

# UNIFIED FACILITIES MANUAL (UFM)

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## CONDITION SURVEYS OF OPERATING SURFACES



## **FOREWORD**

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CONDITION SURVEYS OF OPERATING SURFACES

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## CHAPTER 1 INTRODUCTION

### 1-1 BACKGROUND.

This manual describes the condition survey procedures for flexible pavements (all pavements with conventional bituminous concrete surfaces), rigid pavements (jointed portland cement concrete [PCC] pavements) and unpaved (unsurfaced, dirt, gravel stabilized, semi-prepared) surfaces. This manual also describes the procedure to determine the present condition of each of these pavement surfaces in terms of apparent structural integrity and operational surface condition. These standardized procedures provide a common index to determine operational risk at forward operating locations, compare the condition and performance of pavements between main installations, and provide a rational basis for justifying pavement maintenance and repair (M&R) projects.

### 1-2 PURPOSE AND SCOPE.

This document provides guidance for performing airfield, road, and parking condition surveys for paved and unpaved surfaces at main installations and forward operating locations used in contingency operations. The condition survey is a visual inspection of airfield, road, and parking surface distresses. The pavement condition index (PCI), unsurfaced road condition index (URCI), and semi-prepared airfield condition index (SPACI) are numerical ratings based on the type, severity, and quantity of the inspected distresses. These condition indices cannot measure structural capacity nor provide direct measurement of skid resistance or roughness.

The condition survey and resulting condition index provide an objective and rational basis to determine the rate of pavement deterioration, determine M&R needs and priorities, and permit early identification of major rehabilitation needs. It is the primary means of obtaining and recording important pavement performance data, which provide feedback on pavement performance for validating or improving current pavement design and maintenance procedures.

### 1-3 REPLACES AND CANCELS.

This UFM replaces and cancels UFM 3-260-16, *O&M Manual: Standard Practice for Airfield Pavement Condition Surveys*, dated 24 February 2026.

### 1-4 APPLICABILITY.

Paragraph 1-3 of UFC 1-200-01 defines the applicability of this manual.

Comply with NATO STANAG 7181, *NATO Standard Method for Airfield Pavement Condition Index (PCI) Surveys - AEP-56*, when performing pavement condition surveys for NATO operations.

**1-5 GENERAL BUILDING REQUIREMENTS.**

Comply with UFC 1-200-01, *DoD Building Code*. UFC 1-200-01 provides applicability of model building codes and government-unique criteria for typical design disciplines and building systems, as well as for accessibility, antiterrorism, security, high performance and sustainability requirements, and safety. Use this manual in addition to UFC 1-200-01 and the UFCs and government criteria referenced therein.

**1-6 GLOSSARY.**

Appendix B contains acronyms, abbreviations, and terms.

**1-7 REFERENCES.**

Appendix C contains a list of references used in this document. The publication date of the code or standard is not included in this document. Unless otherwise specified, the most recent edition of the referenced publication applies.

## CHAPTER 2 CONDITION SURVEY PROCEDURES

### 2-1 CONDITION SURVEY PROCEDURES SUMMARY.

UFM 3-270-08, *Pavement Management*, and UFM 3-260-03, *Standard Practice for Airfield Pavement Evaluation*, describe the data hierarchy standards used to organize pavement inventory. The inventory consists of one or more pavement networks, which are divided into branches. Branches are divided into sections and each section is divided into sample units.

Visually inspect the pavement sample units to assess the type, quantity, and severity of each pavement distress as described in Appendix A. The distress data are used to calculate the condition for each sample unit. The distress data are used to determine PCI, URCI, or SPACI, depending on the use and surface type of the pavement. Determine the condition of the pavement section based on the condition of the sample units inspected within the section. The survey procedures used to determine the PCI, URCI, and SPACI are all similar and each can be classified as standard, simplified (contingency), or cursory. The main distinguishing feature between these classifications is the number of sample units inspected and the resultant reliability of the results. The criticality of the asset, nature and duration of the mission, and ultimate use of the data are the determining factors for which procedure is used.

#### 2-1.1 Standard Condition Survey.

Standard condition surveys are typically performed on paved airfield surfaces at main installations or at forward operating locations when the mission requires extended operations or a higher confidence level in the result. Services may also perform standard condition surveys on road and parking pavements for better fidelity on M&R requirements. The standard condition survey uses the project-level (95 percent confidence level) sampling methods described in paragraph 2-6 of this manual, ASTM D5340, *Standard Test Method for Airport Pavement Condition Index Surveys*, ASTM D6433, *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys*, and ASTM E2840, *Standard Practice for Pavement Condition Index Surveys for Interlocking Concrete Roads and Parking Lots*.

#### 2-1.2 Simplified Condition Survey.

Simplified condition surveys are typically performed on paved or unpaved road and parking surfaces at main installations and paved or unpaved airfields and landing zones (LZ) at forward operating locations. When used to inspect surfaces at forward operating locations, this procedure is also known as a contingency assessment and is performed when the mission requires a higher confidence level than is achievable with a cursory inspection. The simplified condition survey uses the network-level sampling method, which requires a “lesser sampling rate” as described in paragraph 2-5 of this manual, ASTM D5340, ASTM 6433, and ASTM E2840.

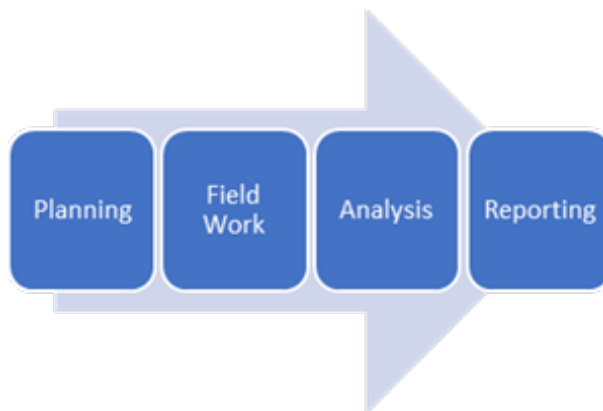
### 2-1.3 Cursory Condition Survey.

