PDHonline Course C399 (2 PDH)

Asphalt Pavement - Distress Identification

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DISTRESS IDENTIFICATION MANUAL

for the Long-Term Pavement Performance Program

U.S. Department of Transportation
Federal Highway Administration

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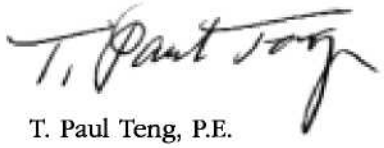
Foreword

In 1987, the Strategic Highway Research Program began the largest and most comprehensive pavement performance test in history—the Long-Term Pavement Performance (LTPP) program. During the program's 20-year life, highway agencies in the United States and 15 other countries will have collected data on pavement condition, climate, and traffic volumes and loads from more than 1,000 pavement test sections. That information will allow pavement engineers to design better, longer-lasting roads.

This manual was developed to provide a consistent, uniform basis for collecting distress data for the LTPP program.

This manual provides a common language for describing cracks, potholes, rutting, spalling, and other pavement distresses being monitored by the LTPP program.

The manual is divided into three sections, each focusing on a particular type of pavement: (1) asphalt concrete-surfaced, (2) jointed portland cement concrete, and (3) continuously reinforced portland cement concrete. Each distress is clearly labeled, described, and illustrated.



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Notice

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16. Abstract

Accurate, consistent, and repeatable distress evaluation surveys can be performed by using the *Distress Identification Manual for the Long-Term Pavement Performance Program.* Color photographs and drawings illustrate the distresses found in three basic pavement types; asphalt concrete-surfaced; jointed (plain and reinforced) portland cement concrete; and continuously reinforced concrete. Drawings of the distress types provide a reference to assess their severity. Methods for measuring the size of distresses and for assigning severity levels are given. The manual also describes how to conduct the distress survey, from obtaining traffic control to measuring the cracks in the pavement. Sample forms for recording and reporting the data are included. The manual also tells how to calibrate and operate fault measurement devices.

17. Key Words	18. Distribution Statement
Distress, LTPP, pavement, cracking, rutting, faulting.	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2002)

Contents

GUIDANCE TO OTHER USERS

As a pavement distress dictionary, the manual will improve communications within the pavement community by fostering more uniform and consistent definitions of pavement distress. Highway agencies, airports, parking facilities, and others with significant investment in pavements will benefit from adopting a standard distress language.

Colleges and universities will use the manual in highway engineering courses. It also serves as a valuable training tool for highway agencies. Now when a distress is labeled "high severity fatigue cracking," for example, it is clear exactly what is meant. Repairs can be planned and executed more efficiently, saving the highway agency crew time and money.

Although not specifically designed as a pavement management tool, the *Distress Identification Manual* can play an important role in a State's pavement management program by ridding reports of inconsistencies and variations caused by a lack of standardized terminology. Most pavement management programs do not need to collect data at the level of detail and precision required for the LTPP program, nor are the severity levels used in the manual necessarily appropriate for all pavement management situations. Thus, you may choose to modify the procedures (but not the definitions) contained in the manual to meet your specific needs, taking into account the desired level of detail, accuracy and timeliness of information, available resources, and predominant types of distress within the study area.

This section covers asphalt concrete-surfaced pavements (ACP), including ACP overlays on either asphalt concrete (AC) or portland cement concrete (PCC) pavements. Each of the distresses has been grouped into one of the following categories:

A. Cracking
B. Patching and Potholes
C. Surface Deformation
D. Surface Defects
E. Miscellaneous Distresses

Table 1 summarizes the various types of distress and unit of measurement. Some distresses also have defined severity levels.

TABLE 1. Asphalt Concrete-Surfaced Pavement Distress Types

DISTRESS TYPE	UNIT OF MEASURE	DEFINED SEVERITY LEVELS?
A. Cracking / page **3**		
1. Fatigue Cracking	Square Meters	Yes
2. Block Cracking	Square Meters	Yes
3. Edge Cracking	Meters	Yes
4a. Wheel Path Longitudinal Cracking	Meters	Yes
4b. Non-Wheel Path Longitudinal Cracking	Meters	Yes
5. Reflection Cracking at Joints		
Transverse Reflection Cracking	Not Measured	N/A
Longitudinal Reflection Cracking	Not Measured	N/A
6. Transverse Cracking	Number, Meters	Yes
B. Patching and Potholes / page **15**		
7. Patch/Patch Deterioration	Number, Square Meters	Yes
8. Potholes	Number, Square Meters	Yes
C. Surface Deformation / page **21**		
9. Rutting	Millimeters	No
10. Shoving	Number, Square Meters	No
D. Surface Defects / page **25**		
11. Bleeding	Square Meters	No
12. Polished Aggregate	Square Meters	No
13. Raveling	Square Meters	No
E. Miscellaneous Distresses / page **29**		
14. Lane-to-Shoulder Dropoff	Not Measured	N/A
15. Water Bleeding and Pumping	Number, Meters	No

1

DISTRESSES FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES

This section includes the following distresses:

1. Fatigue Cracking
2. Block Cracking
3. Edge Cracking
4a. Longitudinal Cracking—Wheel Path
4b. Longitudinal Cracking—Non-Wheel Path
5. Reflection Cracking at Joints
6. Transverse Cracking

Measurement of crack width is illustrated in Figure 1. Figure 2 depicts the effect on severity level of a crack, in this case block cracking, due to associated random cracking.

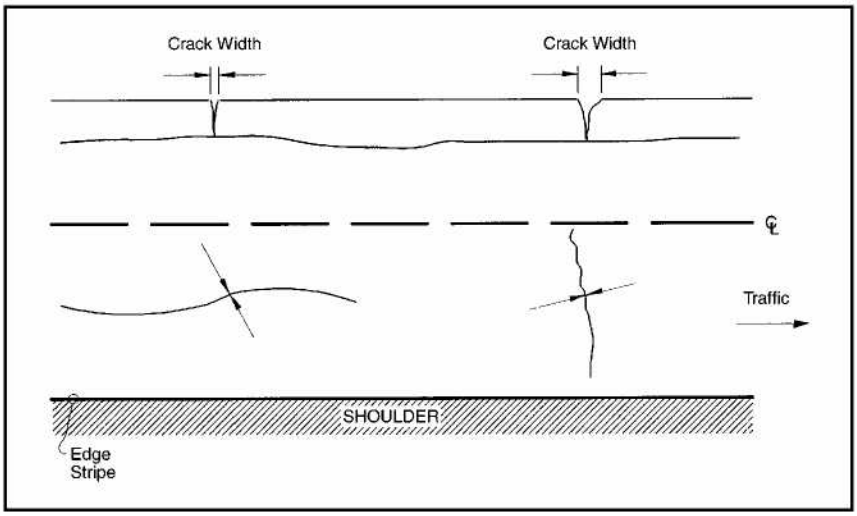

FIGURE 1
Measuring Crack Width in Asphalt Concrete-Surfaced Pavements

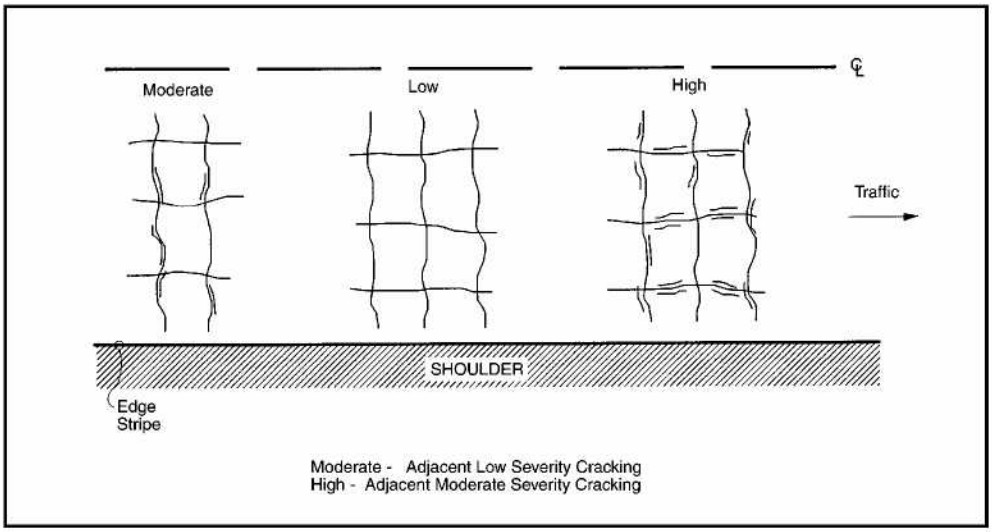

FIGURE 2
Effect on Severity Level of Block Cracking due to Associated Random Cracking

1

FATIGUE CRACKING

Description

Occurs in areas subjected to repeated traffic loadings (wheel paths). Can be a series of interconnected cracks in early stages of development. Develops into many-sided, sharp-angled pieces, usually less than 0.3 meters (m) on the longest side, characteristically with a chicken wire/alligator pattern, in later stages.

