

AMENDMENT TO OPSS 313, MARCH 1993

Special Provision No. 103F31

February 2006

Asphaltic Concrete Surface Tolerance and Payment Adjustment for Surface Smoothness

313.01 SCOPE

Section 313.01 of OPSS 313 is amended by the addition of the following:

This specification covers all surface smoothness requirements for hot mix construction.

313.02 REFERENCES

Section 313.02 of OPSS 313 is amended by the addition of the following:

Ministry of Transportation Publications:

LS-100 Rounding-Off of Test Data and Other Numbers

LS-293 Method of Test for Correlating Profile Measuring Devices and Conducting Surface Smoothness Measurements

American Society for Testing and Materials (ASTM):

ASTM E 1274 - 88 - Standard Test Method for Measuring Pavement Roughness Using a Profilograph

313.03 DEFINITIONS

Section 313.03 of OPSS 313 is amended by the addition of the following:

Blanking band: means a band of uniform height “B” in mm (0 mm for asphaltic concrete) and with a length equal to the subplot length, which is positioned optimally between the highs and the lows of the profile trace to “blank out” as much of the profile trace as possible.

Cold in-Place Recycled Mix (CIR): means the in situ mixture of reclaimed existing asphalt pavement, emulsified asphalt, and water.

Existing Surface: means the original pavement surface prior to construction under the Contract.

Expanded Asphalt Mix (EAM): means “Full Depth Reclamation With Expanded Asphalt Stabilization” which is a mixture of reclaimed existing asphalt pavement, granular base, corrective aggregate if required, and expanded asphalt.

Filter factor: means an input parameter which can be used to electronically modify the surface trace.

Final profile index: means the profile index used for acceptance purposes.

Initial profile index: means the first profile index measured for a given subplot as soon as it is feasible to do so after final rolling.

Micromilling: means the use of a milling machine equipped with a specialized milling drum fitted with closely-spaced carbide bits (i.e. about 450 to 500, spaced approximately 5 mm apart) which allows for the restoration of the riding characteristics of some asphaltic concrete pavements.

Profile index: means the rate of smoothness averaged over both wheel paths for a given subplot.

Profile Measuring Device (PMD): means a device used for measuring the pavement profile.

PMD Operator: means the Ministry-approved person who actually operates the PMD or the Ministry-approved Quality Control Technician (QCT) or the Paving Control Technician (PCT) who provides on-site direct supervision during the operation of the PMD.

Pulverized Grade: means a grade that has undergone “In-place Full Depth Reclamation of Bituminous Pavement and Underlying Granular”.

Quality Assurance (QA): Means a system or series of sampling, testing or other activities carried out by the Owner to ensure that materials/products received from the Contractor meet the specified requirements.

Quality Control (QC): Means a system or series of sampling, testing or other activities carried out by the Contractor to ensure that materials/products supplied to the Owner meet the specified requirements.

Rate of Smoothness: means the amplitudes of all of the individual bumps and depressions outside of a blanking band which are greater than 0.8 mm and which also extend at least 0.6 m as measured by a PMD along the profile length; are all added together and then divided by the subplot length; expressed in mm/km.

Reduction length: means an input parameter which is equal to the subplot length normally set at 100 m.

Scallop: means a bump or depression in the pavement surface at a location which is automatically determined by the PMD’s computer as either a line through the profile trace for McCracken profilographs or a shaded mark above the trace for Cox profilographs, which is at least “S” mm (“S”=10 mm shall be the upper limit for acceptability of asphaltic concrete) above or below a 7.5 m long baseline which is constantly changing in elevation due to the surrounding pavement.

Sublot: means a continuous traffic lane of pavement; excluding the shoulder, which has been measured by PMD for purposes of repairs/payment adjustments and normally having a length of 100 m, measured horizontally for highway survey purposes.

Subsequent profile index: means any profile index measured after the initial profile index.

Tolerance(s): means measurements of deviations which are taken using a rigid metal straight edge.

Total Allowable Repair Area Limit: means the limit for all surface smoothness-related repairs which is equal to 5% of the area represented by all measured sublots of surface course constructed within the same construction season.

Wheel paths: means 1.0 m on each side of the centreline of the actual trafficked lane. The trafficked lane does not include adjacent paved areas such as paved shoulders or tapers.

313.06 EQUIPMENT

Section 313.06 of OPSS 313 is amended by the addition of the following subsection:

313.06.03 Profile Measuring Device (PMD)

The Contractor shall conduct surface smoothness measurements using a PMD, which has been approved by the Owner.

California profilographs shall conform to ASTM E 1274 – 88 and LS-293.

313.06.03.01 Calibration, Correlation and Operator Approval

The Contract Administrator shall verify that the Contractor's PMD is accurately calibrated for both height and distance recording using the method and frequency outlined in ASTM E1274 and the air pressure of the measuring wheel is within specified tolerances at all times, in accordance with LS-293.

The Owner shall have the right at any time to confirm the height/distance calibration of the Contractor's PMD, in accordance with LS-293. In the event that the height calibration is not within the specified limits and the Contractor is unable to bring it within specified limits by following the Manufacturer's recommended assembly and maintenance procedures in the presence of the Owner, the faulty PMD will not be permitted to be used for further measurements until it has been recalibrated by the Manufacturer.

