PAVEMENT SURFACE CONDITION RATING MANUAL

Sixth Edition March 2020

British Columbia Ministry of Transportation and Infrastructure Construction Maintenance Branch

Prepared by: WSP Canada Limited

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Glossary of Terms

Term / Acronym	Description
AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
AC	Alligator cracking
BCMoTI	British Columbia Ministry of Transportation and Infrastructure
BLD	Bleeding
СМ	Centimetre
IRI	International Roughness Index
FHWA	Federal Highway Administration (U.S. Department of Transportation)
LCMS	Laser Crack Measurement System
LJC	Longitudinal joint cracking
LWP	Longitudinal wheel path cracking
М	Metre
ММ	Millimetre
MLC	Meandering longitudinal cracking
PEC	Pavement edge cracking
POT	Potholes
RUT	Rutting
RPMS	Roadway Pavement Management System
TAC	Transportation Association of Canada
TC	Transverse cracking



1 Introduction

1.1 Overview

The British Columbia Ministry of Transportation and Infrastructure (Ministry) has implemented a multifaceted pavement asset management program. It is built around the Roadway Pavement Management System (RPMS) application and supported by data collection procedures and asset management policies. The Ministry relies on its pavement management system to monitor and track pavement condition, forecast future pavement condition and funding needs, and develop its resurfacing program.

Pavement surface condition data is a key component of the Ministry infrastructure asset management program. It enables the systematic measurement, monitoring, analysis, and evaluation of asset condition and performance data. The condition data ensures that the province's transportation infrastructure is being appropriately managed from both life cycle and risk mitigation perspectives.

This manual describes the technical specifications for pavement surface condition data collection and quality assurance requirements for both network level and manual pavement surface condition surveys. They have been developed collaboratively over time working with the Ministry's data collection contractors and incorporating best practice, including the ASTM, AASHTO and Transportation Association of Canada (TAC) guidelines.

Note: These standards are also applicable to the network level pavement surface condition survey requirements of provincial concession agreements. However, the concession agreements may also contain additional requirements. In the case of any material contradiction between the information contained in this manual, and that required in a concession agreement or network level survey contract, the language in the concession agreement or network level survey contract shall take precedence

1.2 Versions

This manual was originally released in 1994. It was developed by a committee comprised of provincial rehabilitation and pavement design personnel.



The manual was subsequently updated in 2002, 2009, 2012 and 2016 based on field experience and feedback from data collection contractors. Key changes have included improvements to the survey procedures and quality assurance, consolidation of specifications, incorporating advancements in surveying technology and a wider application of the manual.

This sixth release incorporates changes to the surface distress rating and quality assurance testing requirements for the network level surveys.

1.3 Manual Format

The manual is comprised of the following chapters:

- Chapter 2 Pavement Condition Surveys
- Chapter 3 Surface Distress Guidelines Network Surveys
- Chapter 4 Surface Distress Guidelines Manual Surveys
- Chapter 5 Asphalt Surface Distress Rating System
- Chapter 6 IRI and Rut Depth Guidelines Network Surveys
- Chapter 7 Locational Referencing Network Surveys
- Chapter 8 QA Specifications Network Surveys
- Chapter 9 Manual Distress Survey Forms



2 **PAVEMENT CONDITION SURVEYS**

This chapter provides of an overview of the contracted network level surveys and manual surveys.

2.1 Network Level Surveys

Network level pavement surface condition surveys are conducted on a cyclical basis for the provincial highway network under the Ministry's jurisdiction. The surveys capture surface distress, rut depth and roughness measurements as well as digital images of the right-of-way.



The objective of the network level surveys is to obtain performance data that is sufficiently accurate, representative and consistent to support network level analyses. The information is used to evaluate the pavement rehabilitation needs and assess appropriate investment levels to support strategic long-term asset management planning. This in turn dictates the rating methodology and measuring equipment that are used for the surveys.

Multi-year pavement condition survey contacts are outsourced to contractors with multi-function pavement evaluation vehicles equipped with sophisticated onboard systems and instrumentation. Using third party contractors supports objectivity and consistency throughout the province. The surveys are guided by quality assurance procedures to ensure that collected data is accurate, repeatable, and of consistent quality and integrity from year to year and between contractors.

A brief description of the types of data collected and the equipment used to date for the network level surveys follows.

2.1.1 Surface Distress

The surface distress ratings are performed in accordance with this manual. The rating data is collected continuously and reported at 50 metre intervals.

The distress types included for the network level surveys are summarized in the following table.





Category	Distress Type	Code
Cracking	Longitudinal wheel path cracking	LWP
	Longitudinal joint cracking	LJC
	Pavement edge cracking	PEC
	Transverse cracking	TC
	Meandering longitudinal cracking	MLC
	Alligator cracking	AC
Deformation	Rutting	RUT
Defects	Bleeding	BLD
	Potholes	POT

Prior to 2012, surface distress ratings were conducted exclusively using a visual windshield survey methodology. The ratings were recorded while the vehicle traversed the roadway in real time by a person using a programmable event keyboard and data processor.

From 2012 to 2015, the surveys transitioned to a two-dimensional (2D) image rating methodology. Planar-view digital images were recorded for the full width of the travel lane using high-resolution monochrome digital cameras and a synchronized strobe lighting system. The distress rating was later performed during data post processing using image viewing / analysis software to visually identify and rate the crack severity, with density levels computed automatically.

In 2016, the Ministry moved to a fully automated Laser Crack Measurement System (LCMS - Pavemetrics) for its surveys. Three dimensional (3D) high resolution downward images, combined with laser intensity measurements across the travel lane are used to automatically identify the distress type and severity and density.

Neither windshield or 2D imagery subjective distress rating methodologies are permitted now for network level surveys, with the exception for the rating of bleeding.



2.1.2 Rutting

The transverse profile of the travel lane is measured on a continuous basis. Sensor measurements are recorded across the full travel lane profile and used to calculate the average rut depths for each wheel path and the maximum rut depth in each wheel path. The data is reported at 50 metre intervals. Both multi-sensor profilers and scanning laser profilers have been used to date.

2.1.3 Roughness

Longitudinal profile roughness measurements are collected for each wheel path on a continuous basis using a laser profiler that conforms to the FHWA Class II Profiler Specification. The data is collected continuously, and reported at 50 metre averaged intervals, as per the International Roughness Index (IRI) protocols.

2.1.4 Right of Way Digital Images

High resolution digital images are collected during the surveys that show the full right of way view of the roadway, including both the pavement surface, and roadside features such as signs, structures and guard rails. The resolution specifications may be defined within the data collection contracts given the changes in technology.



2.1.5 Spatial Referencing

Spatial referencing of the pavement condition data is provided through a fully integrated differential GPS, inertial positioning, and an orientation system. Both linear and GPS positioning measurements are collected concurrently for each pavement condition record and digital image according to a defined linear referencing system for the highway network.





2.2 Manual Surveys

Manual surface condition surveys are sometimes conducted during the more detailed evaluations that are carried out for candidate rehabilitation project planning. In addition to distress surveys, this can include geotechnical investigations, strength testing, coring, and laboratory testing.

The purpose of the manual surveys is to provide a more accurate and detailed investigation of the pavement deterioration to assist in determining appropriate rehabilitation treatments.

The manual surface distress mapping method consists of a rater walking the pavement section, identifying and classifying the existing distress features and plotting them on a map.

Marking off the test section in advance at 10 metre intervals, assists in the mapping and rating process.



Based on the crack mapping and visual observation, the rater assigns the severity and density ratings for the distress types identified, using the rating manual guidelines and photographs as references.

Rutting is rated based upon the measured wheel path rut depths. Both the right and left wheel path rut depths are measured according to "ASTM E 1703/E 1703M - Standard Test Method for Measuring Rut-Depth of Pavement Surface using a Straightedge".



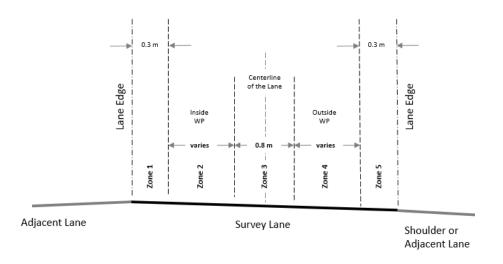
3 Surface Distress Guidelines – Network Surveys

This chapter describes the data collection guidelines for contracted network level surveys.

3.1 Distress Identification

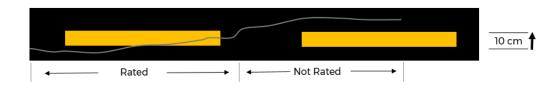
Specific requirements for surface distress identification are summarized as follows:

- a) Distress ratings apply only to the travel lane, including the painted line markings.
- b) Longitudinal distresses are rated according to the 5 zones as shown below. This means that longitudinal joint cracking can only occur in Zone
 1, wheel path cracking in Zones 2 and 4, meandering cracks in Zone 3 and edge cracking in Zone 5.



Note: For typical 3.6 metre lane width, Zones 2 and 4 would each be 1.1 metres in width.

c) Longitudinal joint cracks are measured within 10 centimetres (cm) of the painted direction dividing line as follows:

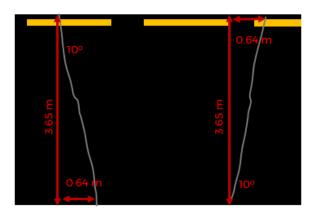




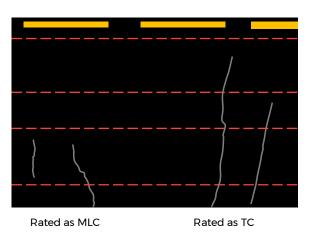
d) Pavement edge cracks are measured within 10 cm of the painted lane edge line as follows:



e) Transverse cracks must be less than or equal to a 10° angle measured perpendicular to the travel lane. Those that do not, are rated as meandering longitudinal cracks.



 f) Transverse cracks must touch 3 zones to be rated as a transverse crack. Those cracks that do not touch 3 zones are rated as meandering longitudinal cracks.



g) Alligator cracking is a load related distress that is indicative of structural failure in the layer materials and will generally be either longitudinal or



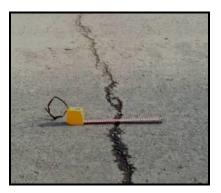
localized blowouts. The interconnected cracks must form a complete and clear block pattern over a minimum area of 1.0 square metres to be rated as alligator cracking. Those that do not, are rated as severe cracking.