Must have a quantifiable area.

Severity Levels

LOW

An area of cracks with no or only a few connecting cracks; cracks are not spalled or sealed; pumping is not evident.

MODERATE

An area of interconnected cracks forming a complete pattern; cracks may be slightly spalled; cracks may be sealed; pumping is not evident.

HIGH

An area of moderately or severely spalled interconnected cracks forming a complete pattern; pieces may move when subjected to traffic; cracks may be sealed; pumping may be evident.

How to Measure

Record square meters of affected area at each severity level. If different severity levels existing within an area cannot be distinguished, rate the entire area at the highest severity present.

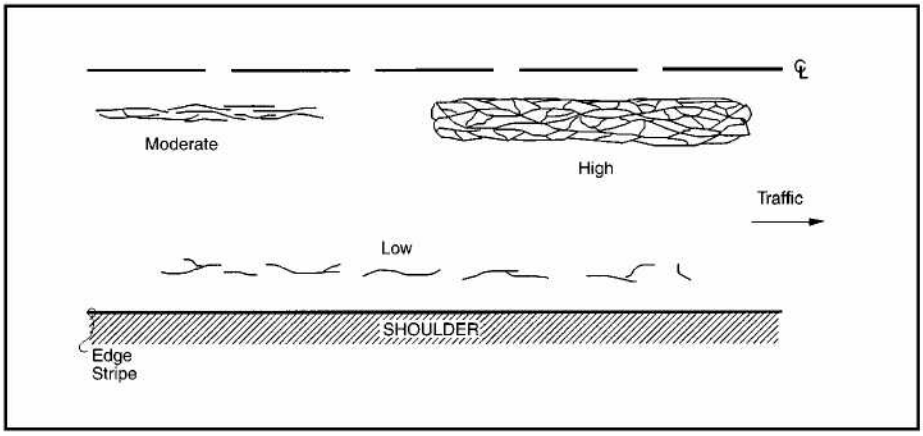

FIGURE 3
Distress Type ACP 1—Fatigue Cracking

FIGURE 4
Distress Type ACP 1—Chicken Wire/Alligator Pattern Cracking Typical in Fatigue Cracking

FIGURE 5
Distress Type ACP 1—Low Severity Fatigue Cracking

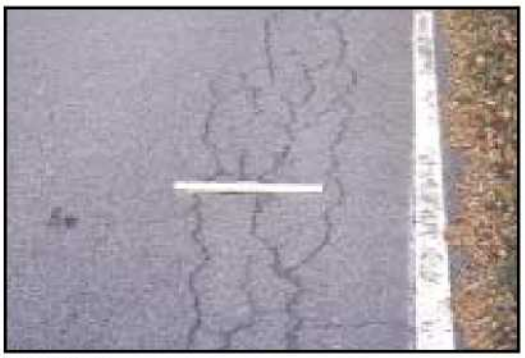

FIGURE 6
Distress Type ACP 1—Moderate Severity Fatigue Cracking

FIGURE 7
Distress Type ACP 1—High Severity Fatigue Cracking with Spalled Interconnected Cracks

2

BLOCK CRACKING

Description

A pattern of cracks that divides the pavement into approximately rectangular pieces. Rectangular blocks range in size from approximately 0.1 m^2 to 10 m^2.

Severity Levels

LOW

Cracks with a mean width ≤ 6 millimeters (mm); or sealed cracks with sealant material in good condition and with a width that cannot be determined.

MODERATE

Cracks with a mean width > 6 mm and ≤ 19 mm; or any crack with a mean width ≤ 19 mm and adjacent low severity random cracking.

HIGH

Cracks with a mean width > 19 mm; or any crack with a mean width ≤ 19 mm and adjacent moderate to high severity random cracking.

How to Measure

Record square meters of affected area at each severity level. If fatigue cracking exists within the block cracking area, the area of block cracking is reduced by the area of fatigue cracking.

Note: An occurrence should be at least 15 m long before rating as block cracking.

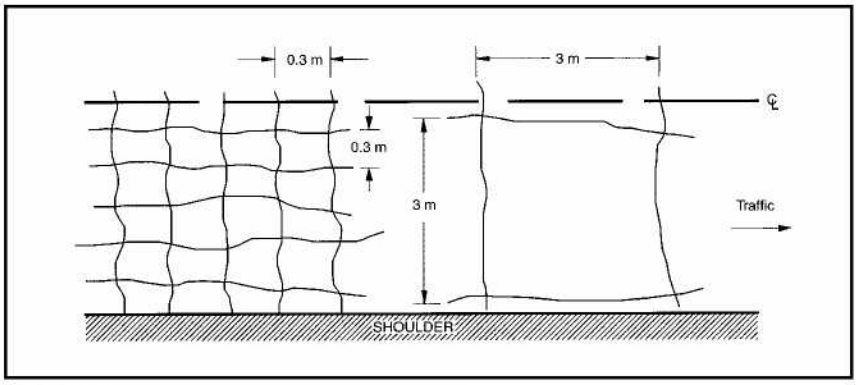

FIGURE 8
Distress Type ACP 2—Block Cracking

FIGURE 9
Distress Type ACP 2—Block Cracking with Fatigue Cracking in the Wheel Paths

FIGURE 10
Distress Type ACP 2—High Severity Block Cracking

EDGE CRACKING

Description

Applies only to pavements with unpaved shoulders. Crescent-shaped cracks or fairly continuous cracks which intersect the pavement edge and are located within 0.6 m of the pavement edge, adjacent to the shoulder. Includes longitudinal cracks outside of the wheel path and within 0.6 m of the pavement edge.

Severity Levels

LOW
Cracks with no breakup or loss of material.

MODERATE
Cracks with some breakup and loss of material for up to 10 percent of the length of the affected portion of the pavement.

HIGH
Cracks with considerable breakup and loss of material for more than 10 percent of the length of the affected portion of the pavement.

How to Measure

Record length in meters of pavement edge affected at each severity level. The combined quantity of edge cracking cannot exceed the length of the section.

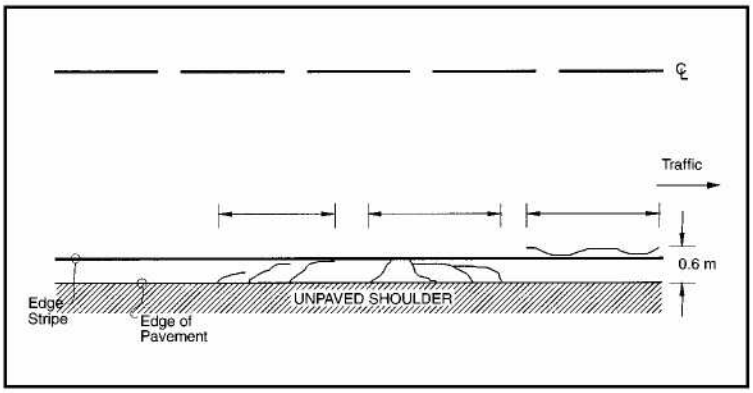

FIGURE 11
Distress Type ACP 3—Edge Cracking

FIGURE 12
Distress Type ACP 3—Low Severity Edge Cracking

4

LONGITUDINAL CRACKING

Description

Cracks predominantly parallel to pavement centerline. Location within the lane (wheel path versus non-wheel path) is significant.