All PMD's to be used on the Contract site shall be correlated with the Owner's California Profilograph at a Correlation Site, on an annual basis, in accordance with LS-293 and must meet the Owner's requirements prior to use on any of the Owner's contracts.

All PMD's shall be operated under the direct supervision of a Ministry-approved PMD Operator. PMD Operators will be required to present a signed card to the Contract Administrator when requested.

313.06.04 Diamond Grinder

A diamond grinder shall be power-driven, self-propelled and designed for grinding asphalt. It shall be equipped with a grinding head with at least 50 diamond blades per 300 mm of shaft. The grinding head shall be at least 0.9 m wide. The grinder shall be equipped with the capability to adjust the depth, slope and cross fall to ensure that the asphalt is removed to the desired dimensions and shall also include a slurry pick-up system. The slurry shall be removed from the site by the Contractor and managed and disposed of as specified elsewhere in the contract.

313.07 CONSTRUCTION

Clause 313.07.01.07 of OPSS 313 is replaced by the following:

313.07.01.07 Smoothness Correction of Pavement Surface(s) Beneath the Surface Course

At no additional cost to the Owner, unless otherwise specified in the Contract, the Contractor may place hot mix padding on the existing pavement or any other pavement(s) underlying the surface course, as the Contractor deems necessary, in order to meet the surface smoothness requirements specified for the surface course. Diamond grinding or micro-milling will also be allowed for such corrections on existing pavements or any other pavements underlying the surface course, but only if the thickness of those pavements after

grinding or micro-milling is not reduced by more than 5 mm below the general profile of the surrounding unground or unmilled pavement surface.

313.07.01.10 Use of Paving Equipment

Clause 313.07.01.10 of OPSS 313 is amended by deleting paragraphs 3 and 5.

313.07.01.16 Surface Tolerance and Smoothness

Clause 313.07.01.16 of OPSS 313 is deleted and replaced with the following:

Each course of pavement after final compaction shall be smooth and true to the established crown and grade and shall be free from deviations determined as follows:

a. Tolerances Determined by Straight Edge:

Tolerances shall be measured using a rigid metal straight edge, 3 m in length, which has been approved by the Contract Administrator.

Tolerance measurements shall be carried out by the Contractor for quality control. In addition, at any time, the Contractor may be required to take additional tolerance measurements at the direction of and in the presence of the Contract Administrator or his representative.

b. Surface Smoothness:

The Contractor shall measure the pavement surface using an approved PMD on all areas of surface courses where the posted speed limit of the in-service pavement will be greater than 60 km/hour.

The following areas shall be exempt from PMD measurements:

- areas of Open Friction Course construction;
- areas where a single lift (with or without leveling and/or padding) is placed on an existing surface;
- areas where a single lift is placed on partial depth reclamation in Northeastern or Northwestern Regions;
- lanes less than 400 m in length;
- portions of lanes which are not full lane width;
- acceleration, deceleration and turning lanes;
- shoulder widenings;
- detours and other temporary pavement that will be removed or overlaid under the Contract;
- longitudinal joints;

- curves with a centreline radius of less than 300 m and pavement within the superelevation transition, i.e. slope changes, of such curves;
- the first adjacent lane consisting of one or more lifts of hot mix where the Contractor must match to an existing surface which is not being resurfaced under this Contract;
- within 10 m of the end of a placement where the paving Contractor is not responsible for the adjoining surface;
- within 15 m of the expansion joints on the roadway side of the abutments and within 10 m of expansion joints on adjacent bridge deck sections for sections greater than 50 m in length where the expansion joints are being installed prior to paving;
- bridge decks and bridge deck sections less than 50 m in length;
- within 10 m of any access holes, water valves or similar structures which are located within the lane or within 1.5 m of the outside edge of the lane;
- where damage occurs to the pavement which is beyond the reasonable control of the Contractor as described in sub clause 313.08.05.02.06 and;
- the following additional stations, roadways and major intersections:

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At least 24 hours prior to beginning the construction of the surface course, the Contractor may propose areas for consideration by the Contract Administrator, in consultation with the Owner which the Contractor wants exempted from the surface smoothness-related payment adjustment or repair requirements. The decision of the Contract Administrator regarding such areas will be binding and no additional areas may be exempted from such requirements, except for “Damaged Areas” excluded by the Contract Administrator in accordance with clause 313.08.05.02.06 of this special provision.

If the tolerance requirements are not met, the requirements for repairs as stated in clause 313.08.05.03 shall apply to any longitudinal joints and any areas which are exempt from surface smoothness measurements or surface smoothness-related payment adjustments or repairs.

313.08 QUALITY ASSURANCE

Section 313.08 of OPSS 313 is amended by the addition of the following:

313.08.05 Acceptance Criteria for Surface Tolerance and Smoothness

313.08.05.01 Tolerances

The tolerances of the pavement surface shall be such that when tested with a 3 m long straight edge placed anywhere, including the edge of the pavement, in any direction on the surface, except across the crown or drainage gutters, there shall not be a gap between the bottom of the straightedge and the surface of the pavement greater than 6 mm for all binder courses and their joints and all padding, or greater than 3 mm for all surface courses.

