- b) When Granular B is composed of slag, the payment quantities shall be determined by comparing the density of the material to the average density of granular material as set by the Owner for that specific area and applying the conversion factors that have been determined to the weighed tonnes.
- c) When granular material is composed of slag, it is necessary to determine the amount of overrun or underrun. Such overrun and underrun shall be the difference between the tender quantity and the payment quantity as determined by applying the foregoing factors to the weighed tonnes.

#### **314.09.01.01.02          Cubic Metre**

When payment is by cubic metre, one of the following methods shall be used as determined by the Contract Administrator:

##### **a) End Area Method**

###### **i. At Source**

The volume of material shall be measured at the source in its original location and computed in cubic metres by the method of average end areas.

Cross-sections shall be taken after the source has been cleared, grubbed, and stripped of all unsuitable surface material.

The volume of boulders removed from borrow pits that cannot be accommodated in embankments or any other areas acceptable to the Owner, shall be deducted.

###### **ii. In Place**

When the measurement for payment of material in its original location is impractical, the measurement for payment shall be made of material measured in place with no allowance for shrinkage and computed in cubic metres by the method of average end areas.

##### **b) Truck Box Method**

The truck box method shall only be used when the Contract Administrator deems that the quantities are too small or the end area method is impractical for other reasons.

In this case, measurement for payment shall be based on the total volume in cubic metres of loose granular material, calculated by the Contract Administrator, from estimated percentages of the pre-determined capacity of each truck box determined from measurements of its dimensions.

Each truck that the Contractor intends to use shall be uniquely and readily identifiable to the satisfaction of the Contract Administrator.

#### **314.09.01.01.03          Square Metre**

When payment is by square metre, the area shall be based on that shown in the Contract Documents.

#### **314.09.02          Plan Quantity Measurement**

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

**314.10****BASIS OF PAYMENT****314.10.01**

**Granular A - Item**  
**Granular A, Stockpiled - Item**  
**Granular A, from Stockpile - Item**

**Granular B Type I - Item**  
**Granular B Type I, Stockpiled - Item**  
**Granular B Type I, from Stockpile - Item**

**Granular B Type II - Item**  
**Granular B Type II, Stockpiled - Item**  
**Granular B Type II, from Stockpile - Item**

**Granular B Type III - Item**  
**Granular B Type III, Stockpiled - Item**  
**Granular B Type III, from Stockpile - Item**

**Granular M - Item**  
**Granular M, Stockpiled - Item**  
**Granular M, from Stockpile - Item**

**Granular O - Item**  
**Granular O, Stockpiled - Item**  
**Granular O, from Stockpile - Item**

**RAP Shouldering - Item**  
**Select Subgrade Material, Compacted - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

As specified in the Acceptance subsection, \$250.00 shall be deducted from payment for each station where the QA grade check of the finished grade is found to be outside of the specification limit.

Any additional grading carried out to correct grades that are not within the tolerances specified in the Tolerances subsection shall be carried out at no additional cost to the Owner.

Where a finished granular course exceeds the horizontal tolerances specified in the Tolerances subsection and the material outside that tolerance has been left in place, the Owner shall deduct from payment the theoretical quantity of material placed outside of that tolerance, based on a conversion factor of 2.0 t/m<sup>3</sup>, regardless of the type of granular material used.

**TABLE 1**  
**Modified Layer Compaction Thickness for Granular B, Type II**  
**Single Drum, Vibratory, Smooth Wheel Drum Roller**

Minimum Operating Mass (kg)	Minimum Operating Dynamic Force (kN)	Maximum Layer Depth After Compaction (mm)
5,000	75	300
8,000	150	450
12,000	250	600
15,000	350	750

**TABLE 2**  
**Allowable Tolerances for Finished Granular Surfaces**

Tolerances From Specified Grade and Cross-Section	Finished Granular Courses (mm)	Finished Granular Surfaces Immediately Beneath Bituminous Courses, Sidewalks, and Curb and Gutter (mm)		Finished Granular Surfaces Immediately Beneath Concrete Courses, Sidewalks, and Curb and Gutter (mm)
		When the Finished Grade is Controlled by Fixed Components Such as Existing Pavements and Curbs	All Others	
<b>Vertical</b>	+ 30 - 30	+ 10 - 10	+ 30 - 30	+ 10 - 10
<b>Horizontal</b>	+ 30 - 0	+ 10 - 0	+ 30 - 0	+ 10 - 0
<b>Surface Deviation (Note 1)</b>	15	10		10

Notes:

1. The maximum gap between a granular surface and the underside of a 3 m rigid metal straightedge, placed anywhere and in any direction on that surface.