Severity levels

LOW

A crack with a mean width ≤ 6 mm; or a sealed crack with sealant material in good condition and with a width that cannot be determined.

MODERATE

Any crack with a mean width > 6 mm and ≤ 19 mm; or any crack with a mean width ≤ 19 mm and adjacent low severity random cracking.

HIGH

Any crack with a mean width > 19 mm; or any crack with a mean width ≤ 19 mm and adjacent moderate to high severity random cracking.

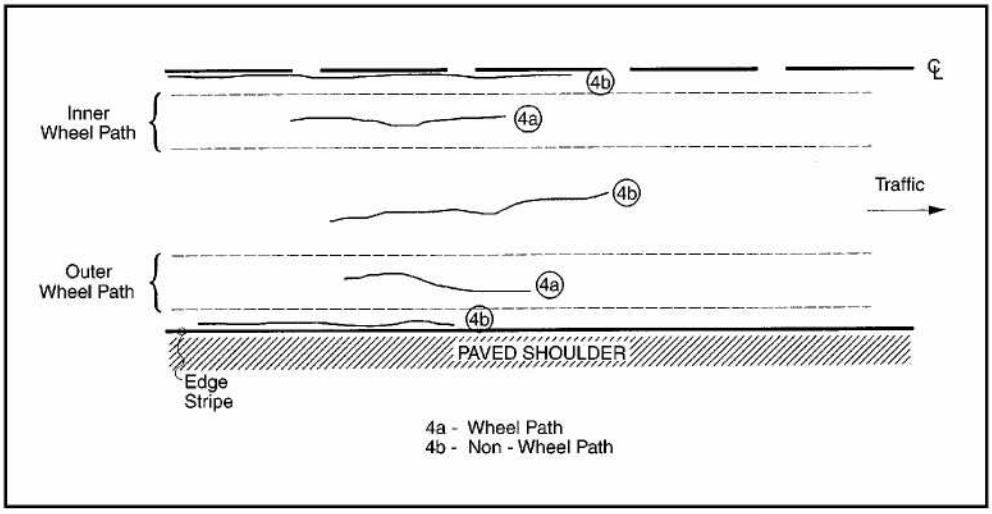

FIGURE 13
Distress Type ACP 4—Longitudinal Cracking

How to Measure

Record separately:

4A. WHEEL PATH LONGITUDINAL CRACKING

Record the length in meters of longitudinal cracking within the defined wheel paths at each severity level.

Record the length in meters of longitudinal cracking with sealant in good condition at each severity level.

Note: Any wheel path longitudinal crack that has associated random cracking is rated as fatigue cracking. Any wheel path longitudinal crack that meanders and has a quantifiable area is rated as fatigue cracking.

4B. NON-WHEEL PATH LONGITUDINAL CRACKING

Record the length in meters of longitudinal cracking not located in the defined wheel paths at each severity level.

Record the length in meters of longitudinal cracking with sealant in good condition at each severity level.

FIGURE 14
Distress Type ACP 4a—Moderate Severity Longitudinal Cracking in the Wheel Path

FIGURE 15
Distress Type ACP 4b—High Severity Longitudinal Cracking not in the Wheel Path

5

REFLECTION CRACKING AT JOINTS

Description

Cracks in asphalt concrete overlay surfaces that occur over joints in concrete pavements.

Note: The slab dimensions beneath the AC surface must be known to identify reflection cracks at joints.

Severity Levels

LOW

An unsealed crack with a mean width ≤ 6 mm; or a sealed crack with sealant material in good condition and with a width that cannot be determined.

MODERATE

Any crack with a mean width > 6 mm and ≤ 19 mm; or any crack with a mean width ≤ 19 mm and adjacent low severity random cracking.

HIGH

Any crack with a mean width > 19 mm; or any crack with a mean width ≤ 19 mm and adjacent moderate to high severity random cracking.

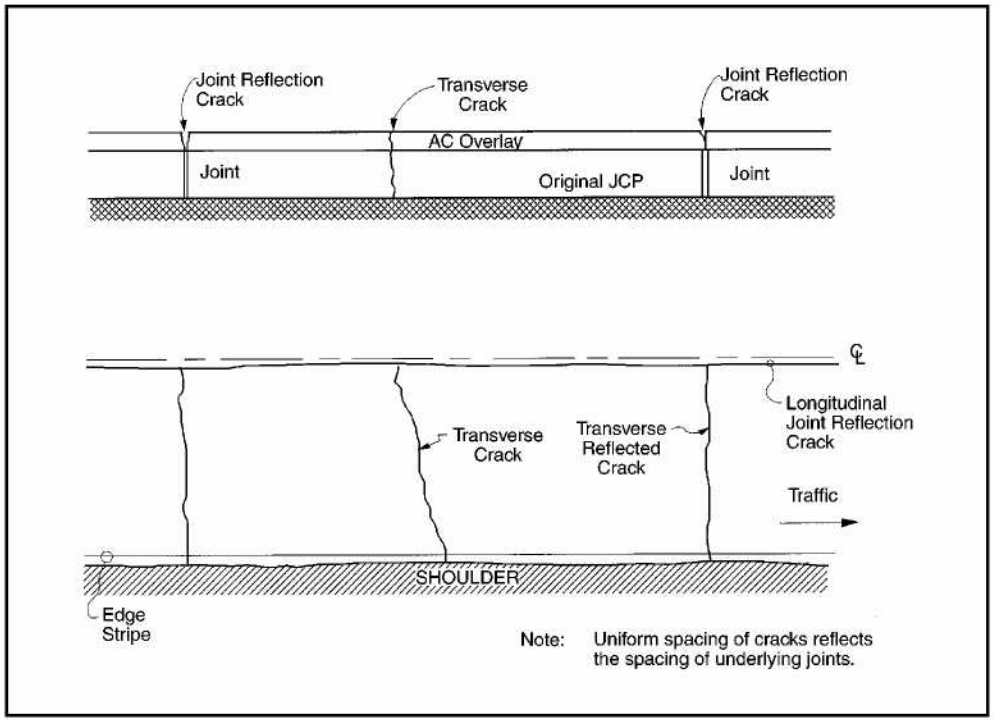

FIGURE 16
Distress Type ACP 5—Reflection Cracking at Joints

How to Measure

Recorded as longitudinal cracking (ACP4) or transverse cracking (ACP6) on LTPP surveys.

FIGURE 17
Distress Type ACP 5—High Severity Reflection Cracking at Joints

6

TRANSVERSE CRACKING

Description

Cracks that are predominantly perpendicular to pavement centerline.

Severity Levels

LOW

An unsealed crack with a mean width ≤ 6 mm; or a sealed crack with sealant material in good condition and with a width that cannot be determined.

MODERATE

Any crack with a mean width > 6 mm and ≤ 19 mm; or any crack with a mean width ≤ 19 mm and adjacent low severity random cracking.

HIGH

Any crack with a mean width > 19 mm; or any crack with a mean width ≤ 19 mm and adjacent moderate to high severity random cracking.