313.08.05.02 Surface Smoothness

Surface smoothness measurements must be carried out on all surface courses, with the exception of the areas listed under Clause 313.07.01.16, Part b and any “Damaged Areas” in accordance with clause 313.08.05.02.06 of this special provision.

313.08.05.02.01 Lot Size

A lot shall consist of the total pavement quantity in a given surface course contract item that was measured by a PMD. Each lot will generally be divided into 100 metre sublots.

Upon finishing the last complete subplot in any lane, if the remaining portion of the lane is greater than or equal to 50 m in length, then that remaining portion of the lane will be considered to be the last subplot in the lane. However, if the portion of the lane is less than 50 m in length, then it will be added to the previous subplot in the lane. In either case, the profile index of the affected subplot shall be averaged over the increased/reduced subplot length and the subplot will be considered equally with all other sublots when calculating the overall payment factor.

313.08.05.02.02 Measurement of Surface Smoothness

Before the pre-pave meeting, the Contractor shall present a sketch to the Contract Administrator with the proposed details for the numbering and stations of each subplot, separating out the sublots subject to the full requirements for payment adjustments/repairs from those which will be subject to smaller payment reductions which are listed in Note 3, Table B. During the pre-pave meeting, the sketch will be reviewed and discussed. However, at any time up until surface smoothness measurements of any particular subplot begin, the Contract Administrator will have the right to make any changes to the sketch which affect that subplot. The Contract Administrator will notify the Contractor in writing of such changes not later than two business days before the measurements of that subplot are taken.

The Contractor shall carry out surface smoothness testing of an individual subplot of surface course, in accordance with LS-293 and all other requirements herein, within 10 business days of that subplot being constructed, unless otherwise agreed to by the Contract Administrator.

The Contractor shall give the Contract Administrator a minimum of 48 hours notice prior to surface smoothness testing at any locations on the surface course or on the upper binder course for carry-overs, as described in Clause 313.08.05.02.05.

Prior to testing, the Contractor shall clearly mark each subplot at regular intervals of no more than 100 m, either on the pavement surface by using painted marks or surveyed nails or on the shoulder by using chainage stakes located within the right-of-way. All marks shall remain visible until the final measurements are completed and accepted.

Prior to beginning surface smoothness measurements each day, the Contractor shall give the Contract Administrator sufficient notice to allow him to observe the height calibration and to sign the beginning of the daily profile record. In addition to the Contract Administrator, the PMD Operator shall also sign the beginning of the profile trace. At that time the Contractor shall inform the Contract Administrator of:

- 1) The pavement sections that he intends to measure,
- 2) The longitudinal reference line (s) and offsets that he intends to use during that visit to ensure that the measurements are taken within 150 mm of the proposed wheel paths for the finished lane and

- 3) The method that the Contractor intends to use to ensure that the proposed reference line remains visually intact until all sublots have been accepted for payment by the Contract Administrator.

Stations, areas that will not be measured, areas that will be measured but not payment-reduced and all distances from such areas shall be referenced from the centreline of the PMD's measuring wheel.

At the end of each day or prior to the PMD leaving the site, whichever occurs first, the Contractor shall present the Contract Administrator with an original, unbroken, continuous profile record, representing all of the sublots and any other pavement surfaces which were measured that day, in accordance with LS-293. All daily profile records shall have the signatures of both the Contract Administrator and the PMD Operator with the date and time, which they were signed both at the beginning and end of the roll. Should the printer for the PMD require a change in its paper spool at some time during the day, then the Contractor shall inform the Contract Administrator of this requirement and he shall not proceed with any additional measurements until the Contract Administrator has signed the beginning of the new profile record, along with date and time clearly written. Profile records shall be submitted to the Contract Administrator on the date that the profile record is signed by the Contract Administrator or his representative.

Sublots with profile traces that are incomplete, of improper format, contain discrepancies or missing shall be deemed incomplete and unacceptable for payment purposes and will have to be remeasured.

After the initial profile trace is made, all areas to be repaired due to scallops shall be marked on the pavement surface by the Contractor prior to doing any corrective work.

The Contractor shall fill out all of the required information on summary acceptance forms which have been approved by the Contract Administrator for the surface course(s), in accordance with LS-293. The updated forms for the sublots measured for payment purposes shall be handed to the Contract Administrator no later than five business days following the date when the measurements were taken and prior to any corrective action taking place.

The Contractor shall also provide to the Contract Administrator and the Bituminous Section summaries of all profile indices and all scallop locations/heights taken in both wheel paths in Microsoft® Excel spreadsheet file(s) on either 3.5" floppy disks or sent electronically by E-mail for use by IBM-compatible PC's. The disks or E-mail shall be submitted within ten working days after all surface smoothness measurements taken on the Contract, during the same season, have been completed.

The individual payment factors for each subplot based on profile index measurements are shown in Table B.

The original profile traces for any subplot of surface course(s) shall be made available to the Contract Administrator for inspection, at any time when requested. All profile traces shall remain the property of the Owner.

313.08.05.02.03 QA Testing

The Owner will conduct QA measurements on a minimum of 10% of the surface course constructed and measured by the Contractor, within a given construction season. All QA measurements will be conducted on independent QA sections, from 300 to 1000 m long. Each independent QA section will be measured within 15 business days of its construction.