Cursory condition surveys have sampling rates below those required in the simplified procedure. This procedure is typically used on airfields and LZs in contingency environments when there are mission-warranted time constraints and is considered an “expedient” type evaluation, valid for limited operations. It focuses on any conditions that would restrict or limit operations. If the immediate mission involves more than a handful of operations (five passes), a more detailed inspection should be performed, or the cursory inspection can be repeated between ongoing operations, monitoring surface deterioration.

## 2-2 PAVEMENT EVALUATION PROCESS.

Condition surveys are often performed in conjunction with more comprehensive pavement evaluations, especially on airfields. These evaluations may include structural, surface friction, roughness, or void detection testing. The condition survey focuses on the surface condition of paved or unpaved surfaces but, as outlined in UFM 3-260-03 and in Figure 2-1, the overall process is the same whether the condition survey is performed in conjunction with a more comprehensive evaluation or not.

**Figure 2-1 Evaluation Process**



### 2-2.1 Planning.

Gather and review information about the site to determine the scope and validity of available data. Develop maps of the site with the inventory segmented, as outlined in paragraph 2-3, to a sufficient level of detail appropriate for the required fidelity of the inspection. Develop a test plan that defines the location and estimated number of sample units to be inspected based on the category of survey required, as outlined in paragraph 2-5.

## **2-2.2 Field Work.**

Whether collecting inspection information on a computer with a sample map in the background for reference, as with the DoD's pavement management application PAVER or on paper forms, it is a best practice to mark individual sample units to be inspected on the ground in a manner that allows inspectors and quality control personnel to easily locate them on the pavement surface. The intent is to accurately relocate the sample units to allow verification of current distress data, examine changes in condition of a particular sample unit over time, and enable future inspections of the same sample unit if desired.

## **2-2.3 Analysis.**

Whether field inspection data on main installations is collected on paper forms or electronically, PAVER is used to analyze the inspection data and determine the condition of paved and unpaved (road and parking) surfaces to determine the pavement section PCIs. PAVER does not currently have the capability to do a SPACI analysis on unpaved airfields or for interlocking concrete pavement (pavers). Condition survey analysis for forward operating locations may use PAVER, but often the analysis is manual or by using spreadsheets that automate the computations.

## **2-2.4 Reporting.**

Report format and content varies by Service and mission (e.g., the report format and content for a contingency evaluation is different than that for a main operating installation). UFM 3-260-03, UFM 3-270-08, and TSPWG M 3-260-03.02-19, *Airfield Pavement Evaluation Standards and Procedures*, provide examples and details on report format and content. A blank section/branch report form is available in Appendix A-9.11.

## **2-3 PAVEMENT SEGMENTATION.**

The pavement inventory is the aggregation of all pavement assets on an installation or at a forward operating location. An installation with an airfield will maintain separate inventories for the airfield and road and parking networks. Each of these inventories is subdivided into one or more networks, which are in turn subdivided into branches, sections, and sample units. The first step in performing a condition survey is to create or update this inventory framework to organize the data collection, analysis, and reporting process.

### **2-3.1 Networks, Branches and Sections.**

UFM 3-270-08 outlines standards for structuring and naming networks, branches, and sections as well as associating branches with their respective pavement facilities. Networks are defined by factors such as location, ownership, or funding. A network will have one or many branches that are defined by use, such as a runway or taxiway and road or parking. Sections are defined by factors such as surface type, pavement

structure, construction history, or traffic area. Each section is subdivided into sample units.

**2-3.2 Sample Units.**

A sample unit is a subdivision of a pavement section that has a standard size range and is used to collect distress data in a systematic manner, as shown in Figures 2-2 and 2-3.

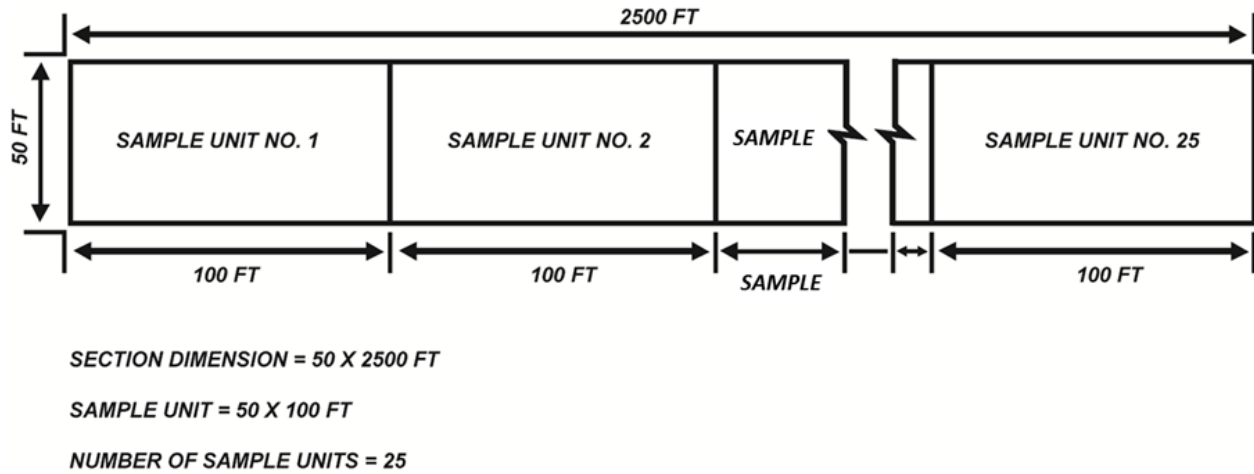
**2-3.2.1 Asphalt-Surfaced Airfield Sample Unit Sizes.**

Each asphalt-surfaced airfield sample unit is defined as  $5,000 \pm 2,000$  square feet ( $465 \pm 186$  square meters).