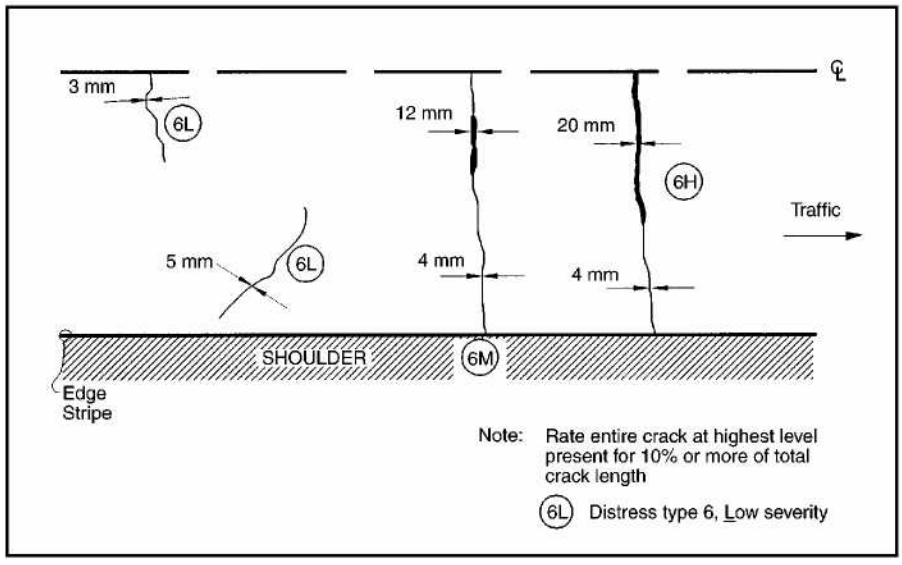

FIGURE 18
Distress Type ACP 6—Transverse Cracking Asphalt Concrete Surfaces

How to Measure

Record number and length of transverse cracks at each severity level. Rate the entire transverse crack at the highest severity level present for at least 10 percent of the total length of the crack. Length recorded, in meters, is the total length of the crack and is assigned to the highest severity level present for at least 10 percent of the total length of the crack.

Also record length in meters of transverse cracks with sealant in good condition at each severity level.

Note: The length recorded is the total length of the well-sealed crack and is assigned to the severity level of the crack. Record only when the sealant is in good condition for at least 90 percent of the length of the crack.

If the transverse crack extends through an area of fatigue cracking, the length of the crack within the fatigue area is not counted. The crack is treated as a single transverse crack, but at a reduced length.

Cracks less than 0.3 m in length are not recorded.

FIGURE 19
Distress Type ACP 6—Low Severity Transverse Cracking

FIGURE 20
Distress Type ACP 6—Moderate Severity Transverse Cracking

FIGURE 21
Distress Type ACP 6—High Severity Transverse Cracking

B

Patching and Potholes

This section includes the following distresses:

7. Patch/Patch Deterioration
8. Potholes

7

PATCH/PATCH DETERIORATION

Description

Portion of pavement surface, greater than 0.1 m^2, that has been removed and replaced or additional material applied to the pavement after original construction.

Severity Levels

LOW

Patch has, at most, low severity distress of any type including rutting < 6 mm; pumping is not evident.

MODERATE

Patch has moderate severity distress of any type or rutting from 6 mm to 12 mm; pumping is not evident.

HIGH

Patch has high severity distress of any type including rutting > 12 mm, or the patch has additional different patch material within it; pumping may be evident.

How to Measure

Record number of patches and square meters of affected surface area at each severity level.

Note: Any distress in the boundary of the patch is included in rating the patch. Rutting (settlement) may be at the perimeter or interior of the patch.

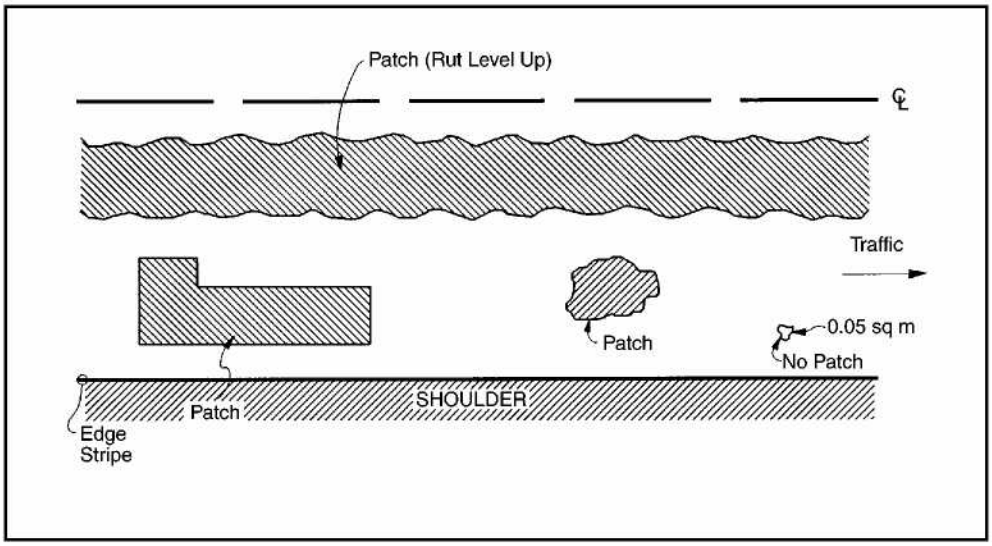

FIGURE 22
Distress Type ACP 7—Patch/Patch Deterioration

FIGURE 23
Distress Type ACP 7—Low Severity Patch

FIGURE 24
Distress Type ACP 7—Moderate Severity Patch

FIGURE 25
Distress Type ACP 7—High Severity Patch

8

POTHOLES

Description

Bowl-shaped holes of various sizes in the pavement surface. Minimum plan dimension is 150 mm.

Severity Levels

LOW
< 25 mm deep.

MODERATE
25 mm to 50 mm deep.

HIGH
> 50 mm deep.

How to Measure

Record number of potholes and square meters of affected area at each severity level. Pothole depth is the maximum depth below pavement surface. If pothole occurs within an area of fatigue cracking the area of fatigue cracking is reduced by the area of the pothole.

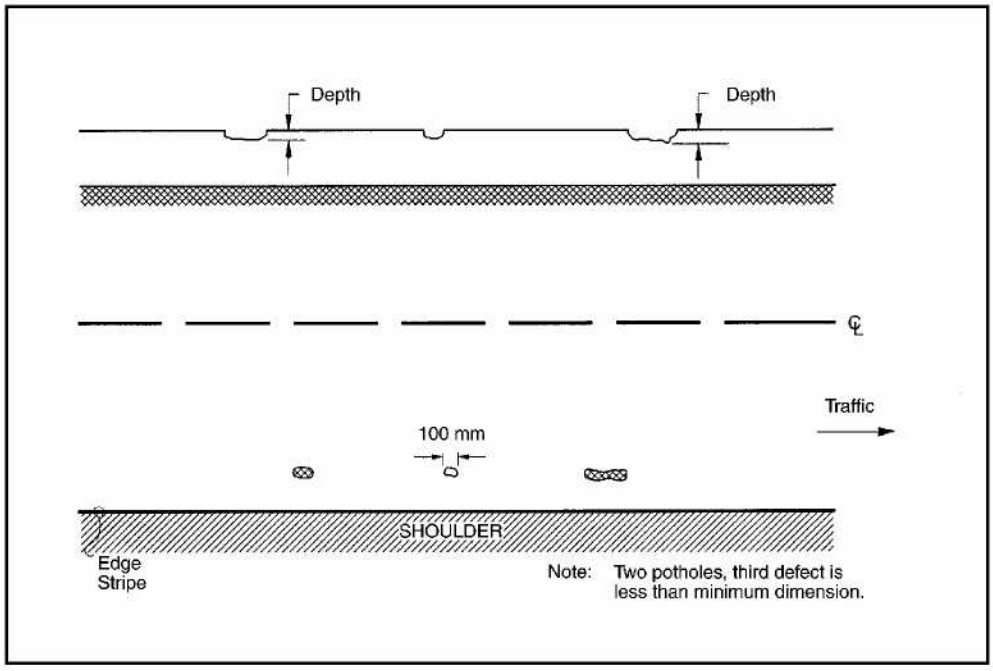

FIGURE 26
Distress Type ACP 8—Potholes

FIGURE 27
Distress Type ACP 8—Low Severity Pothole

FIGURE 28
Distress Type ACP 8—Moderate Severity Pothole

FIGURE 29
Distress Type ACP 8—Moderate Severity Pothole, Close-up View

FIGURE 30
Distress Type ACP 8—High Severity Pothole, Close-up View

C

Surface Deformation

This section includes the following types of surface deformations:

9. Rutting
10. Shoving

9

RUTTING

Description

A rut is a longitudinal surface depression in the wheel path. It may have associated transverse displacement.