The Contract Administrator will designate a third party, to operate an approved, i.e. correlated, PMD, on behalf of the Owner, which will be deemed to be the "Owner's PMD" for such testing. The Contract

Administrator will inform the Contractor, at least 48 hours prior to taking any QA measurements at the contract site.

The disposition of each independent QA section resulting from a comparison between the average QA and QC profile index measurements within that section is summarized in Table A.

As part of the QA/QC comparison of the independent QA sections described above, the Contract Administrator will verify that the QC summaries and profile traces have correctly identified the number and amplitude of all scallops which were identified by the QA measurements. If, in any single subplot, the Contract Administrator finds at least one scallop(s) present in the QA trace with an amplitude greater than 11.0 mm that is not identified in the applicable QC trace or summary sheet or the amplitude of at least one of the scallops within that subplot is at least 1.5 mm larger than the amplitude of the same scallop identified on the applicable QC trace or summary sheet and that difference affects the disposition of that scallop (i.e. the QA measurements indicate that the size of its payment adjustment increases or that it now must be repaired) then:

- a) The QA profile traces and/or applicable summary sheets for the affected subplot will be given to the Contractor,
- b) The QA measurements for that subplot will be used for the disposition of any scallops measured by the Owner's PMD within the affected subplot,
- c) The QA profile index will be used for the acceptance of the affected subplot, and will take precedence over the adjustment of that subplot based on the QC/QA outcome outlined in Table A, or
- d) The Contractor, may request referee testing for the single subplot which contains the disputed scallop(s) in accordance with clause 313.08.05.02.04.

For any of the QC/QA comparisons described herein, the Contractor shall provide all required traffic control, protection and lane closures at any locations chosen by the Owner, for up to three separate visits to the site by the Owner's PMD for a combined total of up to 20 hours of measurements, excluding any waiting time in which the Owner was delayed by the Contractor.

TABLE A – QA Versus QC testing For Independent QA Sections

Average QA Versus QC Profile Index (see Note 1)	Outcome
$QA_{avgPI} \leq 1.10 \times QC_{avgPI}$	- The Contractor’s QC measurements for the sublots measured by the Owner’s PMD will be used for acceptance purposes.
$QA_{avgPI} > 1.10 \times QC_{avgPI}$	- The Contract Administrator will give one original copy of all of the Owner’s QA traces and/or one copy of the summary sheet(s) for the measured sublots which were used to determine QA_{avgPI} to the Contractor within 20 business days of the construction of those sublots; - Either the Owner’s QA measurements will be used for acceptance of the sublots measured by the Owner’s PMD or - The Contractor may request referee testing in accordance with clause 313.08.05.02.04.

Note 1: QA_{avgPI} = average QA profile index for each independent QA section
 QC_{avgPI} = average QC profile index for each independent QA section

313.08.05.02.04 Referee Testing

When the Contractor chooses Referee testing, as permitted in clause 313.08.05.02.03, the Contractor shall request “Referee testing” within 5 business days of receiving all of the Owner’s applicable QA profile traces for the subplot(s) that are challenged. The Contractor may request referee testing for an entire independent QA section when the dispute involves average profile index for that section, for any subplot when the dispute involves one or more scallops within that subplot or for both. The request shall state exactly what independent QA sections and/or single sublots that the Contractor wants the Referee PMD to measure.

Provided that the Contractor’s written request for Referee testing is received within the specified time period, the Owner will select a company which will conduct that testing from a pre-approved list of consultants. The measurements will be repeated using a “Referee PMD”, within 10 business days of receiving the Contractor’s written request for Referee testing and will be binding on both the Contractor and the Owner.

Differences Based on Average Profile Indices:

When Referee testing is carried out due to differences of average profile indices between QA and QC test results for the independent QA sections then:

- 1) The Referee profile indices will be used for the acceptance of all sublots measured by the Referee PMD and
- 2) The measurements by the “Referee PMD” will be used for the disposition of any scallops included in all sublots measured by the Referee PMD.

Differences Based on Scallops:

When the Referee testing is carried out for one or more sublots due to differences between QA and QC test results that affect the disposition of one or more scallops, then

- 1) The test results from the "Referee PMD" will be used for the disposition of all scallop(s) within the disputed sublots and
- 2) The Referee profile index will be used for the acceptance of the subplot(s) that contained the disputed scallop(s).

313.08.05.02.05 Carry-Over Contracts

If the Contractor cannot construct a portion of the surface course in the same construction season as its underlying binder course then, prior to the close of the construction season in which the binder course for that portion of the surface course was constructed, the Contractor shall choose one of the following options

- Option 1: The Contract Administrator will reduce the profile indices of each of the sublots in the portion of the surface course which will be constructed over the upper binder course in a following construction season by 15 mm/km or
- Option 2: The Contractor will carry out surface smoothness measurements on all of the sublots included in that same portion of the upper binder course prior to the close of the season in which they were constructed.

If the Contractor does not submit the written notification that Option 2 has been chosen prior to taking any surface smoothness measurements on the upper binder course, then Option 1 shall apply.

Procedures for Option 2:

If the Contractor decides to measure the upper binder course prior to the close of the construction season in which those sublots of binder course were constructed, then the Contractor shall re-measure the surface smoothness of those same sublots of binder course after the frost has come out of the ground and the profilograph has successfully passed the spring re-correlation in the same construction season in which the overlying sublots of surface course will be constructed.