- h) Alligator cracking is double counted where it exists as part of another distress type. For example, alligator cracking in the wheel path would be recorded as severe wheel path cracking and alligator cracking.
- i) The presence of alligator cracking automatically increases the severity of the associated cracking to "Severe".
- j) Potholes are double counted where they occur as part of another distress type. For example, a pothole in a transverse crack would be recorded as a severe transverse crack and as a pothole.

3.2 Rating Severity

Specific requirements for rating severity are listed below.

 a) 10 Percent Rule – when trying to assign the severity level for an individual crack, if at least 10% of the crack is in a higher severity level, the higher level is assigned. For example, if a transverse crack is 2.0 metres in length, with 0.25 metres measured at high severity and the remainder at moderate, the crack is assigned a high severity level.



Example of 10% Rule

- b) Low severity cracks can only consist of single cracks and no spalling.
- c) Moderate severity cracks can consist of single or multiple cracks with moderate spalling.
- d) High severity cracks can consist of single or multiple cracks with severe spalling.
- e) Spalling means significant breakage and chipping of the crack edges.
- f) Cracks that are fully sealed are rated as low severity. Cracks that are not fully sealed are rated as per the inspection guidelines described in this manual. Please note that for network level surveys, cracks with intact, or



fully effective sealant are to be rated as low severity. If a crack has not been sealed, or if it has been sealed and it is apparent that the crack sealant is no longer effective, it should be rated as per the inspection guidelines.

- g) There is no Low severity level for alligator cracking, distortion, raveling and bleeding only moderate and high.
- h) The severity rating for rutting is assigned based on the averaged left and right wheel path rut depth measurements.
- i) Low severity potholes should be clearly distinguishable from surface ravelling. Small depressions less than 15 cm in diameter and 25 mm deep are not to be rated as potholes.

3.3 Rating Density

Specific requirements for rating density are listed below.

3.3.1 General

- a) Area means the measure area of the surface deterioration in square metres.
- b) Quantification of distress density is based on evaluation of a single 50 metre length of roadway lane.
- c) The density calculations for longitudinal wheel path cracking, rutting, shoving and bleeding requires measurement of the surface distress in each wheel path. The calculated density is based on the total length of distress over a single 50 metre length of roadway lane times two (i.e. 50 metre segment 2 x 50 = 100 metre total wheel path length).
- d) The density values for rutting are computed from the transverse profile data as follows:
 - 0% neither wheel path rut depths are \geq 3 mm
 - 35% -only one wheel path rut depths is \geq 3 mm
 - 90% both wheel path rut depths are ≥ 3 mm

3.3.2 Linear Measured Distresses - LWT, MLC, LWP & PEC

e) Linear measured density values are calculated based on the proportional length of the distress severity level identified using the data collection



vehicle's DMI measurements. If the distress severity level is observed over the entire 50 metre segment, then the density value would be 100 percent. If however, the distress severity level is only observed for a portion of the segment, the density value is to be calculated using a weighted average as shown in the following example:

<u>Example</u>: 18 metres of moderate severity longitudinal meandering cracking would be calculated as 36% (i.e. 18m/50m).

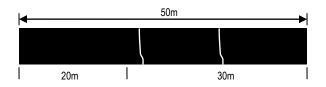


f) Within a 50 metre segment, there can be more than one distress severity level rated. The same calculation process as noted previously is followed and the total combined density rating must be equal to or less than 100 percent.

3.3.3 Number Measured Distresses - TC & POT

g) Calculating the percentage density rating is based on the number of occurrences observed within a 50 metre segment according to the four possible density values (none – 0%, few - 5%, frequent -35% and throughout - 90%). If the same distress severity level is observed for the entire 50 metre segment, then only these values should be applied. If however, the severity level is only observed for a portion of the segment (i.e. transition from no observed distress and starts within a segment), the density value is calculated using a weighted average as shown in the following example:

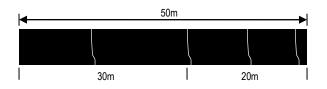
<u>Example</u>: Moderate severity transverse cracking rated as intermittent density (i.e. 35%) only begins in the last 30m of the segment, the density percentage is calculated as $(20m \times 0 + 30m \times 35)/50 = 14\%$ and rounded to the nearest 5% to be 15%.





 h) Similarly, within a 50 metre segment, there can be a transition between density levels. The same calculation process as noted previously is followed.

<u>Example</u>: The first 30m of a segment exhibits low severity transverse cracking with a "few" density level (i.e. 5%) and the last 20m is rated at a "frequent" density (35%), the overall segment density percentage would be $(30m \times 5 + 20m \times 35)/50 = 17\%$ and rounded to 15% (i.e. nearest 5%).



- Within a 50 metre segment, there can be more than one distress severity level rated. The same calculation process as noted previously is followed and the total combined density rating must be equal to or less than 100 percent.
- j) Short transverse cracks that do NOT touch 3 zones are rated as meandering longitudinal cracks as noted previously. In these cases, a nominal density value of 1 percent is assigned for rating purposes.

3.3.4 Area Measured Distresses - AC

- k) Calculating the percentage density rating for alligator cracking is performed the same way as that noted above for transverse cracking and potholes. It is based however, on the number of occurrences observed within a 50 metre segment according to the six possible density levels (none – 0%, few - 5%, intermittent – 15%, frequent -35%, extensive – 65% and throughout - 90%).
- I) If the distress severity level is observed for the entire 50 metre segment, then only these values should be applied. If however, the distress severity level is observed for a portion of the segment or there is a transition within the segment between the two defined severity levels, the density values are calculated by taking a weighted average as noted above.



4 Surface Distress Guidelines - Manual Surveys

The following guidelines are to be applied for conducting manual surveys:

- a) Rating segments can be 20 to 50 metres in length and one lane wide for manual project level surveys.
- b) The rater is advised to mark out the test segments in advance using a tape measure to assist in the distress mapping. Forms to be used for the distress mapping are provided in this manual.
- c) Each test segment should be evaluated separately, with the distress types and severity/extent ratings assigned while on the site. Ensure distresses that occur in the transition between segments are assigned correctly and not duplicated on adjacent segments.
- d) For distress mapping purposes, abbreviations for the distress types are used with the severity level identified on the map. For example, TC-M denotes a transverse crack of moderate severity. Cracks that have been fully sealed are denoted with a subscript "s" (i.e. TCs).
- e) Any features that cannot be drawn on the distress mapping form should be noted in the comments section.
- f) Both the left and right wheel path rut depths should be measured at 5 metre intervals. The highest rut depth measurement identified within the test segment is used as the criteria for assigning the severity.
- g) Following the manual rating of all the test segments, the rater should walk the entire site a few times to ensure that the severity and density ratings have been consistently applied.
- h) The relative angle of the sun and the roadway surface viewing direction can have a significant impact. When conducting manual surveys, make sure to view the pavement from more than one direction.





5 Asphalt Surface Distress Rating System

The rating methodology has been designed for both network level and manual surveys. The rating system includes 12 distress types within the following categories:

Category	Distress Type	Abbreviation
Cracking	a) Longitudinal Wheel Path Cracking	LWP
	b) Longitudinal Joint Cracking	LJC
	c) Pavement Edge Cracking	PEC
	d) Transverse Cracking	TC
	e) Meandering Longitudinal Cracking	MLC
	f) Alligator Cracking	AC
Surface Deformation	g) Rutting ¹	RUT
	h) Shoving ²	SHV
	i) Distortion ²	DST
Surface Defects	j) Bleeding	BLD
	k) Potholes	POT
	I) Ravelling ²	RAV

Notes: (1) For network level surveys, rutting is rated using the transverse profiler data. (2) Not included in network level surveys.

The distress types selected for the rating system represent the most predominant distress manifestations observed in British Columbia, focusing on those that progressively affect the pavement's ability to support traffic loads.

Each distress type is classified and rated according to its severity and density. In most cases, there are three levels of severity that describes the condition of the distress with definitions for each level – low, moderate and high. There are five ranges of density that indicates the portion of the road surface affected by a specific distress type. Photographs and drawings of distress types are provided as a reference for assessing severity and general mechanisms of failure listed.



5.1 Longitudinal Wheel Path Cracking

Description:	Cracks which follow a course predominantly parallel to the pavement centre line and are located at or near the centre of
	the wheel path.

Possible Causes:

- Heavy traffic during spring thaw when pavements are weak.
- Inadequate pavement structural support.

• •		
Severity:	Level	Description
	Low	Single cracks with no spalling; mean unsealed crack width < 5mm
	Moderate	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm
	High	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm, alligator

Density:	Level	Description	Percent Length Affected
	0	None	0%
	1	Few	< 10%
	2	Intermittent	10-20%
	3	Frequent	20-50%
	4	Extensive	50-80%
	5	Throughout	80-100%

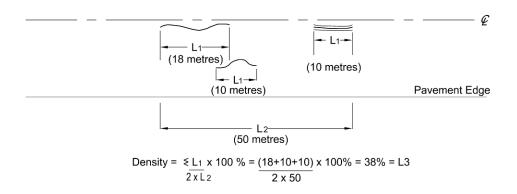






Figure 1 - Low Severity LWP

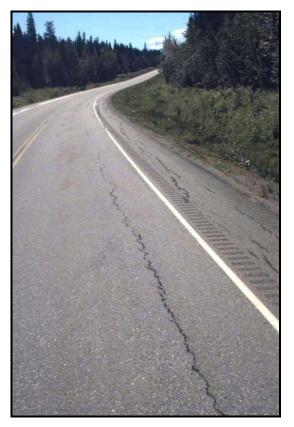


Figure 2 - Moderate Severity LWP





Figure 3 - High Severity LWP (multiple cracks)



Figure 4 - High Severity LWP



5.2 Longitudinal Joint Cracking

Description:	Cracks which occur along or in the immediate adjacent vicinity (i.e. +/- 300 mm) of the longitudinal centre or lane line pavement joint.	
Possible Causes:	 Poor construction of longitudinal joint. Frost action on adjacent lanes with variable granular 	

- Frost action on adjacent lanes with variable granular depths. Differential frost heave along the centre line caused by the insulating value of snow along pavement edges.
 - Moisture changes resulting in swelling and shrinkage

Severity:

Level	Description
Low	Single cracks with no spalling; mean unsealed crack width < 5mm
Moderate	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm
High	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm, alligator

Density:	Level	Description	Percent Length Affected
	0	None	0%
	1	Few	< 10%
	2	Intermittent	10 - 20%
	3	Frequent	20 - 50%
	4	Extensive	50 - 80%
	5	Throughout	80 - 100%

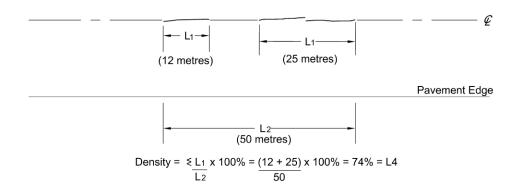






Figure 5 - Low Severity LJC



Figure 6 - Moderate Severity LJC





Figure 7 - High Severity LJC (multiple cracks)



Figure 8 - High Severity LJC (single crack)



5.3 Pavement Edge Cracking

Description:	inside and/ fog line). C	Cracks which occur parallel to and within 300 mm of the inside and/or outside of the pavement edge line marking (i.e. fog line). Cracks may be crescent shaped cracks or other fairly consistent cracks which intersect the pavement edge.		
Possible Causes:	Inadeq pavemePoor drInadeq			
Severity:	Level	Description		
	Low	Single cracks with no spalling: mean unscaled crack width < 5mm		

Low	Single cracks with no spalling; mean unsealed crack width < 5mm
Moderate	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm
High	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm, alligator

Density:

Level	Description	Percent Length Affected
0	None	0%
1	Few	< 10%
2	Intermittent	10 - 20%
3	Frequent	20 - 50%
4	Extensive	50 - 80%
5	Throughout	80 - 100%

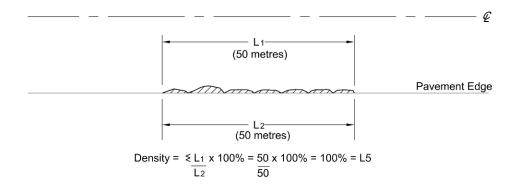






Figure 9 - Low Severity PEC



Figure 10 - Moderate Severity PEC







Figure 11 - High Severity PEC



Figure 12 - High Severity PEC



5.4 Transverse Cracking

Description: Cracks that are predominantly perpendicular to the pavement centre line and may extend fully or partially across the roadway.

Possible Causes:

- Surface shrinkage caused by low temperatures.
- High temperature susceptibility of the asphalt cement binder in asphalt mixes.
- Frost action.
- Reflection cracks.

Severity:

Level	Description		
Low	Single cracks with no spalling; mean unsealed crack width < 5mm		
Moderate	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm		
High	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm, alligator		

Density:

	Description	Project Level Survey		Network Level Survey	
Level		# Cracks per 50m	% Length Affected	# Cracks per 50m	% Length Affected*
0	None	0	0%	0	0%
1	Few	1-2	< 10%	1-2	5%
2	Intermittent	3-4	10 - 20%		
3	Frequent	5-7	20 - 50%	3-10	35%
4	Extensive	8-10	50 - 80%		
5	Throughout	>10	80 - 100%	>10	90%

Note: Network level surveys only include None, Few, Frequent and Throughout.

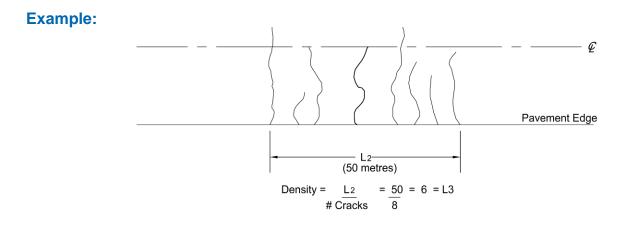






Figure 13 - Low Severity TC



Figure 14 - Moderate Severity TC





Figure 15 - High Severity TC (multiple cracking and spalling)



Figure 16 - High Severity TC



5.5 Meandering Longitudinal Cracking

Description:	pavement middle of t usually sin	hal cracks which wander from edge to edge of the t or run parallel to the centre line, situated near the the lane. Meandering longitudinal cracks are ngle cracks, but secondary cracks can develop in ere transverse cracks also exist.		
Possible Causes:	 Frost action with greater heave at the pavement centre than at the edges. This is more prevalent in mixes where asphalt stripping is extensive. Faulty construction equipment can cause weak planes in the mix, which can fail from thermal shrinkage. 			
Severity:	Level	Description		
	Low	Single cracks with no spalling; mean unsealed crack_width < 5mm		

Low	Single cracks with no spalling; mean unsealed crack width < 5mm		
Moderate	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm		
High	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm, alligator		

Density:

Level	Description	Percent Length Affected
0	None	0%
1	Few	< 10%
2	Intermittent	10 - 20%
3	Frequent	20 - 50%
4	Extensive	50 - 80%
5	Throughout	80 - 100%

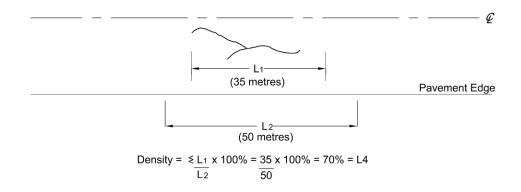






Figure 17- Low Severity MLC



Figure 18 - Moderate Severity MLC





Figure 19 - High Severity MLC (multiple and alligator cracking)



Figure 20 - High Severity MLC



5.6 Alligator Cracking

Description:	Cracks which form a network of multi-sided blocks resembling the skin of an alligator. Block size can range in size which indicates the depth of failure taking place. The pattern of cracking is usually longitudinal, originating in the wheel paths, but can occur transversely due to frost heaves or settlement and also along the centre line on narrow two- lane roads.			
Possible Causes:	 Usually areas subjected to repeated traffic loadings. Insufficient bearing support due to poor quality base materials or saturated base with poor drainage. Stiff or brittle asphalt mixes at cold temperatures. 			
Severity:	Level Description			

Level	Description	
Moderate	Interconnected cracks forming a complete block pattern; slight spalling and no pumping	
High	Interconnected cracks forming a complete block pattern, moderate to severe spalling, pieces may move and pumping may exist	

Density:

Level	Description	Percent Surface Area Affected
0	None	0%
1	Few	< 10%
2	Intermittent	10 - 20%
3	Frequent	20 - 50%
4	Extensive	50 - 80%
5	Throughout	80 - 100%

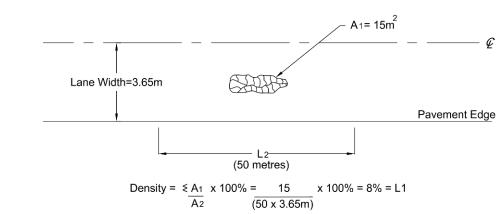






Figure 21 - Moderate Severity AC (progressed from multiple cracks)



Figure 22 - Moderate Severity AC (localized failure)







Figure 23 - High Severity AC (spalling and throughout density)



Figure 24 - High Severity AC with break up and pumping



5.7 Rutting

r	Longitudinal depressions left in the wheel paths after repeated loadings, combined with sideways shoving of the pavement material.			
•	 Poorly compacted structural layers. Heavy loadings of saturated unstable granular bases/sub-bases during spring thaw periods. Unstable asphalt mixes due to high temperature or low binder viscosity. Inadequate lateral support from unstable shoulder materials. Permanent deformation of an overstressed subgrade. 			
Severity:	Level	Description		
	Low	Rut depth is less than 10 mm		
	Moderate	Rut depth is in the range of 10 to 20 mm		
	High	Rut depth is greater than 20 mm		
Demoitry				
Density:	Level	Description	Percent Length Affected	
	0	None	0%	
	1	Few	< 10%	
	2	Intermittent	10 - 20%	
	3	Frequent	20 - 50%	
	4	Extensive	50 - 80%	
	5	Throughout	80 - 100%	

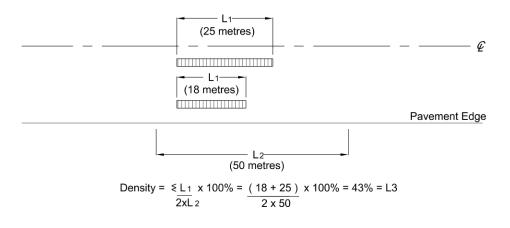






Figure 25 - Low Severity RUT



Figure 26 - Moderate Severity RUT





Figure 27 - High Severity RUT with transverse displacement



Figure 28 - High Severity RUT



5.8 Shoving **Description**: Longitudinal displacement of a localized area of the pavement surface generally caused by braking or accelerating vehicles and usually located on hills, curves or intersections. Possible Stop and start of vehicles at intersections. **Causes:** Heavy traffic on steep downgrades or upgrades. Low stability asphalt mix. Lack of bond in asphalt surface and underlying layer Unstable granular base Severity: Level Description Low Barely noticeable to noticeable Rough ride Moderate High Very rough ride **Density:** Level Description **Percent Length Affected** 0 0% None 1 Few < 10% 2 Intermittent 10 - 20% 3 20 - 50% Frequent 4 Extensive 50 - 80% 5 Throughout 80 - 100%

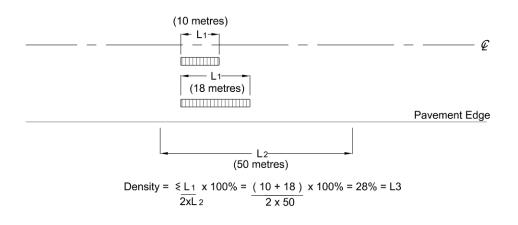






Figure 29 - Typical case at downgrade intersection with heavy loadings



Figure 30 - High Severity SHV (defined by relative effect on ride quality)



5.9	Distortion			
	Description:	shape othe Generally, volume ch heaving, a	er than that describe distortions result fro	0
	Possible Causes:	transitie • Revers • Differen • Lack of	ntial frost heaves in ons and at pavement e differential frost he ntial settlement of su f subgrade support. kment slope failure	t edges or centre.
	Severity:	Level	el Description	
		Moderate	Noticeable swaying motion	; good car control
		High	Fair to Poor car control	
	Density:	Level	Description	Percent Length Affected
		0	None	0%
		1	Few	< 10%
		2	Intermittent	10 - 20%
		3	Frequent	20 - 50%
		4	Extensive	50 - 80%
		5	Throughout	80 - 100%
	Example:		(20 metres)	

____ L2____ (50 metres)

Density = ≤<u>L1</u> x 100% = 20 x 100% = 40% = L3

50

L2

Pavement Edge





Figure 31 - Moderate Severity DST (resulting from differential settlement)



Figure 32 - Moderate Severity DST (example of pavement edge settlement)



5.10 Bleeding

Description :	Excess bituminous binder on the pavement surface can create a shiny, glass-like, reflective surface that may be tacky to the touch. Bleeding quite often occurs in the wheel paths.
Possible Causes:	 Mix design deficiencies where too high an asphalt content relative to voids results in excess asphalt forced to the surface by traffic, especially on hot days. Paving over surfaces with severe bleeding or the application of a heavy prime or tack coat under a new pavement layer may result in excess primer bleeding through the pavement surface over time.