Severity Levels

Not applicable. Severity levels could be defined by categorizing the measurements taken. A record of the measurements taken is much more desirable, because it is more accurate and repeatable than are severity levels.

How to Measure

Specific Pavement Studies (SPS)-3 ONLY. Record maximum rut depth to the nearest millimeter, at 15.25-m intervals for each wheel path, as measured with a 1.2-m straight edge.

All other LTPP sections: Transverse profile is measured with a Dipstick® profiler at 15.25-m intervals.

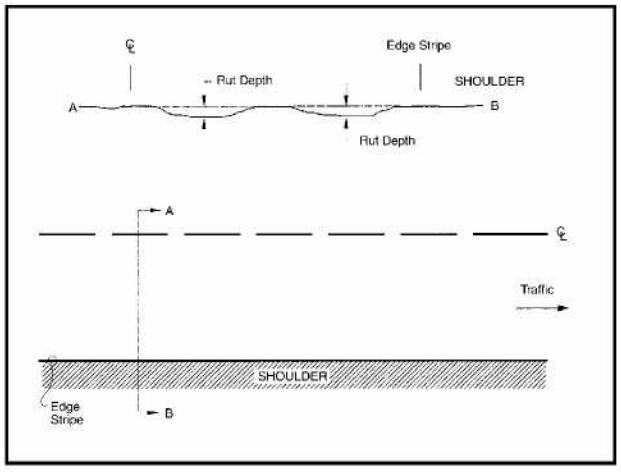

FIGURE 31
Distress Type ACP 9—Rutting

FIGURE 32
Distress Type ACP 9—Rutting

FIGURE 33
Distress Type ACP 9—Standing Water in Ruts

SHOVING

Description

Shoving is a longitudinal displacement of a localized area of the pavement surface. It is generally caused by braking or accelerating vehicles, and is usually located on hills or curves, or at intersections. It also may have associated vertical displacement.

Severity Levels

Not applicable. However, severity levels can be defined by the relative effect of shoving on ride quality.

How to Measure

Record number of occurrences and square meters of affected surface area.

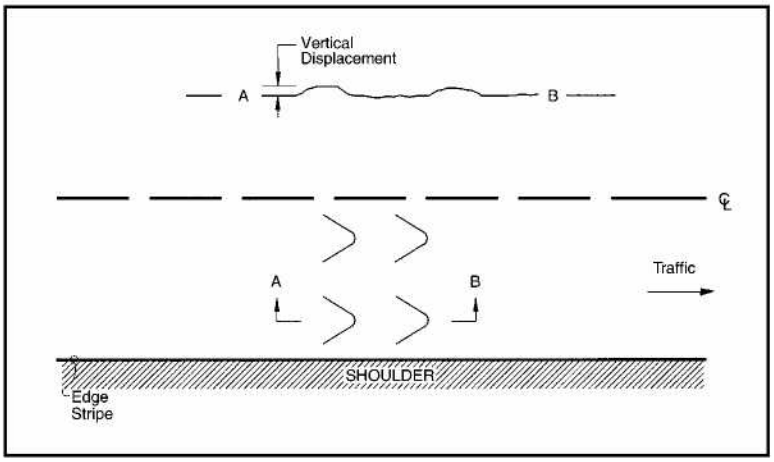

FIGURE 34
Distress Type ACP 10—Shoving

FIGURE 35
Distress Type ACP 10—Shoving in Pavement Surface

D

Surface Defects

This section includes the following types of surface defects:

11. Bleeding
12. Polished Aggregate
13. Raveling

11

BLEEDING

Description

Excess bituminous binder occurring on the pavement surface, usually found in the wheel paths. May range from a surface discolored relative to the remainder of the pavement, to a surface that is losing surface texture because of excess asphalt, to a condition where the aggregate may be obscured by excess asphalt possibly with a shiny, glass-like, reflective surface that may be tacky to the touch.

Severity Levels

Not applicable. The presence of bleeding indicates potential mixture related performance problems. Extent is sufficient to monitor any progression.

How to Measure

Record square meters of surface area affected.

Note: Preventative maintenance treatments (slurry seals, chip seals, fog seals, etc.) sometimes exhibit bleeding characteristics. These occurrences should be noted, but not rated as bleeding.

FIGURE 36
Distress Type ACP 11—Discoloration

FIGURE 37
Distress Type ACP 11—Loss of Texture

FIGURE 38
Distress Type ACP 11—Aggregate Obscured

POLISHED AGGREGATE

Description

Surface binder worn away to expose coarse aggregate.

Severity Levels

Not applicable. However, the degree of polishing may be reflected in a reduction of surface friction.

How to Measure

Record square meters of affected surface area. Polished aggregate should not be rated on test sections that have received a preventive maintenance treatment that has covered the original pavement surface.

FIGURE 39
Distress Type ACP 12—Polished Aggregate

13

RAVELING

Description

Wearing away of the pavement surface caused by the dislodging of aggregate particles and loss of asphalt binder. Raveling ranges from loss of fines to loss of some coarse aggregate and ultimately to a very rough and pitted surface with obvious loss of aggregate.

Severity Levels

Not applicable. The presence of raveling indicates potential mixture related performance problems. Extent is sufficient to monitor any progression.

How to Measure

Record square meters of affected surface. Raveling should not be rated on chip seals.

FIGURE 40
Distress Type ACP 13—Loss of Fine Aggregate

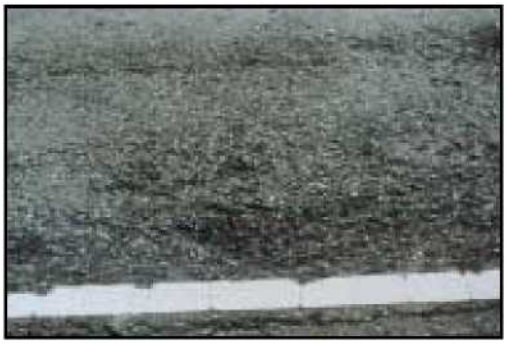

FIGURE 41
Distress Type ACP 13—Loss of Fine and Some Coarse Aggregate

FIGURE 42
Distress Type ACP 13—Loss of Coarse Aggregate

E

Miscellaneous Distresses

This section includes the following distresses:

14. Lane-to-Shoulder Dropoff
15. Water Bleeding and Pumping

14

LANE-TO-SHOULDER DROPOFF

Description

Difference in elevation between the traveled surface and the outside shoulder. Typically occurs when the outside shoulder settles as a result of pavement layer material differences.

Severity Level

Not applicable. Severity levels could be defined by categorizing the measurements taken. A record of the measurements taken is much more desirable, however, because it is more accurate and repeatable than are severity levels.

How to Measure

Not recorded in LTPP surveys.