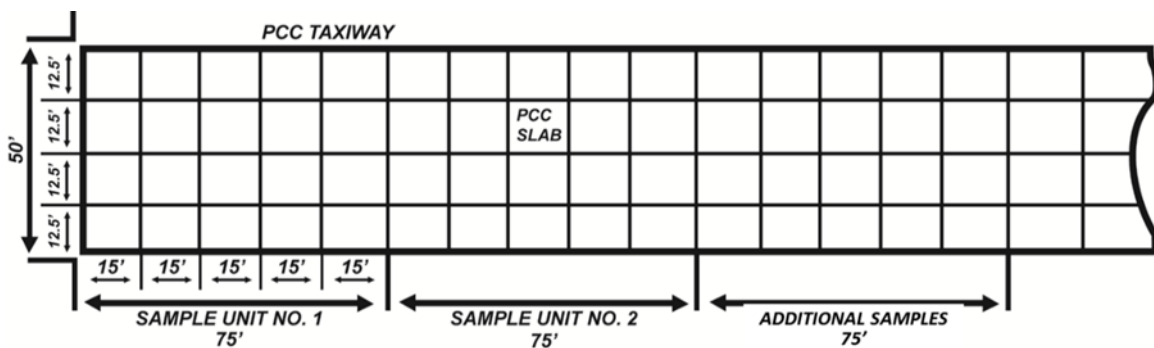
**2-3.2.2 Asphalt-Surfaced Roads and Parking Sample Unit Sizes.**

Each asphalt-surfaced airfield sample unit is defined as  $2,500 \pm 1,000$  square feet ( $225 \pm 90$  square meters).

**Figure 2-2 Flexible Airfield Pavement Section Sample Units**



**Figure 2-3 Rigid Pavement Section Sample Units**



### **2-3.2.3 Concrete-Surfaced Airfields or Road and Parking Sample Unit Sizes.**

For concrete airfields with joints spaced less than or equal to 25 feet (7.6 meters), the recommended sample unit size is  $20 \pm 8$  slabs. For slabs with joints spaced greater than 25 feet (7.6 meters), assume imaginary joints less than or equal to 25 feet (7.6 meters) apart and in perfect condition. For example, if slabs have joints spaced 60 feet (18.3 meters) apart, imaginary joints are assumed at 20 feet (6.1 meters). Thus, each slab is counted as three slabs for the purpose of pavement inspection. This is needed because the deduct values (DV) were developed for jointed concrete slabs less than or equal to 25 feet (7.6 meters).

### **2-3.2.4 Unsurfaced Road and Parking Sample Unit Sizes.**

Each unsurfaced road or parking sample unit is defined as  $2,500 \pm 1,000$  square feet ( $225 \pm 90$  square meters), similar to paved road and parking sample units.

### **2-3.2.5 Interlocking Concrete Road and Parking Sample Unit Sizes.**

Each interlocking concrete road or parking sample unit is defined as  $2,500 \pm 1,000$  square feet ( $225 \pm 90$  square meters).

### **2-3.2.6 Unsurfaced Airfield/Landing Zone Sample Unit Sizes.**

The guidance for a cursory unsurfaced/semi-prepared inspection is sufficiently different that it is discussed in its entirety in paragraph 3-6. Sample units for a simplified (network-level) evaluation is defined as  $5,000 \pm 2,000$  square feet ( $465 \pm 186$  square meters). For paved LZs, use the asphalt and concrete segmentation guidance in UFM 3-270-08 and the sample unit guidance in paragraph 2-3.2.1 for asphalt pavement and paragraph 2-3.2.3 for concrete pavement.

### **2-3.3 Selecting Sample Units to Inspect.**

The number of inspected sample units may vary, from inspecting a limited number of representative samples (cursory) at key areas to determine its suitability for aircraft operations, inspecting a prescribed lesser number of sample units (network level), inspecting the number of sample units that provides a 95 percent confidence level (project level), to inspecting all sample units in the section (100 percent). Inspecting all samples is desirable to estimate M&R quantities for project execution but is usually not done for routine pavement management purposes due to the manpower, funds, and time requirements. In all cases, number each sample on a sample unit map so it is identifiable for future inspections, maintenance needs, or statistical sample purposes. Select samples to be inspected as outlined in paragraphs 2.4, 2.5, or 2.6, depending on the survey category, and identify the sample units inspected on the sample unit map.

## **2-4 CURSORY INSPECTION.**

A cursory inspection requires as detailed and accurate an inspection as time and conditions permit in a contingency operation. Inspect the sections in the touchdown

area, in the primary braking area at approximately 1000 to 1500 feet (300 to 460 meters), at the point of aircraft rotation at approximately 2000 to 2500 feet (600 to 750 meters) for conventional aircraft, and the last 500 feet (150 meters) of the runway. Note that the point of rotation may move due to pressure and altitude changes and will vary for short take-off and vertical take-off/landing aircraft. These sections include the areas that are most likely to be damaged by landing, braking, stopping, acceleration, and takeoff for the runway in use. Inspect and monitor additional areas where degradation develops.

**2-5 SIMPLIFIED (NETWORK LEVEL) INSPECTION.**

**2-5.1 Determine the Number of Representative Sample Units to Inspect.**

A simplified inspection is also known as a network-level or contingency inspection, depending on the context. It uses a lower sampling rate than a standard (project level) inspection. Table 2-1 provides the minimum number of sample units to survey for a network-level inspection. When  $N$  equals 16 to 40, the value of  $n$  is set at 4. When the value of  $N$  is greater than 40,  $n$  is set at 10 percent of  $N$  and rounded up to the next whole sample unit. For example, if  $N = 52$  then  $n = 6$  (rounded up from 5.2). These criteria are applicable to network-level inspections of airfield or road and parking pavements.