To ensure that all of the measurements taken on the upper binder course in the two different construction seasons are coincident with one another, the Contractor shall clearly and permanently mark the subplot stations and the reference lines and offsets used for each wheel path on the pavement surface at the edge of the lane and at regular intervals of no more than 100 m, prior to taking the first set of measurements on the upper binder. In addition, the Contractor shall conduct all smoothness measurements on the binder using profile runs of no more than 500 m long before setting up at a new station.

Prior to taking any such measurements on the binder course, the Contractor shall give the Contract Administrator at least 24 hours written notice. At the end of each day prior to the PMD leaving the site, the Contractor will be required to present the original, unbroken, continuous profile traces for all sublots measured on the binder course that day for each lane and wheel path to the Contract Administrator.

If the average profile index for all of the sublots of binder course which were re-measured in the spring is more than 5% greater than the average profile index for the same sublots measured prior to winter shut-down,

then the profile indices for the corresponding overlying sublots of surface course will be reduced by 80 percent of the difference in average profile index which was recorded for the binder course in the two different construction seasons after adjusting for the difference in means that the PMD(s) established at the correlation site at the beginning of each of the two affected seasons.

If a subplot of the binder course exhibits ravelling in the spring that the Contract Administrator classifies as worse than “very slight”, as described in the Owner’s Manual for Condition Rating of Flexible Pavements – Distress Manifestations” (i.e SP-024), then that subplot shall not be included in the comparison of the two sets of measurements of the binder course.

No additional payment will be made for measurements of the binder course.

313.08.05.02.06 Damage to Existing Pavement Surface After Preparation or Damage to Surface Course Prior to Smoothness Measurements

The Contractor shall provide written documentation to the Contract Administrator within one business day of the occurrence of damage to areas of:

- existing pavement surfaces, underlying a subplot, which have been milled and/or padded; or
- surface course within a subplot;

when such damage was due to circumstances beyond the Contractor’s control and occurred prior to measurement for surface smoothness.

The Contractor shall not cover the affected area with hot mix until a decision is made by the Contract Administrator. The Contract Administrator, in consultation with the Ministry, will evaluate the Contractor’s submission and may exclude all or part of the affected area from the final calculation for the payment factor.

313.08.05.03 Repairs and Redecisioning

In general, all pavement which exceeds the tolerances for straight edge measurements is rejected and must be repaired. However, the Contract Administrator, in consultation with the Ministry, may assess a penalty in lieu of repair.

The Total Allowable Repair Area Limit for all surface smoothness-related repairs shall not be exceeded.

Any scallop will either be repaired or receive a penalty in accordance with the requirements given in Table D. However, if one or more of these scallops are located within a rejected subplot, then at least a portion of the subplot containing the scallop(s) shall be repaired, subject to the Total Allowable Repair Area Limit.

For any subplot with initial profile indices which are greater than 430 mm/km but less than or equal to 550 mm/km, the Contractor will not be permitted to repair the subplot unless it contains at least one scallop with an amplitude greater than 14.5 mm.

For any subplot with initial profile indices which are greater than 550 mm/km, the subplot is rejected and the Contractor shall repair at least a portion of the subplot, subject to the Total Allowable Repair Area Limit.

Where surface smoothness-related repairs are not permitted because such repairs will exceed the Total Allowable Repair Area Limit, then penalties shall be assessed in lieu of repairs, in accordance with Tables B and D.

All repairs shall be made in accordance with clause 313.08.05.03.01 of this special provision prior to the end of the season in which the pavement was constructed, unless otherwise agreed to by the Owner. Redecisioning shall be in accordance with clause 313.08.05.03.02 of this special provision.

All repairs and the rededecisioning of all sublots which are constructed in a given construction season shall be completed within 30 days of the last set of measurements indicating repairs for those sublots, unless otherwise agreed to by the Owner.

313.08.05.03.01 Repairs

General:

At least 5 business days prior to beginning any surface smoothness-related or tolerance-related repairs, the Contractor shall submit a written proposal to the Contract Administrator with the subplot and repair locations including the appropriate stations, length of each repair area, distance between the ends of the repair areas on the same lane that are within 100 m of each other, and method(s) of repair that the Contractor intends to use for each repair area. The Contractor shall not start repairs unless the Contract Administrator has given written permission. If permission is denied, then the Contract Administrator will provide the Contractor with the reason(s) in writing.

Repairs shall consist of one or more of the following corrective measures:

1. Diamond Grinding
2. A hot mix overlay, where permitted;
3. Remove and Replace; and/or
4. Other methods of repair, if approved by the Contract Administrator, in consultation with the Ministry.

Diamond Grinding:

Subject to the Total Allowable Repair Area Limit, diamond grinding will not be allowed in any area of the surface course where that area:

- a) Consists of a single lift of hot mix placed on a granular surface, Expanded Asphalt Mix (EAM) Pavement or on pulverized grade; or
- b) Will be reduced by more than 5 mm below the general profile of the surrounding pavement surface after the repair.

A subplot shall be limited to no more than 3 separate diamond ground repair areas representing a total combined area not exceeding 20 percent of that subplot.