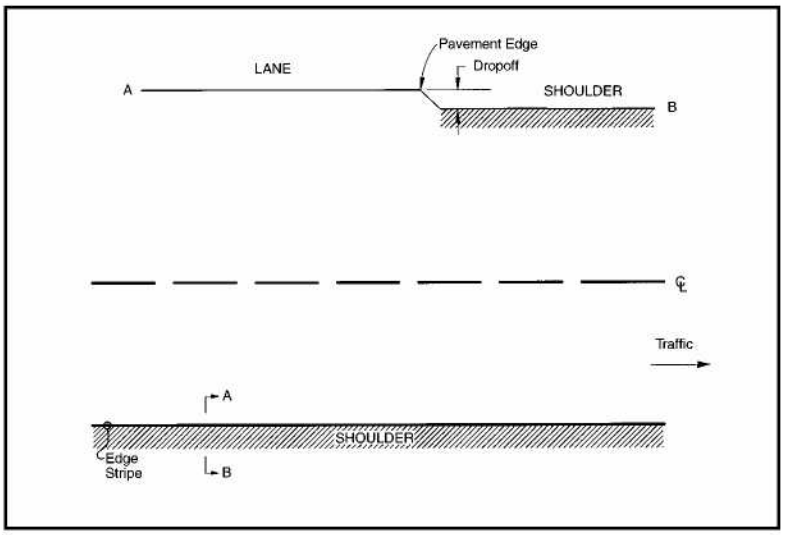

FIGURE 43
Distress Type ACP 14—Lane-to-Shoulder Dropoff

FIGURE 44
Distress Type ACP 14—Lane-to-Shoulder Dropoff

WATER BLEEDING AND PUMPING

Description

Seeping or ejection of water from beneath the pavement through cracks. In some cases, detectable by deposits of fine material left on the pavement surface, which were eroded (pumped) from the support layers and have stained the surface.

Severity Levels

Not applicable. Severity levels are not used because the amount and degree of water bleeding and pumping changes with varying moisture conditions.

How to Measure

Record the number of occurrences of water bleeding and pumping and the length in meters of affected pavement with a minimum length of 1 m.

Note. The combined length of water bleeding and pumping cannot exceed the length of the test section.

FIGURE 45
Distress Type ACP 15—Water Bleeding and Pumping

FIGURE 46
Distress Type ACP 15—Fine Material Left on Surface by Water Bleeding and Pumping

TABLE OF CONTENTS

A

MANUAL FOR DISTRESS SURVEYS

INTRODUCTION

This appendix provides instructions, data sheets, and distress maps for use in visual surveys for the collection of distress information for ACP, JCP, and CRCP surfaces. Visual distress survey procedures have been used in the LTPP program as the primary distress data collection method since 1995. The *Distress Identification Manual for the Long-Term Pavement Performance Program* is the basis for all distress surveys performed for the LTPP.

During the visual distress survey, safety is the first consideration, as with all field data collection activities. All raters must adhere to the practices and authority of the State or Canadian Province.

EQUIPMENT FOR DISTRESS SURVEYS

The following equipment is necessary for performing field distress surveys of any pavement surface type.

- Copy of map sheets and survey forms from most recent prior survey.
- Pavement thermometer.
- Extra blank data sheets and maps.
- Pencils.
- Latest version of the *Distress Identification Manual.*
- Clipboard.
- Two tape measures, one at least 30 m long and a scale or ruler graduated in millimeters.
- Calculator.
- Hard hat or safety cap and safety vest.
- Faultmeter, calibration stand and manual for PCC test sections.
- Digital camera, video camera, tapes.
- Transverse profile equipment required for AC test sections.
- Longitudinal profile equipment is required on sites where the LTPP Profilometer is unable to test.

INSTRUCTIONS FOR COMPLETING DISTRESS MAPS

The distress maps show the exact location of each distress type existing on the test section. The distress types and severity levels should be identified by using the *Distress Identification Manual.* A total of five sheets are used to map; each sheet contains two 15.25-m maps which represent 30.5 m of the test section (with the exception of SPS-6 sections 2 and 5, which are 305 m).

Each test section must be laid out consistently each time a survey is conducted. Sections begin and end at the stations marked on the pavement. Lateral extent of the section, for survey purposes, will vary depending on the existence of longitudinal joints and cracks and the relative position of the lane markings. Figures A1 and A2 illustrate the rules to follow when determining the lateral extent of the section for a distress survey. The lateral extent of the test sections should be consistent with prior distress surveys. On widened PCC sections, the lateral extent of the test section includes the full width (4.3 m) of the slab measured from the centerline longitudinal joint to the shoulder joint. The lateral extent of AC test sections with double yellow lines on the centerline are determined by using the inside yellow line.

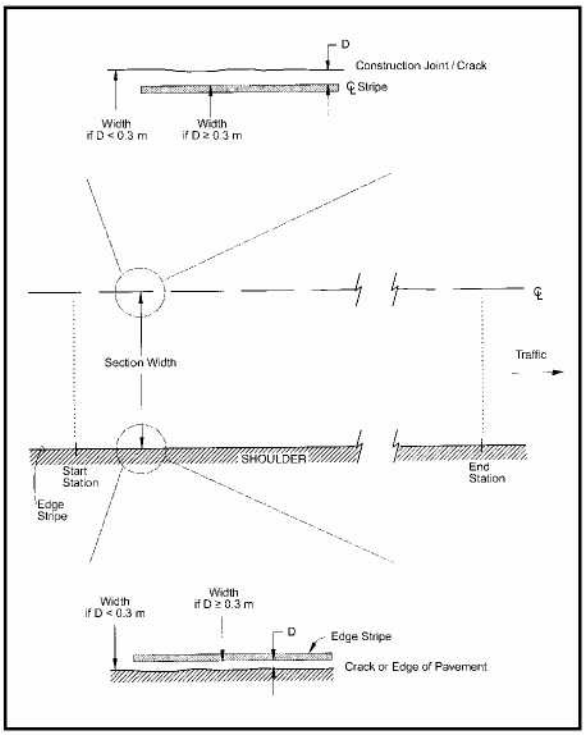

FIGURE A1
Test Section Limits for Surveys—Asphalt Surface

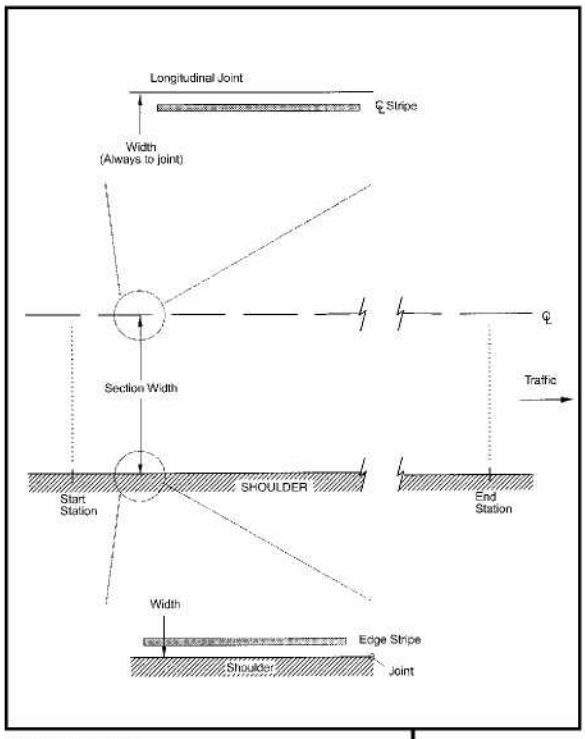

FIGURE A2
Test Section Limits for Surveys—Concrete Surface

To map the test section, place the tape measure on the shoulder adjacent to the test section from Station 0+00 to Station 1+00. It may be necessary to secure the tape onto the pavement with adhesive tape or a heavy object. After the tape is in place, the distresses can be mapped with the longitudinal placement of the distresses read from the tape. The transverse placement and extent of the distresses can be recorded using the additional tape measure. After the first 30.5-m subsection is mapped, the tape measure should be moved to map the second 30.5-m subsection. The process is repeated throughout the test section.

The distresses are drawn on the map at the scaled location using the symbols appropriate to the pavement type. In general, the distress is drawn and is labeled using the distress type number and the severity level (L, M, or H) if applicable. For example, a high severity longitudinal crack in the wheel path of an ACP would be labeled "4aH." An additional symbol is added beside the distress type and severity symbol in cases where the crack or joint is well-sealed. Figures specifying the symbols to be used for each pavement type are presented in the following chapters. In addition, example maps are provided to illustrate properly completed maps.