• Poor construction of surface seal coats.

Severity:	Level	Description
Moderate		Distinctive appearance with free excess asphalt
High		Gives pavement surface a wet look; tire marks are evident

Density:	Level	Description	Percent Length Affected
	0	None	0%
	1	Few	< 10%
	2	Intermittent	10 - 20%
	3	Frequent	20 - 50%
	4	Extensive	50 - 80%
	5	Throughout	80 - 100%

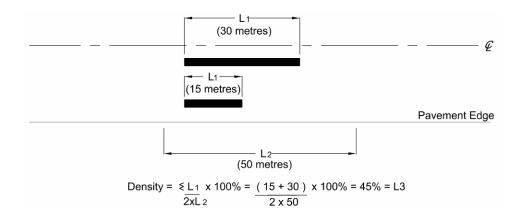






Figure 33 - Moderate Severity BLD



Figure 34 - High Severity BLD



5.11 Potholes

Description:	Bowl-shaped holes of various sizes in the pavement surface
	that are greater than 175 cm ² in area (~ 15 cm diameter).

Possible Causes:

- Thin spot in the asphalt layer.
- Localized drainage problems such as water infiltration through poorly bonded pavement structural layers or segregated spots in the asphalt mix where coarse patches allow intrusion of water
 - Asphalt mix design deficiencies.

Severity:

Level	Description
Low	Pothole > 175 cm ² in area (~15cm ø) and less than 25mm deep
Moderate	Pothole > 175 cm ² in area (~15cm ø) and 25 to 50mm deep
High	Pothole > 175 cm ² in area (~15cm ø) and greater than 50mm deep

Density:

		Project Le	vel Survey	Network Level Survey	
Level	Description	# Potholes per 50m	% Length Affected	# Potholes per 50m	% Length Affected*
0	None	0	0%	0	0%
1	Few	1-2	< 10%	1-2	5%
2	Intermittent	3-4	10 - 20%		
3	Frequent	5-6	20 - 50%	3-9	35%
4	Extensive	7-9	50 - 80%		
* 5	Throughout	>=10	80 - 100%	>=10	90%

Note: Network Level surveys only include None, Few, Frequent and Throughout.

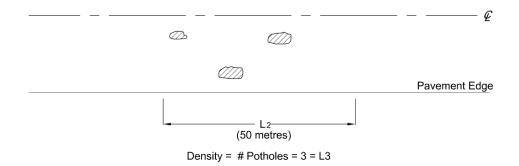






Figure 35 - Low Severity POT (close up view)



Figure 36 - Moderate Severity POT





Figure 37 - High Severity Pothole



Figure 38 - High Severity Pothole with asphalt break up



5.12 Ravelling

Description:	aggregate	essive loss of the pavement material (both particles and bituminous binder) from the surface , leaving a rough surface, vulnerable to weather on.
Possible Causes:	 Poor adhesion of aggregates due to insufficient asphalt content, clay-coated aggregate, use of wet aggregates or stripping due to water action. Fracture of aggregate particles by heavy loads or natural causes. The unbound particles are then removed by traffic, reducing the depth of the asphalt. Poor compaction permits infiltration of water and salts which promote asphalt stripping. Segregated mix placed during construction. Aging and weathering. 	
Severity:	Level	Description
	Moderate	aggregate and/or binder worn away; surface texture rough and pitted; loose particles exist
	High	aggregate and/or binder worn away; texture is very rough and pitted

Density:

Level	Description	Percent Length Affected
0	None	0%
1	Few	< 10%
2	Intermittent	10 - 20%
3	Frequent	20 - 50%
4	Extensive	50 - 80%
5	Throughout	80 - 100%

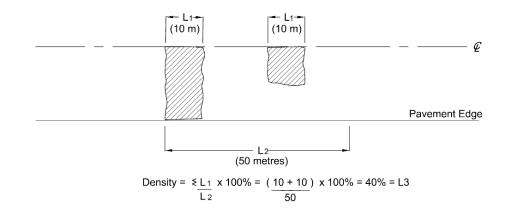






Figure 39 - Moderate Severity RAV



Figure 40 - High Severity RAV



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6 IRI and Rut Depth Guidelines – Network Surveys

This chapter provides guidelines for conducting network level pavement roughness and rut depth surveys.

6.1 Longitudinal Profiles

The following requirements must be followed for measuring longitudinal profiles:

- The IRI is to be determined in accordance with ASTM E1926.
- Longitudinal profile roughness measurements are to be collected continuously using a laser-based Class 1 inertial profiler as defined by ASTM E950, or better and AASHTO M 328-10.
- The inertial profiler is to be capable of accurately measuring the profile in each wheel path as per the accuracy requirements set out this manual.
- Contractors are required to provide Ministry with their data collection and post processing protocols as defined by the manufacturer of the equipment and their internal quality management plan. This should include as a minimum the following:
 - o Minimum data collection speed;
 - Acceleration / deceleration rates;
 - o Section start-up and termination procedures;
 - o Transient events;
 - Environmental conditions; and
 - Other sensor limitations.
- During post processing, all readings will be flagged as "invalid" that fall below the contractor's minimum allowable operating speed or due to the inertial profiler signal out of range errors / discontinuities.
- The calculated roughness measurements are to be based on the averaged readings over the preceding 50 metre segment.
- The IRI will not be reported for any 50 metre segment that contains flagged readings as noted above.
- IRI values are to be reported to the nearest hundredth (e.g. 0.01 mm/m).
- IRI values are to be collected and reported for each wheel-path.



6.2 Transverse Profiles

The following requirements must be followed for measuring transverse profiles:

- Transverse profile measurements collected continuously across the travel lane to compute the left and right wheel path rut depths in accordance with AASHTO PP70-10 using scanning lasers or 3D Laser Crack Measurement System (LCMS) technology.
- Rut depth measurements are to be equivalent to those that would be achieved manually, via ASTM E1703/E1703M as determined for each individual wheel-path referenced to a two (2) metre straight-edge model.
- Profiler is capable of accurately measuring rut depths in each wheel path as per requirements as set out in this manual.
- Contractors are required to provide Ministry with their data collection and post processing protocols as defined by the manufacturer of the equipment and their internal quality management plan as described in this manual.
- The left and right wheel path transverse profile measurements are to be based on the averaged readings over the preceding 50 metre segment. The maximum left and right wheel path transverse profile measurements are to be reported as the maximum readings within the preceding 50 metre segment.
- The following data is to be reported for each 50 metre segment:
 - o Calculated average rut depth for each wheel-path; and
 - Calculated maximum rut depth for each wheel path rounded to the nearest whole millimeter (i.e. 2 mm).

6.3 Additional Operational Requirements

The following additional operational requirements must be followed when measuring longitudinal and transverse profiles:

- Data collection contractors may be required to obtain a special operating permit (Form T-53) from the Ministry of Transportation and Infrastructure prior to conducting surveys on provincial highways and roads.
- Network level surveys on undivided highways are to be generally conducted in one direction of travel only (i.e. one lane) and conducted in



both directions (i.e. one lane on each side) for divided or multi-lane highways. Data collection in all lanes may be required for other projects.

- Transient events are to be identified and their location (start km and end km) referenced according to the linear referencing system.
- Construction areas encountered during surveys are to be bypassed.
- Where truck climbing/passing lanes occur, the vehicle is to move to the outside lane (unless both lanes are being surveyed).

6.4 Transient Events

The following transient events are to be recorded while conducting network level pavement roughness and rut depth surveys:

- a) Bridges greater than 50m in length;
- b) Steel mesh bridge decks;
- c) Railway crossings;
- d) Construction zone detours including any temporary pavement;
- e) Storm-water drainage / utility infrastructure (i.e. manholes, drains, etc.) that are located in the travel lane; and
- f) Rumble strips that extend into and/or traverse the travel lane.

For each transient event, the start / end kilometre chainages and GPS coordinates will be recorded.



7 Locational Referencing – Network Surveys

This chapter provides details on the locational referencing method that is to be used when conducting network level surveys.

7.1 General

Within the corporate RPMS, a standardized locational referencing system is used to ensure constant referencing from year to year for the pavement performance data and accurate referencing of attribute data. The Ministry has established a Linear Referencing System (LRS) that is based on highway sections and anchor points (i.e. landmarks).

7.2 GPS Measurements

GPS measurements are collected concurrently with the linear distance measurement instrumentation (DMI). Network level data collection contractors must use a differential GPS system to improve the real time position accuracy.

The spatial referencing system must include at minimum real-time inertial aided GPS with satellite based DGPS, 12 channel receiver and an accuracy of less than 1m horizontal, post processed or with satellite based differential corrections to accurately determine the true location of the data point, in areas where weak GPS signals could affect locational accuracy. The differential corrections are received from Landstar or the Canadian DGPS Service.

7.3 Linear Measurements

Each highway is referenced as a continuous segment from start to end with landmarks established as additional referencing points along the highway. Landmarks are physical, long lasting features such as intersections, bridge abutments or sign posts that are referenced to the highways based on a kilometre point location. Each highway has a defined start point, a defined end point, and an assigned cardinal direction. The interval between each pavement condition data roll-up point, is the driven distance 50m in the cardinal direction from the start point toward the end point.

All pavement performance data within the RPMS are referenced to the highways based on the highway ID and the kilometre location as a distance from the start of the highway. During the surveys, the contractor is required to reference the designated survey reference landmarks every 20 to 30 kilometres.