If the Contractor wishes to grind more than 5 mm below the general profile of the surrounding pavement surface, the Contractor shall, at the Contract Administrator's request, prove by coring that the design thickness of the surface course will not be reduced by more than 5 mm after the repair.

Diamond grinding shall be performed parallel to the lane with each pass overlapping the previous one by at least 25 mm. The elevation difference between abutting edges of adjacent lanes shall not exceed 3 mm after grinding and the pavement cross slope shall be maintained throughout the repaired area. The pavement after repair shall be of uniform surface texture.

Hot Mix Overlay / Remove and Replace

As long as the Total Allowable Repair Area Limit is not exceeded, overlays on traffic lanes beneath structures may be allowed, if clearances between the pavement surface and the underside of the structure after overlay meet the established minimum requirements. Overlays on traffic lanes adjacent to curb-and-gutter or on bridge decks shall not be permitted. If an overlay is constructed, it shall be re-tested. If the overlay does not meet the tolerances and/or surface smoothness requirements specified in the Contract, a second overlay will not be permitted.

The transverse joints for an overlay shall be a butt joint-constructed by removing the existing surface course to a minimum depth of 40 mm to form a straight vertical face and for a longitudinal distance of not less than 3 m.

A paver shall be used wherever corrective measures include removal and replacement or the construction of a hot mix overlay. Hot mix used in such repairs shall meet all of the requirements specified for the item in the Contract. Hot-in-place recycling may only be used to repair hot-in-place contract items. Where there is an integral overlay, the integral overlay must be replaced with a new integral overlay of the same specified thickness as the original integral overlay.

The minimum width of all repairs by “remove and replace” or a hot mix overlay shall be the width of the lane being repaired, i.e. between longitudinal joints, and including any pavement markings that may be present. Also, for such repairs, there shall be no more than one repair area in an individual subplot and all individual repair areas shall be at least 50 m apart.

313.08.05.03.02 Redecisioning

When repairs are made to pavement courses, due to unacceptable tolerances measured by straight edge or for any other reasons, the Contract Administrator may, at his discretion and in his presence, require the Contractor to re-test the repaired area by 3m straight edge at the Contractor’s cost.

When repairs are made to all or part(s) of any subplot for the pavement courses defined by part b) of clause 313.07.01.16 of this special provision for any reason, then the entire subplot shall be re-tested by PMD as specified in the Contract. Re-testing by PMD shall include at least 15 m on either side of the repaired area. If this requirement extends the testing onto an adjacent subplot, then the adjacent subplot shall also be re-tested. Subsequent profile indices acquired after such repairs shall be used, to a maximum value of 1.0, in the final calculations for payment adjustment to the lot.

After a subplot is repaired/overlayed due to high initial profile indices or scallops, then that subplot shall have no scallops with amplitudes greater than 14.5 mm and its subsequent profile index shall be less than or equal to 550 mm/km.

313.10 BASIS OF PAYMENT

313.10.01 Hot Mix

Subsection 313.10.01 of OPSS 313 is amended by the addition of the following:

313.10.01.02 Surface Smoothness

Profilograph Correlations, Recorrelations and Operator Approvals:

The Contractor shall be responsible for all costs that the Contractor and the Owner incurs, in order to meet and maintain the Owner's requirements for the correlation of the profilograph, regardless of the number of times that the Contractor must visit the Correlation Site and for the approval of all persons responsible for either supervising or actually operating the PMD.

The Ministry's cost for the first approval of each PMD at the beginning of each construction season will be \$250 for a maximum two-hour visit to the correlation site, plus an additional \$50 for each additional hour beyond the maximum. The cost for any additional visits to the correlation site for PMD re-approvals during each construction season will be \$500 for a maximum two-hour visit, plus \$100 for each additional hour beyond the maximum. A "visit" shall be deemed to begin when the Operator first begins calibration of the Contractor's assembled PMD, in the presence of the Ministry's representative. An additional \$200 will also be charged for each PMD/QCT Operator approval test which is conducted by the Ministry.

Profile Index:

A subplot's payment factor for smoothness shall be based on the subplot's QC profile index, unless that subplot has been repaired or the initial QC profile index has been substituted or adjusted as a result of a QC/QA comparison, Referee testing or carry-over. Where a subplot has been repaired, a subsequent reading taken after the repair shall be used in the calculation for the payment adjustment to that subplot.

A subsequent profile index shall not be used to increase a payment factor, unless the subplot has been repaired.

No subplot that has been repaired for any reason shall receive a payment factor greater than 1.0.

For any subplot with an initial profile index which is greater than 430 mm/km but less than or equal to 550 mm/km, the Contractor may either accept the inclusion of its payment factor in the calculation for the lot or the Contractor may choose to repair at least a portion of the subplot, subject to the Total Allowable Repair Area Limit.

The individual payment factors for each subplot shall be determined by substituting the profile indices into the applicable formulae shown in Table B and rounding to 3 decimal places, in accordance with LS 100.

The payment factor for the entire lot shall be the average of the individual payment factors for all measured sublots of surface course within the lot, rounded to 3 decimal places, in accordance with LS 100, up to a maximum 1.050 times the Contract price of the hot mix surface course tender item.

If the average payment factor for the lot is equal to 1.000, the payment adjustment shall be zero.