**Table 2-1 Network-Level Sampling Criteria**

| No. of Sample Units in Section ( $N$ ) | No. of Units to be Inspected ( $n$ )                   |
|--|--|
| 1                                      | 1  |
| 2 to 5                                 | 2  |
| 6 to 15                                | 3  |
| 16 to 40                               | 4  |
| Over 40                                | 10 percent of $N$ (round up to next whole sample unit) |

**2-5.2 Select Representative Sample Units to Inspect.**

Ensure the sample units are representative (not random) of the overall condition of the section when selecting sample units to inspect per Table 2-1. The main objective is to obtain a meaningful rating with the least cost that will provide a reasonable network condition assessment and budget estimates.

## 2-6 STANDARD (PROJECT LEVEL) INSPECTION.

Standard inspections use a systematic random sampling process as outlined below. If a random sample is not representative of the overall condition of the section, treat it as an additional sample unit as described in paragraph 2-7. The objective is to attain a higher confidence level with greater fidelity on condition and budget estimate without doing a 100 percent inspection.

### 2-6.1 Determine the Number of Random Sample Units to Inspect.

Project-level management requires accurate data for preparing work plans. Therefore, more sample units are inspected than for network-level management. Use Equation 2-1 to determine the minimum number of sample units ( $n$ ) to survey to obtain an adequate estimate of the section's PCI. This number will provide a 95 percent probability that the estimate is within  $\pm 5$  points of the true mean PCI (the PCI obtained if all the sample units were inspected).

#### Equation 2-1. Minimum Sample Units

$$n = \frac{N(s^2)}{\frac{e^2}{4}(N-1) + s^2}$$

Where:

$n$  = Minimum number of sample units

$N$  = Total number of sample units in the pavement section

$e$  = Acceptable error in estimating the section PCI. Commonly,  $e = \pm 5$  PCI points

$s$  = Standard deviation of the PCI between sample units in the section

When performing the initial inspection, the standard deviation is assumed to be ten for AC pavements and 15 for PCC pavements. After the PCI values are determined, use Equation 2-2 to check that the 95 percent confidence level is met. For subsequent inspections, the standard deviation from the preceding inspection should be used to determine the number of sample units to inspect initially while still checking that the 95 percent confidence level is attained using Equation 2-1. When the total number of samples within a section is less than five, survey all of the sample units.

#### Equation 2-2. Standard Deviation

$$s = \sqrt{\sum_{i=1}^n \frac{(PCI_i - PCI_f)^2}{(n-1)}}$$

Where:

$PCI_i$  = PCI of surveyed sample  $i$

$PCI_f$  = Mean PCI of surveyed sample units

$n$  = Total number of sample units surveyed

Calculate the revised minimum number of sample units (Equation 2-1) to be surveyed using the calculated standard deviation (Equation 2-2). If the revised number of sample units to be surveyed is greater than the number of sample units already surveyed, select and survey additional random sample units. Repeat the process of checking the revised number of sample units and surveying additional random sample units until the total number of sample units surveyed equals or exceeds the minimum required sample units ( $n$ ) in Equation 2-1, using the actual total sample standard deviation.

### 2-6.2 Inspected Sample Unit Spacing.

Once the number of sample units to be inspected has been determined, compute the spacing interval of the sample units using systematic random sampling. Samples are equally spaced throughout the section, with the first sample selected at random. The spacing interval ( $i$ ) of the units to be sampled is calculated by the following formula rounded to the next-lowest whole number:

#### Equation 2-3. Sample Unit Spacing Interval

$$i = \frac{N}{n}$$

Where:

$N$  = Total number of sample units in the section

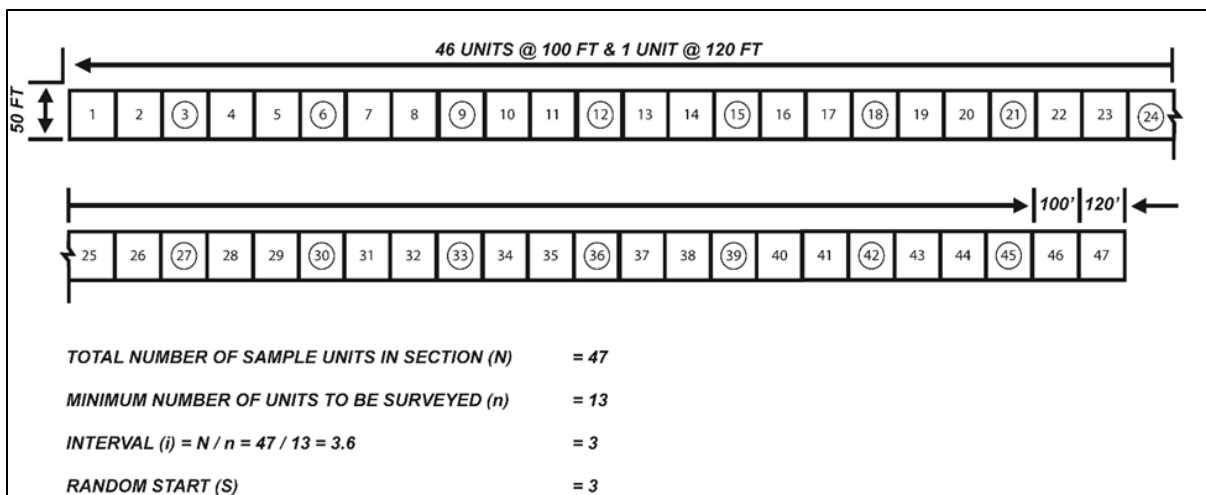
$n$  = Number of sample units to be inspected

The first sample unit to be inspected is selected at random from sample units 1 through  $i$ . The sample units within a section that are successive increments of the interval  $i$  after the first randomly selected unit are also inspected.