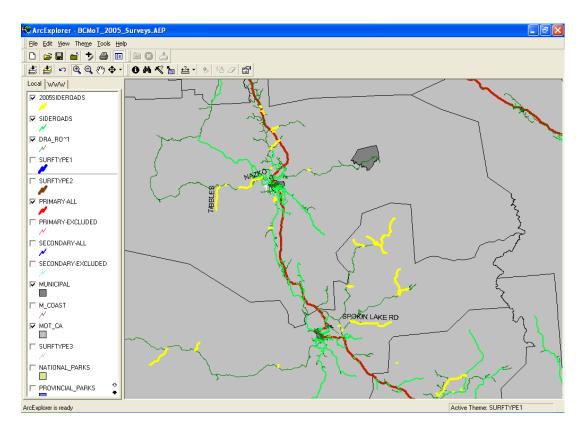


For highways that have not been realigned, the data collection contractor is to ensure that their landmark chainages match those used in the Province's RPMS, and shall rubber-sheet their data if required to make their data collection chainages match the Provinces RPMS chainages.

If the data collection contractor identifies what appears to be an error in the province's RPMS chainages (such as may occur if a highway has been realigned); the data collection contractor is to advise the Ministry of the change, (Highway number, cardinal direction, describe start and end points of variance, provide updated landmark chainage along the revised alignment), such that the variance can be reviewed, and if the province agrees with the contractors findings, the new / correct chainages can then be incorporated into the Provinces RPMS.

7.4 Digital Mapping

The Ministry maintains digital mapping of the provincial roadway network within its Corporate Highway Resource & Information System (CHRIS).





ArcGIS shape files of all highways and side roads included in the annually contracted network level surveys are available to support the surveys. The provincial online iMAP application is also useful for visualizing all highways and side roads in the Ministry inventory with additional spatial layer datasets from across the BC government.

The ability to utilize spatial mapping can assist the data collection contractor to quickly identify and locate survey routes using their on-board GPS equipment and mapping software.

7.5 Highway Definitions

A highway segment is defined as a length of road that is continuous from the starting location until any of the following conditions occurs:

- Road ends; or
- Segment becomes subordinate when there is an overlap with another highway.

A highway segment shall have:

- A described Start Point and Start Point chainage; and
- A described End Point and End Point chainage.

The highway definition is composed of all of the items that are required to uniquely identify a roadway segment within the Province:

- Route Number designated route or road number (e.g. Route 97 or 16)
- Route Aux ID auxiliary identifier (e.g. Route 97B or 3A)
- Contract Area Ministry designated maintenance contract area
- District Management Area Ministry designated maintenance sub-area
- Direction cardinal direction assigned within RPMS for the route / road

Each of fields above has been defined for all highways and side roads within the province and is to be used for pavement surface condition surveys.

For Primary or Secondary Highways, the Contract Area is always 00 (zero zero) unless otherwise specified. No Primary or Secondary Highways bear the District Management Area Designation - this data field is to be left blank.



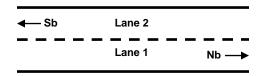


7.6 Lane Numbering

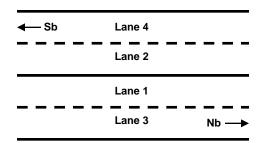
A standardized lane number system has been developed to be used for all network level pavement condition surveys. This ensures consistent referencing of data from year to year.

7.6.1. Primary and Secondary Highways

- Northbound and Eastbound lanes are numbered using odd numbers.
- Southbound and Westbound lanes are numbered using even numbers.
- Lane 1 is the designation for the Northbound and Eastbound inside lane.
- Lane 2 is the designation for the Southbound and Westbound inside lane.



On multi-lane roads, the additional lanes are numbered in ascending order, from the inside lane to the outside lane. (Still using odd or even numbers according to the direction of travel, relative to the cardinal direction of the highway).



- The condition of outside High Occupancy Vehicle (HOV) lanes is not to be surveyed during network level pavement condition surveys. Instead the outermost non-HOV (slow vehicle / truck bearing) lane is the lane to be surveyed.
- Where inside HOV or bus only lanes exist, they are considered Lane 1 or 2 depending upon the direction of the highway.

7.6.2. Side Roads



Each side road is assigned a cardinal direction. That direction is noted in the digital mapping / RPMS and the landmark chainage should correlate with the cardinal direction. In the event that they do not correlate, please contact your contract administrator for direction.

When travelling in the assigned cardinal direction, from the defined start point to the defined end point; the inside lane in that direction of travel, is lane 1. The inside lane in the opposite direction of travel is lane 2. The chainage will always increase, when travelling from the defined start point to the defined end point. Should it ever be required to survey in the opposite direction of travel - from the defined end point to the defined start point, the lane numbering will not change, but the chainage of the survey findings will decrease as one travels from the defined end point, to the defined start point at km 0.000.

Mapping and RPMS Defined Cardinal Direction	Desired Survey Direction	Lane 1 if the inside Xb lane	Chainage Ascends when Travelling	Chainage Descends when Travelling
North	NB	NB	NB	SB
East	EB	EB	EB	WB
South	SB	SB	SB	NB
West	WB	WB	WB	EB

7.7 Divided Highways

The above lane numbering scheme is also applicable to divided highways. While a divided highway may have different suffixes for the opposite directions of travel (e.g. Hwy 1E and Hwy 1W), and while the pavement surface condition data for each direction of travel is to be collected and submitted separately; the "EB" and "NB" lanes will always bear odd numbers, and the "WB" and "SB" lanes will always bear even numbers."

7.8 Lane Location Referencing

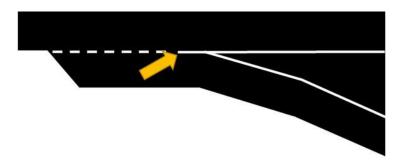
When referencing passing lanes, the survey data corresponds to the full lane width from the end of entrance taper to beginning of exit taper.

7.9 Landmark Referencing

The intersecting centre lines are to be used for identifying the location of roadway landmarks and the first bridge abutment (unless otherwise noted in the landmark description) used for referencing bridge landmarks. The intersecting centre lines are to be used for identifying the location of roadway.



Data collection is to start (or end) at the beginning of the solid line at the front of the gore as shown below.





8 QA Specifications – Network Surveys

This chapter describes the Quality Assurance specifications that are applied for network level surveys.

8.1 Introduction

Quality assurance (QA) plays a critical role ensuring that the data is collected accurately and is repeatable from year to year. The Ministry's QA testing program has evolved over the years as surface condition rating technology has progressed. The current QA procedures consist of three levels of testing:

- a) Initial QA tests completed before the surveys commence to ensure that the contractor's LCMS surface distress, roughness and rut-depth outputs comply with the acceptance criteria,
- b) Monitoring QA retesting of the initial QA sites at the survey mid-point and at the end of the surveys; and
- c) Data File QA assessing submitted data files to ensure they comply with the file format specifications.

8.2 Initial Quality Assurance Tests

Four test sites, each 500 metres in length are used for the initial QA. The sites are intended to exhibit a representative variety of distress types, range in pavement deterioration and surface types that are representative of the actual survey conditions.

Manual surface distress, roughness and rut depth surveys are conducted at all the test sites in advance of the initial QA testing.





8.3 Acceptance Criteria for QA Tests

The QA acceptance criteria for the accuracy and repeatability of the surface distress, roughness and rut depth measurements as part of the initial QA tests are outlined below. Should the contractor fail to meet the criteria for acceptance, it is their responsibility to provide remedy until such time that the acceptance criteria are met and Ministry representative is satisfied. Once the contractor has satisfactorily completed the initial QA testing, they are authorized to begin the field surveys

Category	Criteria	Acceptance Criteria Value
Surface Distress	Measure Calculation Unit Accuracy Repeatability	PDI value 500 m average based on 50 m values lane +/- 1 PDI value of manual survey +/- 1 standard deviation of the PDI values for five runs
Roughness	Measure Calculation Unit Accuracy Repeatability	IRI 500 m average based on 50 m values outside wheel path 10% of Class I profile survey 0.1 mm/m standard deviation for five runs
Rutting	Measure Calculation Unit Accuracy Repeatability	Rut depth (mm) 500 m average based on 50 m values averaged for both wheel paths +/- 3 mm of manual survey +/- 3 mm standard deviation for five runs

8.4 Initial QA Process

The initial QA testing process is completed in two stages. Both the roughness and rut depth testing are conducted on site prior to commencing the field surveys. At this time, the LCMS data is also collected, however the QA testing is completed following the post-processing of the data (e.g. approximately 1-2 weeks later).

8.4.1. Roughness and Rut Depth Tests

The roughness and rut depth testing consist of validating the contractor's instrumentation by field comparisons to the known longitudinal and transverse profiles at each test site. The survey vehicle completes a series of five runs over each site to assess both accuracy and repeatability. The contractor is required to produce a report with their onboard software that specifies the IRI and rutting values for each wheel path at 50 metre intervals as shown in the following table.



Chainage (m)	IRI Right	Rut Left	Rut Right
0-50	2.16	5	9
50-100	2.15	7	13
100-150	2.13	6	12
150-200	2.11	8	9
200-250	2.11	8	10
250-300	2.18	7	11
300-350	2.15	10	10
350-400	2.22	11	10
400-450	2.24	12	12
450-500	2.23	9	12
Average	2.17	8	11

The outside wheel path data is used for the IRI assessment and the average wheel path rut depth for the rutting assessment. A spreadsheet program generates the QA testing results that are reviewed with the contractor to resolve any compliance issues (see examples below)

Site	Site Name	Manual OWP IRI	Run 1	Run 2	Run 3	Run 4	Run 5	Avg	Error	Std-Dev
1	Highway 97	1.01	1.17	1.19	1.14	0.98	1.03	1.10	9.7%	0.1
2	Giscome 1	1.94	1.89	1.83	1.95	1.92	1.89	1.90	2.3%	0.0
3	Giscome 3	1.24	1.17	1.21	1.22	1.19	1.34	1.23	1.1%	0.1
4	Old Cariboo	1.25	1.14	1.13	1.16	1.17	1.15	1.15	7.6%	0.0

Site	Site Name	Manual Avg WP	Run 1	Run 2	Run 3	Run 4	Run 5	Avg	Error	Std-Dev
1	Highway 97	10	9	9	9	9	9	9	1	0.0
2	Giscome 1	4	5	5	5	5	5	5	-1	0.0
3	Giscome 3	5	6	6	6	6	6	6	-1	0.0
4	Old Cariboo	5	6	6	6	6	6	6	0	0.0

8.4.2. Surface Distress Rating Tests

The collected LCMS data is processed, and the results are submitted to the Ministry in a prescribed spreadsheet format, as shown in the following table.