If the average payment factor for the lot is greater than 1.000, the payment adjustment shall be:

$$(PFS - 1.000) \times \text{Price} \times \text{Lot Quantity}$$

If the average payment factor for the lot is less than 1.000, the payment reduction shall be:

$$(1.000 - \text{PFS}) \times \text{Price} \times \text{Lot Quantity}$$

where: PFS = the average payment factor for smoothness for the lot

The term “Price” means the contract price of the hot mix surface course tender item. However, when the Contract specifies that the contract price will be adjusted due to a change in asphalt cement content from that specified for bidding purposes, then “Price” means the contract price after adjustment for the change in asphalt cement content, if applicable.

For the “Lot Quantity”, the Contract Administrator will calculate the theoretical tonnage of surface course in the lot using the length of pavement on which the PMD measurements were made, design widths and lift thickness of the finished lane; including any paved shoulder up to 0.5 m in width which is being placed at the same time and using the same paver as the finished lane, and the mean lot average bulk relative density calculated from all of the values obtained from compaction acceptance testing of core samples for the applicable surface course. The bulk relative density values shall be the same as those used in calculating the final compaction payment factors, as specified elsewhere in the Contract Documents.

TABLE B - Payment Factors

Surface Course Profile Indices (PI) (mm/km per Sublot)	Payment Factor
≤ 150	1.200 (subject to Note 2 given below)
150 to 230	$1.575 - \frac{\text{PI}}{400}$ (subject to Note 2 given below).
230 to 430	1.000
430 to 550	$1.358 - \frac{\text{PI}}{1200}$ (subject to Notes 3 and 4 given below)
551 or greater	REJECTED (Requires repairs – subject to Notes 4 and 5 given below)

NOTES: 2 The payment factor shall be equal to 1.000 for subsequent profile index measurements which are taken after repairs regardless of the reason for the repairs

- 3 For sublots with profile indices between 430 and 550 mm/km and located:
- where the surface course consists of Stone mastic Asphalt (SMA); or
 - where the construction consists of a single lift of hot mix (with or without leveling and/or padding) placed on pulverized grade where provision for Granular “A” placed on the pulverized grade is not included in the Contract; or
 - in areas on resurfacing contracts where the Contractor is required to match pavement elevations to a curb or barrier wall which was not constructed on the Contract, is within 1.5

- m of the lane being paved and the paver has simultaneously paved both the lane and shoulder, if there is a shoulder; or
- d) where the construction consists of a single lift of hot mix placed over Expanded Asphalt Mix (EAM) pavement:

then the payment factor shall be:

$$1 - \frac{\text{TODRF (PI-430)}}{1200}$$

Where: TODRF is the Tender Opening Date Reduction Factor given by Table C and PI is the profile index for the applicable subplot in mm/km.

- 4 Sublots, with profile indices between 430 and 600 mm/km and located in areas of hot-in-place being used as a surface course (including hot-in-place with an integral overlay and hot in-place recycled premium mix), shall receive a payment factor of 1.00. Sublots with profile indices greater than 600 mm/km and located in areas of hot-in-place recycling being used as a surface course (including hot-in-place with an integral overlay and hot in-place recycled premium mix) shall be repaired if within the total repair area limit.
- 5 Repairs to a subplot will only be allowed provided that the total area for all surface smoothness-related repairs has not exceeded the Total Allowable Repair Area Limit. Any rejectable subplot that is not allowed to be repaired because the Total Allowable Repair Area Limit is exceeded will receive a payment factor of 0.500, in addition to any other penalties assessed for scallops within that subplot that are also not allowed to be repaired.

TABLE C – Tender Opening Date Reduction Factor

Paving Situation	Year of Tender Opening	Tender Opening Date Reduction Factor (TODRF)
Where:		
- a single lift is placed over EAM pavement	2006	0.6
	2007	0.8
	2008	1.0
Where:		
- the surface course consists of SMA;		
- the construction consists of a single lift of hot mix (with or without leveling and/or padding) placed on pulverized grade where provision for Granular "A" placed on the pulverized grade is not included in the Contract; or	2006	0.8
- in areas on resurfacing contracts, the Contractor is required to match pavement elevations to a curb or barrier wall which was not constructed on the Contact, is within 1.5 m of the lane being paved and the paver has simultaneously paved both the lane and shoulder, if there is a shoulder.	2007	1.0

Scallops:

The Contractor will either be given penalties or required to repair all scallops in accordance with Table D.

Where two scallops on the same side of the blanking band have been recorded in adjacent wheelpaths in the same lane at stations which are within 3 m of one another and they are both left unrepaired, then the two scallops shall be treated as a single scallop for penalty assessment purposes. In addition, where the profile trace crosses the same “excessive height line”, where it is printed on the profile traces more than once within the same baseline distance of 7.5 m and these bumps or dips are recorded as separate scallops, then these “multiple-peaked” scallops shall be treated as a single scallop for penalty assessment purposes.

The payment adjustment for a subplot which includes any unrepaired scallops shall be unaffected by any penalties given for such scallops.