### 2-6.3 Systematic Random Sampling Example.

1. Determine the sample interval ( $i$ ) by  $i = N \div n$ , where  $N$  equals the total number of available sample units and  $n$  equals the minimum number of sample units to be surveyed. The sampling interval ( $i$ ) is rounded to the smaller whole number (for example, 3.6 is rounded to 3.0).
2. Select initial sample unit between 1 and the sampling interval ( $i$ ). For example, if  $i = 3$ , the random start would be a number from 1 to 3.
3. Identify the sample units to be surveyed as the initial sample  $S$ ,  $S+i$ ,  $S+2i$ , and so forth. If the selected start is 3 and the sampling interval is 3, then the sample units to be surveyed are 3, 6, 9, 12, and so forth.

**Figure 2-4 Systematic Random Sampling Example**



**2-7 ADDITIONAL SAMPLE UNIT SELECTION.**

One of the major drawbacks to both systematic random sampling at the project level and representative sampling at the network level is that sample units in exceptionally bad condition may not necessarily be included in the survey. At the same time, sample units that have a one-time-occurrence type of distress (for example, utility cut patching) may be included inappropriately as a random sample.

To overcome these drawbacks, identify any nonrepresentative sample units and inspect them as additional units rather than as random or representative units. When additional sample units are included in the survey, the section PCI calculation is altered to prevent extrapolation of the unusual conditions across the entire section. This procedure is described in more detail in Chapter 4.

**2-8 INSPECTION PROCEDURE.**

Inspections can be performed using manual or automated methods but, in all cases, use the definitions and guidelines in Appendix A for quantifying PCI distresses. Inspectors should identify distress types accurately 95 percent of the time using this test method. Linear measurements are considered accurate when they are within 10 percent if remeasured, and area measurements are considered accurate when they are within 20 percent if remeasured. Distress severities determined based on ride quality are considered subjective.

**2-8.1 Manual Inspection Apparatus.**

Using a GPS-enabled tablet with PAVER is a best practice for conducting a PCI survey but, at a minimum, the inspector should have a layout plan for the network being inspected and data sheets to record the data. Note that the PAVER Inspection Report/Forms/Setup Wizard can be used to generate inspection forms. In addition, the following are essential tools:

- Measuring wheel that reads to the nearest 0.1 foot (30 millimeters)
- 10-foot (3-meter) straightedge or string line
- Tape measure
- 12-inch (300-millimeter) scale that reads to 0.125 inch (3 millimeters)
- GPS-enabled camera to record distresses

### **2-8.2 Inspecting Asphalt, Unsurfaced, and Paver-Surfaced Pavement.**

Individually inspect each chosen sample unit. If using paper forms, sketch the sample unit, including orientation. Record the branch and section number and the number and type of the sample units (random or additional). Record the sample unit size (typically measured with a measuring wheel). Conduct the distress inspection by walking over the sample unit being surveyed, measuring the quantity of each distress type present at every severity level, and recording the data. Each distress must correspond in type and severity to that described in Appendix A. The method of measurement is included with each distress description. Repeat this procedure for each inspected sample unit and capture georeferenced photos of typical distresses in each section. Paragraph A-9 has copies of blank flexible pavement, unpaved, and interlocking concrete paver condition survey data sheets for airfields and roads and parking.

### **2-8.3 Inspecting Portland Cement Concrete Pavement.**

Individually inspect each chosen sample unit. If using paper forms, sketch the sample unit, showing the location of the slabs. Record the sample unit size, branch, and section number, the number and type of the sample unit (random or additional), the number of slabs in the sample unit, and the slab size measured. Perform the inspection by walking over each slab of the sample unit being surveyed and recording all distresses existing in the slab along with their severity level. Each distress type and severity must correspond with that described in Appendix A. Summarize the distress types, their severity levels, and the number of slabs in the sample unit containing each type and severity level. Repeat this procedure for each sample unit to be inspected and capture georeferenced photos of typical distresses in each section. A copy of a blank jointed rigid pavement condition survey data sheet is included in paragraph A-9 for airfields and roads and parking.

## CHAPTER 3 PCI CALCULATION PROCEDURES.

### 3-1 INTRODUCTION.

PAVER performs the calculations described in this chapter for the user, with the exception of SPACI for unpaved airfields and the PCI for interlocking concrete pavements. Whether calculating the PCI for paved surfaces or the URCI or SPACI for unpaved surfaces, the process is basically the same: determine the PCI of each inspected sample unit within the section and use the sample unit PCIs to calculate the section PCI. While the basic process is the same for each, there are differences in the details of the PCI, URCI, and SPACI calculations for airfields and roads and parking, as described in this chapter.

#### 3-1.1 Sample Unit Condition Index Determination Process.

The sample unit condition index determination process is the same for both the PCI and URCI but the SPACI process varies in that it does not include determining the distress density (step 2), does not require a maximum allowable number of distresses (step 5), and does not require a check for distresses at multiple severity levels (part of step 6).

1. Determine the total quantity of each distress type at each severity level.
2. Calculate the percent density of each distress type and severity.
3. Determine the deduct value (DV) for each distress type and severity level combination.
4. Calculate the total DV.
5. Determine the maximum allowable number of distresses.
6. Determine the maximum corrected deduct value (CDV).
7. Calculate the sample unit PCI.

#### 3-1.2 Section PCI Calculation.

After determining the PCI of each sample unit, use the weighted area average of these values to determine the section PCI, with adjustments for non-representative “additional” sample units.