Chainage	LWP		LJC		PE	C	Т	С	MI	LC	A	C	P	DT	BLD	
(m)	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D
0-50	1	3					2	3								
50-100	1	3					2	3								
100-150	1	3					2	3								
150-200							2	3								
200-250							2	3								
250-300							2	3								
300-350	3	5					2	3					2	2		
350-400	3	5									1	2				
400-450	3	5			3	3					1	2				
450-500	2	5			3	3										

Severity: 1 – Low 2 – Moderate 3 – High Density: 1- Few (<10%), 2- Intermittent (10-20%), 3 - Frequent 20-50%), 4 - Extensive (50-80%) and 5 - Throughout (80-100%)

A spreadsheet program generates the average PDI value from the distress ratings for both the manual and contractor surveys. The results are reviewed with the contractor to resolve any compliance issues (see example below).

Site	Site Name	Manual Avg WP	Run 1	Run 2	Run 3	Run 4	Run 5	Avg	Error	Std-Dev
1	Highway 97	6.2	5.7	5.8	5.5	5.1	5.6	5.5	-0.7	0.2
2	Giscome 1	4.9	5.3	5.3	5.4	5.3	5.5	5.4	0.5	0.1
3	Giscome 3	7.3	7.7	7.6	7.5	7.7	7.4	7.6	0.3	0.1
4	Old Cariboo	7.4	6.8	6.7	6.5	6.6	6.6	6.6	-0.8	0.1

8.5 Monitoring QA Process

Each Monday during the field surveys, the contractor is required to submit a progress report to the Ministry. The progress report will be in spreadsheet format that lists each road section surveyed and length (km) according to the defined highway definitions.

The initial QA sites are retested at the approximate mid-point of the surveys and at the conclusion following the same procedures described previously for the Initial QA testing process and acceptance criteria.



8.6 Data File QA

Quality assurance assessment of submitted data is considered an integral part of the overall survey QA process. The Ministry uses both manual and system checks to assess submitted surface distress, roughness and rut depth data files.

The first step consists of conducting a thorough manual review of the submitted data files and includes verifying the following:

- Data exists for all road segments;
- Highway traversal definitions for all road segments;
- Correct data file structure;
- Start and end boundaries for all road segments;
- All lane references and chainages according to provided data files;
- Screening all data for null and negative values; and
- Screening all data according to max/min tolerance parameters.

The QA results are summarized and provided to the contractor for correction.

The final step then involves uploading the distress, roughness and rut depth data to the Ministry's corporate pavement management system. The system includes functionality that conduct internal standardized and user defined verification tests. Afterwards, the PMS generates a log report listing all discrepancies which can be reviewed, confirmed and input data corrected and reloaded as required. All of this is documented on file as well for future reference.

The following tables (with examples) describe the file format specifications for RPMS pavement condition data files. All files are to be provided in DBF and CSV formats.



Distress Data File

Description	Field Name	Units	Туре	Width	Decimal
Route Type	ROUTE_TYPE	-	С	2	0
Route Number	HIWY_ID	-	Ν	5	0
Route Aux ID	AUX_ID	-	С	1	0
Contract Area	CA	-	Ν	2	0
Direction	DIRECTION	-	С	1	0
Area Manager (Area) and Sub Area	AMSA	-	С	2	0
From Distance	START_KM	km	Ν	8	3
To Distance	END KM	km	Ν	8	3
Lane ID	LANE	1-10	Ν	1	0
Survey Date	SURVEY_DAT	yyyymmdd	D	8	0
Pavement Type (Asphalt =1)	PAVE_TYPE	-	Ν	1	0
% Longitudinal Wheel Path Crack Low Severity	LNGC_L	%	Ν	3	0
% Longitudinal Wheel Path Crack Moderate Severity	LNGC_M	%	Ν	3	0
% Longitudinal Wheel Path Crack High Severity	LNGC H	%	N	3	0
% Longitudinal Joint Crack Low Severity	LCJT L	%	Ν	3	0
% Longitudinal Joint Crack Moderate Severity	LCJT M	%	Ν	3	0
% Longitudinal Joint Crack High Severity	LCJT_H	%	Ν	3	0
% Pavement Edge Crack Low Severity	EDGE L	%	N	3	0
% Pavement Edge Crack Moderate Severity	EDGE M	%	Ν	3	0
% Pavement Edge Crack High Severity	EDGE H	%	N	3	0
% Transverse Cracking Low Severity	TRNC L	%	N	3	0
% Transverse Cracking Moderate Severity	TRNC M	%	N	3	0
% Transverse Cracking High Severity	TRNC_H	%	N	3	0
% Meandering Longitudinal Crack Low Severity	MEAN L	%	Ν	3	0
% Meandering Longitudinal Crack Moderate Severity	MEAN M	%	Ν	3	0
% Meandering Longitudinal Crack High Severity	MEAN H	%	Ν	3	0
% Alligator Cracking Moderate Severity	ALGC_M	%	Ν	3	0
% Alligator Cracking High Severity	ALGC_H	%	Ν	3	0
% Rutting Low Severity	RUTT_L	%	Ν	3	0
% Rutting Moderate Severity	RUTT_M	%	Ν	3	0
% Rutting High Severity	RUTT_H	%	Ν	3	0
% Potholes Low Severity	POTH_L	%	Ν	3	0
% Potholes Moderate Severity	POTH_M	%	Ν	3	0
% Potholes High Severity	POTH_H	%	N	3	0
% Bleeding Moderate Severity	BLDG_M	%	Ν	3	0
% Bleeding High Severity	BLDG H	%	Ν	3	0
Corporate Performance Measure	CPM	-	С	2	0
Latitude – NAD83(CSRS)	LATITUDE	Decimal degrees	С	10	6
Latitude Direction	LATDIR	N	С	1	0
Longitude - NAD83(CSRS)	LONGITUDE	Decimal degrees	С	11	6
Longitude Direction	LONGDIR	W	С	1	0
Elevation	ELEVATION	metres	N	9	1

Notes:

- Route Type: Primary Highway = P, Secondary Highway = S, Side Road = SR, IRI & Images Only = I
- See this manual for further explanation of the Route Number, Route Aux ID, Contract Area, Direction, Area Manager Area and Lane ID fields shown above.
- Pavement Type: Asphalt =1
- Corporate Performance Measure: Network Level (NL) and Project Level (PL)
- The latitude and longitude coordinates correspond to the From Distance chainage point
- Longitude values shall be prefixed with a negative sign ()



Roughness and Rutting Data File

Description	Field Name	Units	Туре	Width	Decimal
Route Type	ROUTE_TYPE	-	С	2	0
Route Number	HIWY_ID	-	Ν	5	0
Route Aux ID	AUX_ID	-	С	1	0
Contract Area	CA	-	Ν	2	0
Direction	DIRECTION	-	С	1	0
Area Manager (Area) and Sub Area	AMSA	-	С	2	0
From Distance	START_KM	km	N	8	3
To Distance	END_KM	km	N	8	3
Lane ID	LANE	1-10	Ν	1	0
Survey Date	SURVEY_DAT	yyyymmdd	D	8	0
Left Wheel path IRI	LIRI	mm/m	Ν	5	2
Right Wheel path IRI	RIRI	mm/m	Ν	5	2
Left Wheel path Rut Depth	LRUT	mm	Ν	2	0
Right Wheel path Rut Depth	RRUT	mm	Ν	2	0
Maximum Left Wheel path Rut Depth	MAX_LRUT	mm	Ν	2	0
Maximum Right Wheel path Rut Depth	MAX_RRUT	mm	Ν	2	0
Corporate Performance Measure	CPM	mm	С	2	0
Latitude – NAD83(CSRS)	LATITUDE	Decimal degrees	С	10	6
Latitude Direction	LATDIR	Ν	С	1	0
Longitude - NAD83(CSRS)	LONGITUDE	Decimal degrees	С	11	6
Longitude Direction	LONGDIR	W	С	1	0
Elevation	ELEVATION	metres	N	9	1

Notes:

- Route Type: Primary Highway = P, Secondary Highway = S, Side Road = SR, IRI & Images Only = I
- See this manual for further explanation of the Route Number, Route Aux ID, Contract Area, Direction, Area Manager Area and Lane ID fields shown above.
- If IRI and/or rut depth values cannot be obtained for a segment, a 0 is placed in the field.
- Corporate Performance Measure: Network Level (NL) and Project Level (PL)
- The latitude and longitude coordinates correspond to the From Distance chainage point
- Longitude values shall be prefixed with a negative sign ()