Any observed distresses that are not described in the *Distress Identification Manual* should be photographed and described on the comments line of the map sheet. The location and extent of the distress should be shown and labeled on the map. Crack sealant and joint sealant condition is to be mapped only for those distresses indicated in figures A4, A5, and A8. The specific distress types that are not to be included on the maps are to be recorded as follows:

Asphalt Concrete-Surfaced Pavement

If raveling, polished aggregate, or bleeding occur in large areas over the test section, do not map the total extent. Instead, note the location and extent in the space for comments underneath the appropriate map(s). These distresses should be mapped only if they occur in localized areas. The extent of these distresses must be summarized on the data summary sheets.

Jointed Concrete Pavement and Continuously Reinforced Concrete Pavement

If map cracking/scaling, or polished aggregate occur in large areas over the test section, do not map the total extent. Instead, note the location, extent, and severity level if applicable in the space for comments underneath the appropriate map(s). These distresses should be mapped only if they occur in localized areas. The extent of these distresses must be summarized on the data summary sheets.

SURVEY SHEETS' DATA ELEMENTS

In the common data section appearing in the upper right-hand corner of each of the distress survey data sheets the six-digit SHRP ID (two-digit State code plus four-digit SHRP Section ID) is entered. The date the survey was conducted, the initials of up to three raters, before and after pavement surface temperature readings, and the code indicating whether photographs and/or video tape were obtained at the time of the survey are entered in the appropriate spaces.

INSTRUCTIONS FOR COMPLETING ACP DISTRESS SURVEY SHEETS

Location of the vehicle wheel paths is critical for distinguishing between types of longitudinal cracking in ACP. Figure A3 illustrates the procedure for establishing the location and extent of the wheel paths. Both wheel paths must be drawn and identified on the distress maps. The distresses observed are recorded to scale on map sheets. The individual distresses and severity levels depicted on the map are carefully scaled and summed to arrive at the appropriate quantities (e.g., square meters or number of occurrences) and are then recorded on sheets 1-3. It is important to carefully evaluate the distress

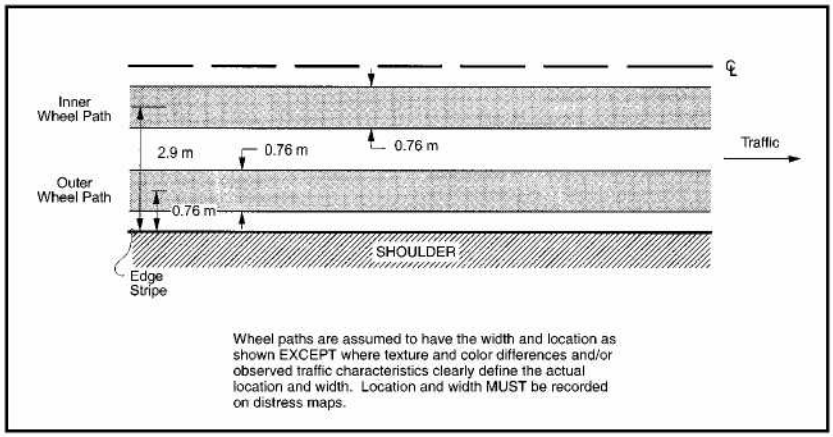

FIGURE A3
Locating Wheel Paths in Asphalt Concrete-Surfaced Pavements

map for certain distress types which have multiple methods of measurement because of orientation or location within the section. Longitudinal cracking, in the wheel path or elsewhere, are examples of these. Except where indicated otherwise, entries are made for all distress data elements. If a particular type of distress does not exist on the pavement, enter "0" as a positive indication that the distress was not overlooked in summarizing the map sheets. All data sheets are to be completed in the field prior to departing the site. Symbols to be used for mapping ACP sections are contained in figure A4, and an example mapped section is shown in figure A5.