### 3-2 ASPHALT-SURFACED PAVEMENT SAMPLE PCI CALCULATION.

#### 3-2.1 Record Distresses.

Following the process in paragraph 2-8.2, the inspector can populate the data directly into PAVER on a tablet or record the distresses on a paper form generated using the PAVER Inspection/Report/Forms Setup Wizard or like the form in Figure 3-1 (see paragraphs A-9.1 through A-9.7 for paved and unpaved data forms for airfields and roads and parking). Input the data in PAVER, capturing the total quantity of each distress type at each severity level. Figure 3-1 shows entries for a sample unit on an airfield with five distress types, several at different severity levels: longitudinal and

transverse cracking (48L, 48M), alligator cracking (41L), rutting (53L and 53M), depression (45L and 45M), and patching (50L). The units for the quantities may be either in square feet (square meters), linear feet, or linear meters.

**Figure 3-1 Asphalt-Surfaced Airfield PCI Survey Data Sheet Example**

| AC Airfield Pavement Condition Survey Data Sheet |                             |                               |                |                 |
|--|-----------------------------|-------------------------------|----------------|-----------------|
| PID: Base X_RW1230_R01A                          |                             | SURFACE TYPE:<br>AC           |                |                 |
| INSPECTOR NAME: S. Smith                         |                             | DATE INSPECTED: 01/29/2024    |                |                 |
| SECTION LENGTH:<br>2,000 ft                      | SECTION WIDTH:<br>100 ft    | SECTION TRUE AREA: 200,000 sf |                |                 |
| AC Surfaced Airfield Distress Codes              |                             |                               |                |                 |
| 41. Alligator Cracking                           | 46. Jet Blast               | 51. Polished Aggregate        | 56. Swell      |                 |
| 42. Bleeding                                     | 47. JT. Reflection (PCC)    | 52. Raveling                  | 57. Weathering |                 |
| 43. Block Cracking                               | 48. Long. & Trans. Cracking | 53. Rutting                   |                |                 |
| 44. Corrugation                                  | 49. Oil Spillage            | 54. Shoving From PCC          |                |                 |
| 45. Depression                                   | 50. Patching                | 55. Slippage Cracking         |                |                 |
| SAMPLE NUMBER:<br>001                            |                             | SAMPLE AREA:<br>5,000 sf      |                | SKETCH/COMMENTS |
| DISTRESS CODE                                    | L                           | M                             | H              |                 |
| 48   | 45 FT                       | 9 FT                          |                |                 |
| 41   | 50 FT                       |                               |                |                 |
| 53   | 375 FT                      | 25 SF                         |                |                 |
| 45   | 15 SF                       | 20 SF                         |                |                 |
| 50   | 50 SF                       |                               |                |                 |
|  |                             |                               |                |                 |
|  |                             |                               |                |                 |

**3-2.2 Determine Distress Density.**

Divide the total quantity of each distress type at each severity level by the total area of the sample unit and multiply by 100 to obtain the percent density of each distress type and severity in the sample unit. For example, given that the sample unit size is 5,000 square feet, the density of the 50 square feet of alligator cracking shown in Table 3-1 is 1.00 percent. Repeat the process for each distress. Paragraph A-9.8 has a blank density and deduct calculation form for manual computations.

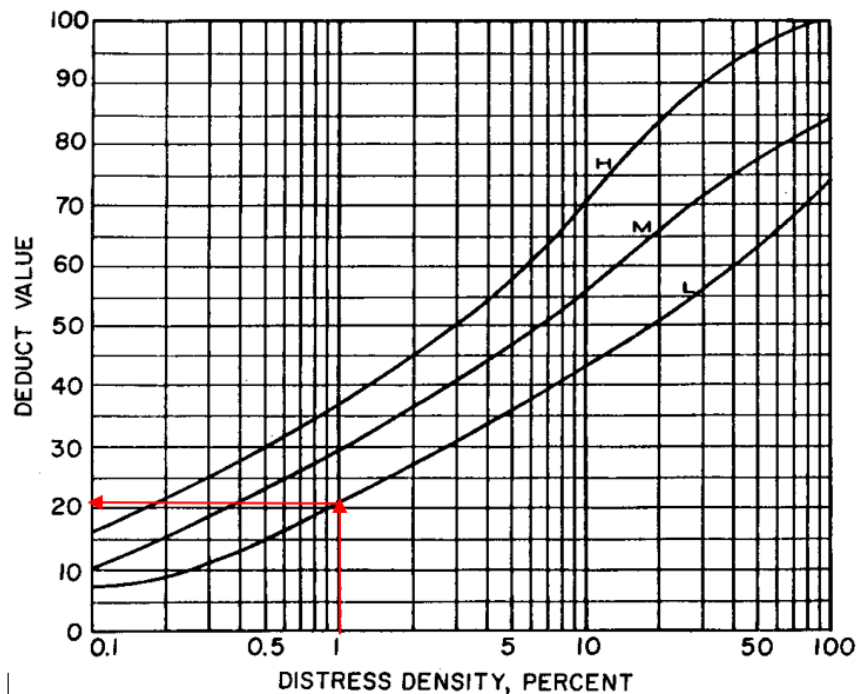
**Table 3-1 Density Calculation for Distresses Shown in Figure 3-1**