Surface Distress

ROUTE_T P P P P P P P P P P P P P P P P P P P	YPE HW 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		LID CA	DIRECTION N N N N N N N N N N N N N N N N N N	AMSA	START_KM 0.000 0.050 0.100 0.200 0.250 0.300 0.350 0.400 0.450 0.500 0.550 0.600 0.550 0.700 0.750 0.800 0.850 0.700 0.850 0.300 0.850 0.350 0.350 0.300 0.350 0.300 0.350 0.350 0.100 0.550 0.750 0.550 0.100 0.550 0.100 0.550 0.100 0.550 0.500 0.550 0.500 0.550 0.500 0.550 0.400 0.550 0.400 0.550 0.400 0.450 0.450 0.450 0.400 0.550 0.400 0.450 0.400 0.550 0.400 0.550 0.400 0.550 0.400 0.550 0.400 0.550 0.400 0.550 0.400 0.550 0.400 0.550 0.400 0.550 0.400 0.550 0.750 0.550 0.750 0.550 0.750 0.550 0.750 0.550 0.750 0.550 0.750 0.550 0.750 0.750 0.750 0.750 0.750 0.750 0.750 0.750 0.750 0.750 0.5	END_KM 0.050 0.100 0.200 0.250 0.300 0.350 0.450 0.450 0.500 0.650 0.650 0.750 0.650 0.750 0.800 0.750 0.800 0.950 0.900 0.950 1.050 1.100	LANE 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	SURVEY_D. 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200 24-06-200	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	WETYPE 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	LNGC_L 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	LNGC_ 8 8 11 13 13 13 13 0 0 0 0 0 0 0 0 0 0 0 0	M LNGC_H 17 15 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	LCJT_L 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	LCJT_M 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	LCJT_H 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	EDGE_0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	L EDGE_M 0 0 0 0 0 23 0 0 0 0 0 0 0 0 0 0 0 0 0	EDGE_H 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	TRNC_L 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	TRINC_M 0 25 35 35 35 25 35 40 50 5 5 5 5 5 5 5 0 0 20 10 30	TRNC_H 0 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
MEAN_L 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	MEAN_M 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	MEAN_H 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ALGC_1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	M ALGC_H 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	POTH_L 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	POTH_M F 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	CTH_H F 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	UTT_L 0 0 0 0 335 335 0 0 0 0 0 0 0 0 0 0 0 0	RUTT_M R 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	UTT_H 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	BLDG_M 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	BLDG_1+ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	NL N	LATITUDE 55,480989 75,481092 55,48109 55,481298 55,48100 75,481608 75,481608 75,481608 75,48170 75,48210 75,48210 75,482120 75,482120 75,482220 75,4822524 75,4822524 75,482252 75,482524 75,48254 75,4855 75,4855 75,4855 75,4855 75,4855 75,4855 75,4855 75,4	LATOR N N N N N N N N N N N N N N N N N N N	LONGITU -120.0027 -120.0036 -120.0044 -120.0052 -120.0053 -120.0057 -120.0057 -120.0052 -120.0036 -120.0135 -120.0135 -120.0123 -120.0123 -120.0152 -120.0155 -120.0155 -120.0157 -1	118 1888 1229 1200 1771 1512 1833 1522 1933 164 1952 1952 1952 1952 1952 1955 1955 1955	n 19 19 19 19 19 19 19 19 19 19 19 19 19	ELEVATION 750.629 750.255 749.664 748.925 747.982 747.081 746.454 745.886 744.894 744.635 744.529 744.529 744.529 744.311 744.524 744.521 745.282 745.741 745.282 745.741 745.855 746.614 746.830 747.512				



Roughness and Rutting

ROUTE_TYPE	HIWY_ID AUX_ID	D CA	DIRECTION	AMSA	START_KM	END_KM	LANE	SURVEY_DAT	LIRI	RIRI	LRUT	RRUT	MAX_LRUT	MAX_RRUT	CPM	LATITUDE	LATDIR	LONGITUDE	LONGDIR	ELEVATION
P	2		N		0.000	0.050	1	24-06-2008	2.22	2.22	2	2	32	17	NL	55.480989	N	120.002118	W	750.629
P	2		N		0.050	0.100	1	24-06-2008	0.84	1.21	2	1	9	9	NL	55.481092	N	120.002888	W	750.255
P	2		N		0.100	0.150	1	24-06-2008	0.76	1.09	2	1	6	5	NL	55.481195	N	120.003658	W	749.664
P	2		N		0.150	0.200	1	24-06-2008	0.83	1.04	2	1	6	6	NL	55.481298	N	120.004429	W	748.925
P	2		N		0.200	0.250	1	24-06-2008	0.86	0.86	2	1	11	8	NL	55.481401	N	120.0052	W	747.982
P	2		N		0.250	0.300	1	24-06-2008	0.90	0.99	2	1	7	6	NL	55.481503	N	120.005971	W	747.081
P	2		N		0.300	0.350	1	24-06-2008	0.93	1.25	4	2	6	7	NL	55.481608	N	120.006741	W	746.454
P	2		N		0.350	0.400	1	24-06-2008	1.15	1.37	3	2	17	8	NL	55.481709	N	120.007512	W	745.867
P	2		N		0.400	0.450	1	24-06-2008	0.67	0.76	3	1	10	9	NL	55.48181	N	120.008283	W	745.328
P	2		N		0.450	0.500	1	24-06-2008	0.63	0.71	3	1	10	9	NL	55.481915	N	120.009052	W	744.894
P	2		N		0.500	0.550	1	24-06-2008	0.74	0.73	2	1	5	8	NL	55.482017	N	120.009822	W	744.635
P	2		N		0.550	0.600	1	24-06-2008	0.62	0.58	2	1	7	7	NL	55.482119	N	120.010593	W	744.529
P	2		N		0.600	0.650	1	24-06-2008	0.85	0.92	2	1	7	7	NL	55.48222	N	120.011364	W	744.311
P	2		N		0.650	0.700	1	24-06-2008	0.77	0.73	2	1	5	9	NL	55.482321	N	120.012135	W	744.524
P	2		N		0.700	0.750	1	24-06-2008	0.69	0.81	2	1	9	7	NL	55.482423	N	120.012905	W	744.951
P	2		N		0.750	0.800	1	24-06-2008	0.60	0.58	2	1	6	6	NL	55.482524	N	120.013674	W	745.282
P	2		N		0.800	0.850	1	24-06-2008	1.00	0.77	2	1	6	9	NL	55.482625	N	120.014444	W	745.741
P	2		N		0.850	0.900	1	24-06-2008	0.82	0.78	2	1	5	5	NL	55.48273	N	120.015213	W	746.018
P	2		N		0.900	0.950	1	24-06-2008	0.75	0.84	2	1	6	6	NL	55.482832	N	120.015983	W	746.355
P	2		N		0.950	1.000	1	24-06-2008	0.74	0.77	2	1	7	4	NL	55.482934	N	120.016753	W	746.614
P	2		N		1.000	1.050	1	24-06-2008	1.05	1.22	3	2	8	11	NL	55.483038	N	120.017522	W	746.890
P	2		N		1.050	1.100	1	24-06-2008	0.62	0.75	3	2	7	8	NL	55.483142	N	120.018294	W	747.156
P	2		N		1.100	1.150	1	24-06-2008	0.66	0.86	3	2	7	6	NL	55.483245	N	120.019065	W	747.512



8.7 Right of Way Digital Image Specifications

The following section describes the right of way digital image specifications for network level pavement surface condition surveys. They are based on using a single high resolution camera mounted onto the vehicle to record the right of way view of the pavement surface.

8.7.1. View

Right-of-Way (ROW) view - continuous images of the full pavement width, shoulders and roadside features such as signs, structures and guardrails. The horizon line shall be at approximately 80 percent of the way up the frame.

8.7.2. Image Resolution

The minimum image resolution is to be a minimum 1600 x 1200 colour image.

8.7.3. Media and Format

The recording media is to be digital and provide a minimum 12 bit color images in JPEG format. The desired image file size is 100 to 150 kbytes. The equipment is to be capable of delivering quality images, during all of the various conditions that the production survey may be undertaken.

Please note that the image quality on side roads can be relaxed recognizing varying light conditions and collection can be extended to sunset if required.

The equipment is to be progressive scan, or equivalent to yield clear images from a moving vehicle. Images will be taken at 10 metre intervals.

8.7.4. Review of Trial Images

During the initial QA testing, the camera angles and magnification will be adjusted and defined by a series of test runs with the Ministry representative to determine the appropriate views. Once the appropriate view has been established, the contractor must take all necessary measures to ensure that the image angle and magnification remain consistent throughout the production surveys, and brightness settings are constantly adjusted to yield high quality images. This is particularly critical if the recording system requires camera to be dismounted and remounted each day.



8.7.5. Quality Assurance

During the production surveys, the contractor is responsible to continuously review will ensure that the correct camera positions, field of view are being captured and the camera lens is clean.

8.7.6. Folder Naming Convention

The digital images are to be delivered in electronic format, using the following folder naming convention.

Primary and Secondary Highways

For Primary and Secondary Highways, the images shall be place in folders named as follows. These folders shall be within a folder named "YYYY Highway Images" - where YYYY is the year the images were taken (Note: each information item immediately follows the preceding item, no spaces):

- The single character H;
- The numeric highway number variable # of characters up to a maximum of four;
- The highways single alpha suffix if applicable (no placeholder needed if not applicable);
- An underscore (_);
- The single character alpha cardinal direction of the highway;
- An underscore (_);
- The two digit numeric Contract Area if applicable (used when another noncontiguous highway with the same number exists in a different Contract Area – 00 placeholder needed if NA);
- An underscore (_);
- For Project Level Survey data only, the letter 'L' followed by the single digit numeric lane number that Project Level images are for;
- An underscore (_);
- The two letters 'km'; and



• The four digit numeric that identifies the start chainage of the first image in that folder – rounded down to the nearest km.

Examples:

 a) For most highways _ no alpha suffix or Contract Area and when more than one folder is needed (i.e. for the images for Highway 31, with images for ~20 km of highway in each folder):

> H31_E_00_km0000 H31_E_00_km0020 H31_E_00_km0040 etc...

b) For highways with an alpha suffix and a Contract Area and when and more than one folder is needed (i.e. for the images for Highway 3A, with images for ~20 km of highway in each folder):

> H3A_E_10_km0000 H3A_E_10_km0020 H3A_E_10_km0040 etc...

c) For Project Level survey images (i.e. for the additional survey of the Wb lane of a two lane segment of Hwy 3A at the same time as the network level survey of the Eb lanes was undertaken, the images for the Wb lanes shall be in folders named_:

> H3A_E_10_L2_km0000 H3A_E_10_L2_km0020 H3A_E_10_L2_km0040 etc...

Side Roads

For Side Roads, the images shall be placed in folders, named in accordance with the CASHH of the roadway, using the following convention. These folders shall be within a folder named "YYYY SideRoad Images" - where YYYY is the year the images were taken (Note: each information item immediately follows the preceding item, no spaces):

• The two digit numeric Contract Area designation;



- An underscore (_);
- The single alpha character Area Manager (AM) Area designation;
- The single character (alpha or numeric) Area Manager Sub Area (SA) designation;
- An underscore (_);
- The five digit (leading zero's required) road number identifier;
- The side road's single alpha suffix if applicable (no placeholder needed if not applicable);
- An underscore (_);
- The single alpha character cardinal direction of the Side Road;
- An underscore (_);
- For Project Level Survey data only, the letter 'L' followed by the single digit numeric lane number that Project Level images are for;
- An underscore (_);
- The two letters "km"; and
- The four digit numeric that identifies the start chainage of the first image in that folder rounded down to the nearest km.

Examples:

a) For side road 1234R located within Contract Area 1, AMSA B@; with the cardinal direction East:

01_B@_01234R_E_km0000

b) For Project Level survey images (i.e. for the additional survey of the Wb lane of side road 1234R located within Contract Area 1, AMSA B@; at the same time as the network level survey of the Eb lanes was undertaken, the images for the Wb lanes shall be in folders named):

01_B@_01234R_E_L2_km0000



8.7.7. Image Naming Convention

The digital images are to be delivered in electronic format, using the following image naming convention.