TABLE D – Penalties/ Repairs for Scallops

Amplitude of Scallops (rounded to nearest 0.5 mm)	Penalty
10.0 to 11.5	The Contractor shall receive a penalty (subject to Notes 6 and 7) of \$1,500 for each scallop located in multi-lane freeways and \$1250 for each scallop located in all other highway types. No repairs (subject to note 8) will be allowed for any scallop in this amplitude range
12 to 14.5	The Contractor shall receive a penalty (subject to Notes 6 and 7) of \$ 3,000 for each scallop located in multi-lane freeways and \$2500 for each scallop located in all other highway types. No repairs (subject to Note 8) will be allowed for any scallop in this amplitude range
> 14.5	All scallops shall be repaired in this amplitude range (subject to Note 9)

- NOTES:
- 6 For scallops located in the areas listed under Note 3, the financial penalties shown in this table shall be multiplied by the applicable tender opening date reduction factor shown in Table C.
 - 7 For scallops with amplitudes between 10.0 and 14.5 mm which are located in areas where hot-in-place recycling is used as a surface course (including hot-in-place recycling with an integral overlay and hot in-place recycled premium mix), shall receive a payment factor of 1.00.
 - 8 Subject to Note 9 below, the Contractor may repair a scallop with an amplitude between 10.0 and 14.5 mm inclusive, if at least one other scallop with an amplitude greater than 14.5 mm is less than 5.0 m away from it and the Contractor wishes to repair both scallops as part of the same repair area. Subject to the restrictions on repairs stated in clause 313.08.05.03.01 entitled “Repairs” and Note 9 below, the Contractor may repair a scallop in this amplitude range when repairing a subplot that has a profile index greater than 550 mm/km. However, if the repair removes that scallop, then the penalty for that scallop will be waived.
 - 9 Scallop repairs will be allowed, provided that the total area for all surface smoothness-related repairs has not exceeded the Total Allowable Repair Area Limit. Any additional scallop with an amplitude greater than 14.5 mm that is not allowed to be repaired because the Total Allowable Repair Area Limit has been exceeded will

receive a \$3000 penalty if it is located in a multi-lane freeway or \$2500 if it is located in any other highway type.

Repair Costs:

All repairs shall be made entirely at the Contractor's expense. Where overlays are allowed, any other associated costs such as additional granular materials for shoulders, shall also be borne by the Contractor.

QA Measurements and Traffic Control:

Payment for the applicable hot mix tender item shall include full compensation for all traffic control, protection and lane closures which are required for smoothness measurements including any QA measurements made by the Owner's PMD up to a maximum of three separate visits to the site by the Owner's PMD for a combined total of up to 20 hours of QA measurements, excluding any waiting time in which the QA measurements were delayed by the Contractor.

Costs for Referee Testing (including any associated traffic control, protection and lane closures):

a) Difference Based Solely on Average Profile Indices:

The cost of Referee testing shall be borne by the party whose average profile index for the independent QA section is further removed from that generated by the Referee PMD for the same section. If the average profile index for the independent QA section is exactly between that determined by the Contractor's QC and Owner's QA results, then the cost of the referee testing will be split evenly between the Owner and the Contractor.

b) Differences Based on Solely on Scallops:

The cost of referee testing for a single subplot due to differences between QA and QC test results that affect the disposition of one or more scallops within that disputed subplot shall be borne by the party whose average measured scallop height for all of the scallops within that subplot is further removed from the average scallop height generated by the Referee PMD. If the average scallop height for all scallops recorded by the Referee PMD is exactly between that determined by the Contractor's QC and Owner's QA results for the same locations, then the cost of the Referee testing for that subplot shall be split evenly between the Owner and the Contractor.

c) Differences Based on Average Profile Indices and Scallops:

In the event that the Contractor requests referee testing for both average profile indices and scallops in the same independent QA section and they result in a difference in the determination of the party that is responsible for the cost of Referee testing, then the cost for Referee testing of that pavement section will be shared between the Owner and the Contractor. The party responsible for the cost of referee testing based on average profile indices will pay 50% of the cost of referee testing plus a portion of the remaining 50% calculated on the basis of the proportional number of sublots challenged for scallops in which that party is responsible for the costs divided by the total number of sublots challenged for scallops within that pavement section.

NOTES TO DESIGNER:

- * Fill in additional pavements, paving situations, pavement areas or major uncontrolled intersections in Section 313.07.01.16, part b), of this special provision, which the designer feels should be excluded from surface smoothness measurement by profilograph. This fill-in should not include any private driveways, commercial driveways or low volume roads unless there are extraordinary circumstances in which the designer feels that contractor will not be able to control (e.g. truck) traffic long enough for the hot mat to be sufficiently compacted.

WARRANT:

Include, (except as noted below), with OPSS 313 for all Hot Mix contracts where at least a portion of the contract will have a posted speed limit for the in-service pavement greater than 60 km/hour and includes at least one lift (with or without levelling and/or padding) of hot mix.

Do NOT include if:

- a) the surface course consists predominantly of OFC;

or if the Contract:

- b) has less than 5000 t of surface course;
- c) consists extensively of detours or temporary pavement;
- d) consists extensively of patching;
- e) consists extensively of structures;

Or the main roadway in the Contract has an AADT less than 2000 and;

- i) has a truck volume less than 50 trucks / lane / day; or
- ii) has demonstrated significant seasonal frost-related distortion in the past; or
- iii) there are numerous tight curves and/or hills; or
- iv) the work will only be used as a holding strategy for less than 8 years.