| Density and Deduct Calculation Form |                         |                  |       |                             |          |             |        |
|-------------------------------------|-------------------------|------------------|-------|-----------------------------|----------|-------------|--------|
| BRANCH ID: RW1230                   |                         | SECTION ID: R01A |       | SAMPLE UNIT #: 001          |          |             |        |
| CALCULATED BY: S Smith              |                         |                  |       | DATE CALCULATED: 01/29/2024 |          |             |        |
| Distress                            | Description             | Severity         | Units | Sample Area                 | Quantity | Density (%) | Deduct |
| 41                                  | Alligator cracking      | L                | sf    | 5,000                       | 50       | 1.00%       | 20.5   |
| 45                                  | Depression              | L                | sf    | 5,000                       | 15       | 0.30%       | 1.6    |
| 45                                  | Depression              | M                | sf    | 5,000                       | 20       | 0.40%       | 9.3    |
| 48                                  | Long and trans cracking | L                | ft    | 5,000                       | 45       | 0.90%       | 4.7    |
| 48                                  | Long and trans cracking | M                | ft    | 5,000                       | 9        | 0.18%       | 4.8    |
| 50                                  | Patching                | L                | sf    | 5,000                       | 50       | 1.00%       | 3.6    |
| 53                                  | Rutting                 | L                | sf    | 5,000                       | 375      | 7.50%       | 26.3   |
| 53                                  | Rutting                 | M                | sf    | 5,000                       | 25       | 0.50%       | 20.1   |
|                                     |                         |                  |       |                             |          |             |        |
|                                     |                         |                  |       |                             |          |             |        |
| TOTAL DEDUCT                        |                         |                  |       |                             |          |             | 90.9   |

**3-2.3 Determine Distress Deduct Values.**

Determine the DV for each distress type and severity level combination in the sample unit using the appropriate distress DV curves in Appendix A. For example, given the density of alligator cracking shown in Table 3-1 is 1.00 percent, use the deduct curve for alligator cracking in Figure 3-2 by entering the value 1 on the x-axis and proceeding up to the curve labeled L (low severity), then go to the y-axis to read the DV, 20.5. Repeat the process for each distress at each severity level to determine the total DV for the sample unit. PAVER automates the process by computing the density and DV as the user enters the distresses and quantities and summing the deducts to determine the total deduct.

Figure 3-2 AC Alligator Cracking Distress Deduct Curve



### 3-2.4 Determine Maximum Corrected Deduct Value (CDV).

If none or only one individual DV is greater than 5 for airfields or 2 for roads and parking, use the total DV in place of the maximum CDV to determine the PCI; otherwise, determine the maximum CDV iteratively as described in the steps below.

#### 3-2.4.1 Determine Maximum Allowable Number of Deducts ( $m$ ).

Calculate the maximum allowable number of individual DVs  $m$ , including the fractional part, using the highest deduct value (HDV) for the sample unit in Equation 3-1 for airfields or Equation 3-2 for roads and parking. If fewer than  $m$  DVs are available, then all the DVs are used.

#### Equation 3-1. Allowable Number of Deducts for Airfields

$$m_i = 1 + \left(\frac{9}{95}\right) (100 - HDV_i) \leq 10$$

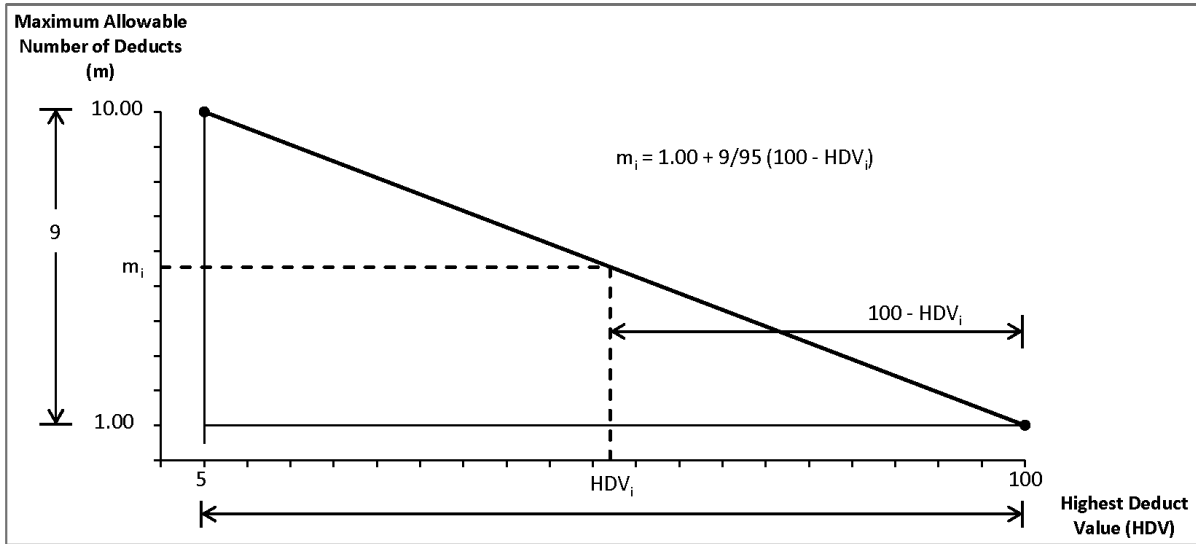
#### Equation 3-2. Allowable Number of Deducts for Roads and Parking

$$m_i = 1 + \left(\frac{9}{98}\right) (100 - HDV_i) \leq 10$$

Where:

$m_i$  = Allowable number of deducts, including fractions (rounded up), for sample unit  $i$   
 $HDV_i$  = Highest individual DV for sample unit  $i$

Figure 3-3 Maximum Allowable Deducts ( $m$ ) - Airfield



For example, the HDV in Table 3-1 (determined from Figure 3-1), is 26.3 (round to 27). Use this value in Equation 3-1 for airfields to determine  $m = 7.92$  as shown below. Use the highest seven deducts in Table 3-1 and a fractional part of the lowest (eighth) deduct (1.6). The eighth deduct is adjusted to 1.5 ( $1.6 * 0.92 = 1.5$ ).

$$m_i = 1 + \left(\frac{9}{95}\right) (100 - 27) = 7.92$$

### 3-2.4.2 List Individual Deduct Values in Descending Order.

List  $m$  individual DVs in descending order, as shown in the first row in Table 3-2 (see paragraphs A-9.9 and A-9.10 for blank PCI calculation forms). For this example, the values from Table 3-1 are sorted in row 1 as follows: 26.3, 20.5, 20.1, 9.3, 4.8, 4.7, 3.6 and 1.5. The total DV for row 1 is 90.8.