For Primary Highways, Secondary Highways, and for Side Roads – The image names shall duplicate the folder names, but the characters following "km" shall be the driven distance along each highway that the image was taken at.

Examples:

a) For the first image along Highway 1 Eb, at Km 0.000

H1_E_00_km0000.000

b) For the image taken 12.345 kilometres along Highway 3A in CA 10 - Eb,

H3A_E_10_km0012.345

c) For the image taken 1.230 km along side road 1234R located within Contract Area 1, AMSA B@; with the cardinal direction East:

01_B@_01234R_E_km0001.230

 For the 'Project Level' Survey images taken at km 1.230 of the westbound lanes of side road 1234R located within Contract Area 1, AMSA B@ - with the cardinal direction East:

01_B@_01234R_E_L2_km0001.230

8.7.8. Image Header

Each image shall contain a header showing:

Left side of Header:

- Date and time image taken;
- For Primary and Secondary Highways The Traversal Code;



- For Side Roads CASHH, or CA_AMSA_HIWY_ID and AUX_ID, and DIRECTION (i.e. 01_B@_1234R E); and
- The word "Lane" followed by a space, and the LANE number.

Right side of Header:

- The MILEPOST;
- LATITUDE;
- LONGITUDE; and
- ELEVATION.

Example: (Note: without time, as time was not requested in 2007 data submission.)





8.7.9. Format for File required for loading images into RPMS and Photolog

The contractor shall create a shape file representing the location of each of the images collected. The format of the data shall be as noted in the following specifications for the Image Loading Data File. This file shall be submitted in both DBF and CSV formats.

The images shall be referenced back to the linear chainage / DMI and offset from the nearest significant Landmark.

Description	Field Name	Units	Туре	Width	Decimal
Route Type	ROUTE_TYPE	_	С	2	0
Route Number	HIWY_ID	_	Ν	5	0
Route Aux ID	AUX_ID	_	С	1	0
Contract Area	СА	_	Ν	2	0
Direction	DIRECTION	_	С	1	0
Area Manager (Area) and Sub Area	AMSA	_	С	2	0
Lane ID	LANE	_	Ν	1	0
Corporate Performance Measure	СРМ	-	С	2	0
Survey Date for RPMS	SURVEY_DAT	YYYYMMDD	D	8	0
Survey Date and Time for Photolog	TAKEN_DATETIME	YYYY/MM/DD HH24:MI:SS	С	20	0
Driven distance from start of road to point image taken.	MILEPOST	Km.mmm	N	8	3
Image Number – the sequential or frame number of the image.	IMAGE_NUMBER	-	N	20	0
Directory - where the image is located.	IMAGE_FOLDER_NAME	-	С	100	0
Image file name as described in section 7.7.7 of this Manual.	IMAGE_FILENAME	-	С	30	0
Traversal Code	TRAVERSAL_CODE	-	С	20	0
Location Description	LOCATION_DESC	-	С	150	0
Reverse Direction Flag	REVERSE_DIRECTION_FLAG	-	С	1	0
Camera Direction	CAMERA_DIRECTION		С	1	0
Latitude – NAD83 (CSRS)	LATITUDE	Decimal degrees	С	10	6
Longitude – NAD83 (CSRS)	LONGITUDE	Decimal degrees	С	11	6
Elevation	ELEVATION	metres	Ν	9	3

Notes:

- Route Type: Primary Highway = P, Secondary Highway = S, Side Road = SR, IRI & Images Only = I
- See this manual for further explanation of the Route Number, Route Aux ID, Contract Area, Direction, Area Manager Area and Lane ID fields shown above.
- Corporate Performance Measure CPM: Network Level (NL) and Project Level (PL)
- Survey Date and Time for Photolog TAKEN_DATE
 Format the TAKEN_DATETIME string as follows: YYYY/MM/DD HH24:MI:SS



Where:

- YYYY is the year including century
- o MM is the month 01 for January, 12 for December
- $\circ \quad \text{DD is the day of the month} \\$
- $_{\odot}$ $\,$ HH24 is the hour in 24 hour notation. Must be in the range 0 23 $\,$
- \circ $\,$ MI are the minutes. Must be in the range 0 59 $\,$
- o SS are the seconds. Must be in the range 0 59
 - Examples: 2009/04/29 06:20:45 2009/04/30 23:59:59
- Directory where the image is located. Does not include drive letter and must have a backslash at the end (i.e. "2005 SIDE ROAD Images\Folder Name\" where Folder Name is as described in section 7.7.6 of this Manual).
- Traversal Code A compilation of:

For Primary and Secondary Highways:

- o the prefix 'H'
- o The Route Number
- o The Route Aux ID
- An Underscore (_)
- o Direction
- For Side Roads:
 - the prefix 'SR'
 - the Contract Area
 - \circ an Underscore (_)
 - o the AMSA
 - o an Underscore (_)
 - o the Route Number
- The Route Aux ID
- An Underscore (_)
- o Direction
- Location Description A description of the road the image was taken on, comprised of: ,<direction of travel>,
 <Traversal Code>, <driven distance>, past <last significant RPMS landmark>, <general geographic location description>.

Example: Nb H5 E, 1.403 km past intersection with Vavenby Bridge Road, East of 100 Mile House.

- Reverse Direction Flag
 - o N is for images taken with increasing driven distances, and
 - o Y if for images taken with decreasing driven distances
- Camera Direction The direction the camera faces, relative to the vehicle.
 - F = Forward
 - R = Reverse

Will only be needed if we require a forward facing and a rear facing camera to capture signs etc. in opposite direction of travel.

 The latitude and longitude coordinates shall record the GPS Coordinate position of the survey vehicle at the time each image was captured.



9 Manual Distress Survey Forms

The following forms are provided for reference purposes and for conducting manual surface distress rating surveys:

- Pavement Distress Rating System Severity Levels
- Pavement Distress Rating System Density Levels
- Pavement Distress Survey Evaluation Form
- Pavement Distress Survey Crack Mapping Form



Pavement Distress Rating S	ystem – Severity Levels				
Distress Type	Low Severity	Moderate Severity	High Severity		
Longitudinal Wheel Path Cracking (LWP)	Single cracks with no spalling; mean unsealed crack width < 5mm	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm; alligator		
Longitudinal Joint Cracking (LJC)	Single cracks with no spalling; mean unsealed crack width < 5mm	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm; alligator		
Pavement Edge Cracking (PEC)	Single cracks with no spalling; mean unsealed crack width < 5mm	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm; alligator		
Transverse Cracking (TC)	Single cracks with no spalling; mean unsealed crack width < 5mm	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm; alligator		
Meandering Longitudinal Cracking (MLC)	Single cracks with no spalling; mean unsealed crack width < 5mm	Single or multiple cracks; moderate spalling; mean unsealed crack width 5-20mm	Single or multiple cracks; severe spalling; mean unsealed crack width >20mm; alligator		
Alligator Cracking (AC)	Not rated	Interconnected cracks forming a complete block pattern; slight spalling and no pumping	Interconnected cracks forming a complete block pattern, moderate to severe spalling, pieces may move and pumping may exist		
Rutting (RUT)	Less than 10mm	10 to 20mm	Greater than 20mm		
Shoving (SHV)	Barely noticeable to noticeable	Rough ride	Very rough ride		
Distortion (DST)	Not rated	Noticeable swaying motion; good car control	Fair to Poor car control		
Bleeding (BLD)	Not rated	Distinctive appearance with free excess asphalt	Free asphalt gives pavement surface a wet look; tire marks are evident		
Potholes (POT)	Less than 25mm deep	25 to 50mm deep	Greater than 50mm deep		
Ravelling (RAV)	Not rated	Aggregate and/or binder worn away; surface texture rough and pitted; loose particles exist	Aggregate and/or binder worn away; surface texture is very rough and pitted		



Pavement Distress Rating System – Density Levels										
Distress Type	Units	None	Few	Intermittent	Frequent	Extensive	Throughout			
Longitudinal Wheel Path Cracking (LWP)	Length	0%	< 10%	10-20%	20-50%	50-80%	80-100%			
Longitudinal Joint Cracking (LJC)	Length	0%	< 10%	10-20%	20-50%	50-80%	80-100%			
Pavement Edge Cracking (PEC)	Length	0%	< 10%	10-20%	20-50%	50-80%	80-100%			
Transverse Cracking (TC)	Number	0	1-2	3-4	5-7	8-10	>10			
Meandering Longitudinal Cracking (MLC)	Length	0%	< 10%	10-20%	20-50%	50-80%	80-100%			
Alligator Cracking (AC)	Area	0%	< 10%	10-20%	20-50%	50-80%	80-100%			
Rutting (RUT)	Length	0%	< 10%	10-20%	20-50%	50-80%	80-100%			
Shoving (SHV)	Length	0%	< 10%	10-20%	20-50%	50-80%	80-100%			
Distortion (DST)	Length	0%	< 10%	10-20%	20-50%	50-80%	80-100%			
Bleeding (BLD)	Length	0%	< 10%	10-20%	20-50%	50-80%	80-100%			
Potholes (POT)	Number	0	1-2	3-4	5-6	7-9	>10			
Ravelling (RAV)	Length	0%	< 10%	10-20%	20-50%	50-80%	80-100%			



Pavement Distress Survey	– Evalua	tion F	orm						Page	of
Rater:		Road	#:		Name:			Drainage:	A B U	
Date:		Start:			Lane #:			Sealing:	_1 L2 L3	3
Weather/Temp: Distress Types					Width:			Patching:	3	
			verity L	evels			Density	Levels		
		L	М	Н	None	Low	Intermittent	Frequent	Extensive	Throughout
Longitudinal Wheel Path Cracking	LWP									
Longitudinal Joint Cracking	LJC									
Pavement Edge Cracking	PEC									
Transverse Cracking	TC					1-2	3-4	5-7	8-10	>1(
Meandering Longitudinal Cracking	MLC									
Alligator Cracking	AC									
Rutting	RUT									
Shoving	SHV									
Distortion	DST									
Bleeding	BLD									
Potholes	POT					1-2	3-4	5-6	7-9	> 10
Ravelling	RAV									
Comments:						•				-



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Pavement Distress Survey – Crack Mapping Form