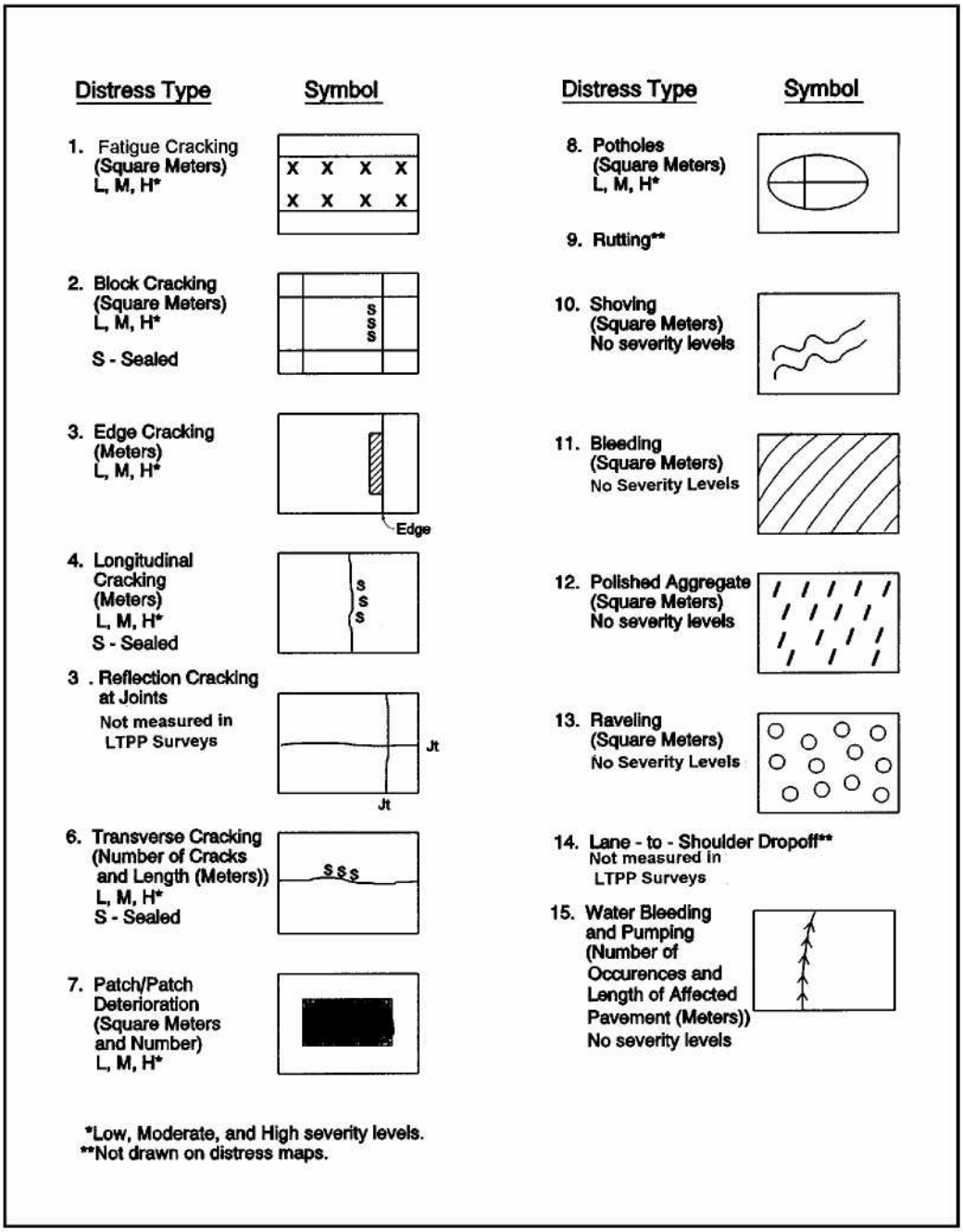

FIGURE A4
Distress Map Symbols for Asphalt Concrete-Surfaced Pavements

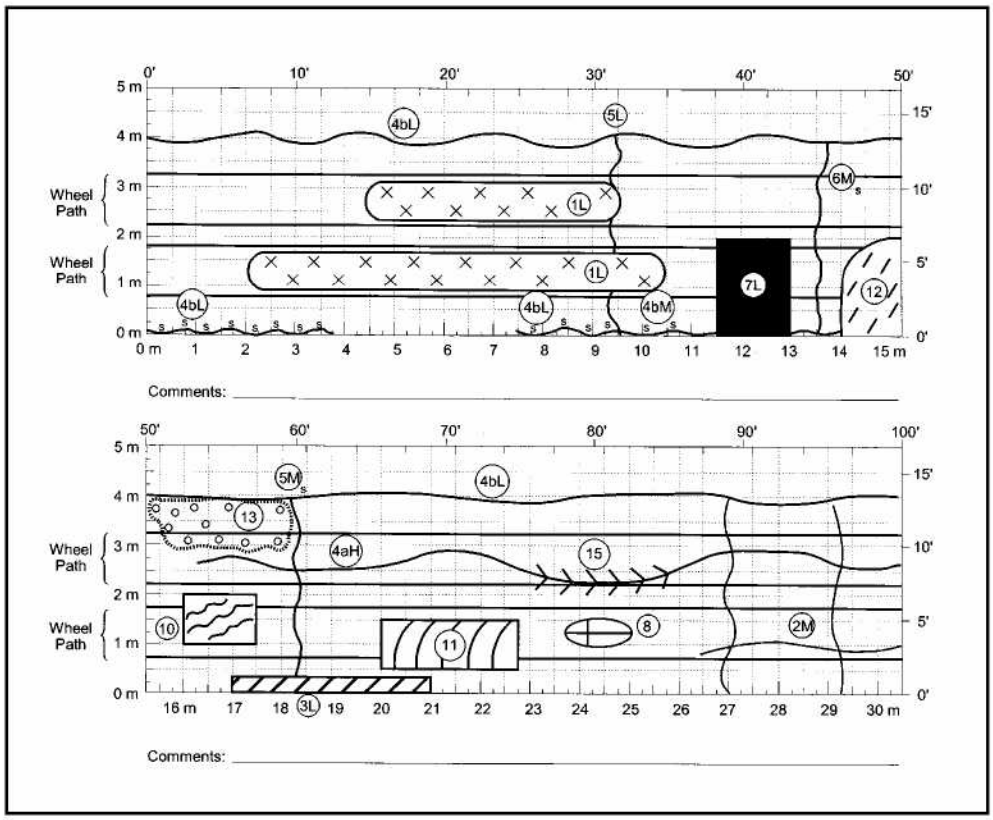

FIGURE A5
Example Map of First 30.5 meters of Asphalt Concrete Pavement Section

Description of Data Sheet 1

This data sheet provides space for recording measured values for the distress types identified in the left column. The units of measurement for each of the distress types are also identified in the left column. The extent of the measured distress for each particular level of severity is entered in the severity level columns identified as low, moderate, or high. Enter "0" for any distress types and/or severity levels not found.

Description of Data Sheet 2

This sheet is a continuation of the distress survey data recorded on sheet 1 and is completed as described under data sheet 1. In addition, space is provided to list "Other" distress types found on the test section but not listed on data sheets 1 or 2.

Revised Dec 1992; Jan 1999; Feb 2002

SHEET 1

DISTRESS SURVEY

LTPP PROGRAM

STATE CODE __ __

SHRP SECTION ID __ __ __ __

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) __ __/ __ __/ __ __

SURVEYORS: __ __ __, __ __ __ PHOTOS, VIDEO, OR BOTH WITH SURVEY(P,V,B) __
PAVEMENT SURFACE TEMP - BEFORE __ __ __ __ºC; AFTER __ __ __ __ºC

DISTRESS TYPE	SEVERITY LEVEL LOW	MODERATE	HIGH
CRACKING			
1. FATIGUE CRACKING (SQUARE METERS)	__ __ __.__	__ __ __.__	__ __ __.__
2. BLOCK CRACKING (SQUARE METERS)	__ __ __.__	__ __ __.__	__ __ __.__
3. EDGE CRACKING (METERS)	__ __ __.__	__ __ __.__	__ __ __.__
4. LONGITUDINAL CRACKING			
4a.Wheelpath (Meters)	__ __ __.__	__ __ __.__	__ __ __.__
Length Sealed (Meters)	__ __ __.__	__ __ __.__	__ __ __.__
4b.Non-Wheelpath(Meters)	__ __ __.__	__ __ __.__	__ __ __.__
Length Sealed (Meters)	__ __ __.__	__ __ __.__	__ __ __.__
5. REFLECTION CRACKING AT JOINTS	Not Recorded		
6. TRANSVERSE CRACKING Number of Cracks	__ __ __	__ __ __	__ __ __
Length (Meters)	__ __ __.__	__ __ __.__	__ __ __.__
Length Sealed	__ __ __.__	__ __ __.__	__ __ __.__
PATCHING AND POTHOLES			
7. PATCH/ PATCH DETERIORATION (Number)	__ __ __	__ __ __	__ __ __
(Square Meters)	__ __ __.__	__ __ __.__	__ __ __.__
8. POTHOLES (Number)	__ __ __	__ __ __	__ __ __
(Square Meters)	__ __ __.__	__ __ __.__	__ __ __.__

SHEET 2

DISTRESS SURVEY

LTPP PROGRAM

STATE CODE __ __

SHRP ID __ __ __ __

DATE OF DISTRESS SURVEY(MONTH/DAY/YEAR) __ __/ __ __/ __ __

SURVEYORS: __ __ __, __ __ __

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES
(CONTINUED)

DISTRESS TYPE	SEVERITY LEVEL LOW	MODERATE	HIGH
SURFACE DEFORMATION			
9. RUTTING - REFER TO SHEET 3 FOR SPS - 3 FOR FORM S1 SEE DIPSTICK MANUAL			
10. SHOVING (Number)			__ __ __
(Square Meters)			__ __ __.__
SURFACE DEFECTS			
11. BLEEDING (Square Meters)			__ __ __.__
12. POLISHED AGGREGATE (Square Meters)			__ __ __.__
13. RAVELING (Square Meters)			__ __ __.__
MISCELLANEOUS DISTRESSES			
14. LANE-TO-SHOULDER DROPOFF - NOT RECORDED			
15. WATER BLEEDING AND PUMPING (Number)			__ __ __
Length of Affected Pavement (Meters)			__ __ __.__
16. OTHER (Describe)			

SHEET 3

DISTRESS SURVEY

LTPP PROGRAM

STATE CODE __ __

SHRP ID __ __ __ __

DATE OF DISTRESS SURVEY(MONTH/DAY/YEAR)__ __/ __ __/ __ __

SURVEYORS:__ __ __,__ __ __

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES (CONTINUED)

9. RUTTING (FOR SPS-3 SURVEYS)

INNER WHEEL PATH			OUTER WHEEL PATH		
Point No.	Point Distance[1] (Meters)	Rut Depth (mm)	Point No.	Point Distance[1] (Meters)	Rut Depth (mm)
1	0.0	__ __ __	1	0.0	__ __ __
2	15.25	__ __ __	2	15.25	__ __ __
3	30.5	__ __ __	3	30.5	__ __ __
4	45.75	__ __ __	4	45.75	__ __ __
5	61.0	__ __ __	5	61.0	__ __ __
6	76.25	__ __ __	6	76.25	__ __ __
7	91.5	__ __ __	7	91.5	__ __ __
8	106.75	__ __ __	8	106.75	__ __ __
9	122.0	__ __ __	9	122.0	__ __ __
10	137.25	__ __ __	10	137.25	__ __ __
11	152.5	__ __ __	11	152.5	__ __ __

14. LANE-TO-SHOULDER DROPOFF -- Not Recorded

Note 1: "Point Distance" is the distance in meters for the start of the test section to the point where the measurement was made. The values shown are approximate S1 equivalents of the 50 ft spacing used in previous surveys.