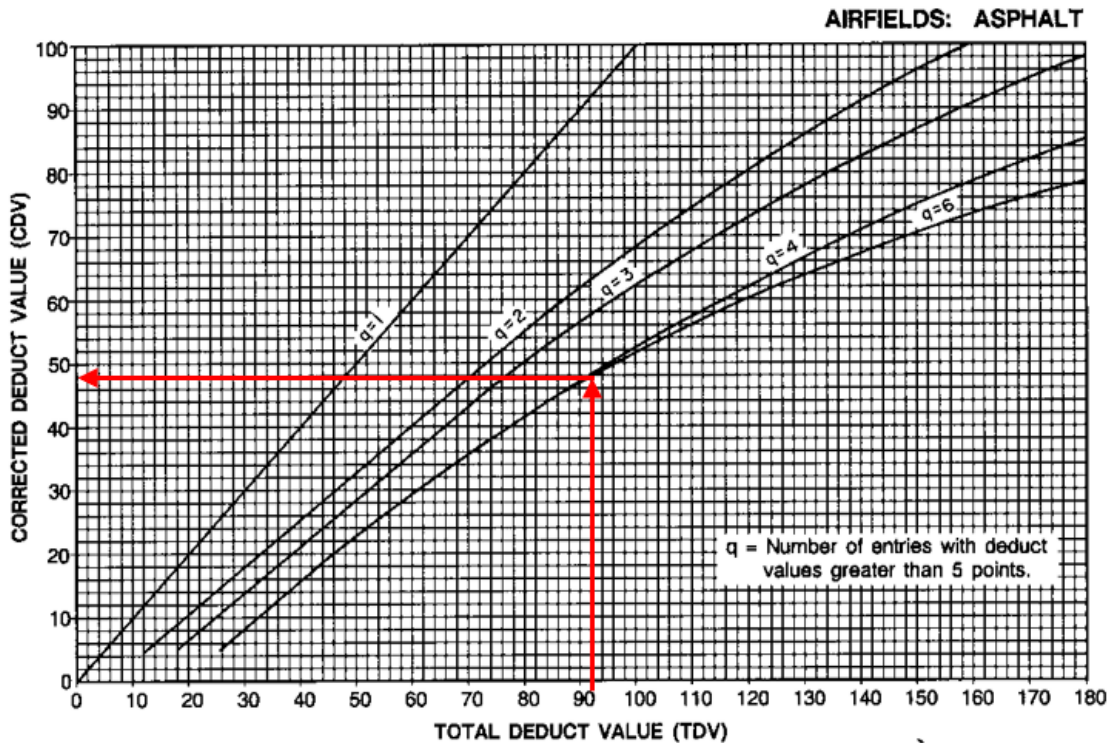
Table 3-2 PCI Calculation Form

| AIRFIELD PCI CALCULATION FORM  |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
|--|---------------------------------------|------|------|------------------|-----|-----|-----|-----------------|--|--|--------------|------------------|------------------------------|
| BRANCH ID: RW1230  |                                       |      |      | SECTION ID: R01A |     |     |     | SAMPLE UNIT 001 |  |  |              |                  |                              |
| CALCULATED BY: S. Smith  |                                       |      |      | DATE: 01/29/2024 |     |     |     |                 |  |  |              |                  |                              |
| Calculate $m$ , maximum number of deduct values allowed where $m = 1 + (9/95) * (100 - HDV)$ with Minimum = 1 and Maximum = 10 |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| Iteration Number   | Deduct Values (See notes 1, 2, and 3) |      |      |                  |     |     |     |                 |  |  | DEDUCT TOTAL | q Value (Note 4) | Corrected Deduct Value (CDV) |
| 1  | 26.3                                  | 20.5 | 20.1 | 9.3              | 4.8 | 4.7 | 3.6 | 1.5             |  |  | 90.8         | 4                | 48                           |
| 2  | 26.3                                  | 20.5 | 20.1 | 5.0              | 4.8 | 4.7 | 3.6 | 1.5             |  |  | 86.5         | 3                | 55                           |
| 3  | 26.3                                  | 20.5 | 5.0  | 5.0              | 4.8 | 4.7 | 3.6 | 1.5             |  |  | 71.4         | 2                | 49                           |
| 4  | 26.3                                  | 5.0  | 5.0  | 5.0              | 4.8 | 4.7 | 3.6 | 1.5             |  |  | 55.9         | 1                | 56                           |
| 5  |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| 6  |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| 7  |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| 8  |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| 9  |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| 10   |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| Notes:   |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| 1. Arrange Deduct Values from Highest Value to Lowest Value  |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| 2. Do not list more values than $m$ Deduct Values (round to the next higher integer if a fraction/decimal)                     |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| 3. The last (lowest) value listed may be a fraction of one of the Deduct Values in the Condition Survey Data Sheet             |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| 4. $q$ is the number of Deduct Values Greater than (but not equal to) 5.0  |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| <b>MAXIMUM CDV = 56</b>  |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |
| <b>Corrected Pavement Condition Index (PCI) = 100 - MAXIMUM CDV = 44</b>   |                                       |      |      |                  |     |     |     |                 |  |  |              |                  |                              |

**3-2.4.3 Determine  $q$  and the Corrected Deduct Value.**

The  $q$  value is the number of DVs greater than 5.0 for airfields or greater than 2.0 for roads and parking.  $q$  is then used to determine the CDV using the appropriate airfield or road and parking corrected deduct curve from Appendix A. Figure 3-4 shows the corrected deduct curves for asphalt airfields chart from Figure A-223. There are four DVs greater than 5 in Table 3-2. Given the total DV of 90.8 for row 1, enter the chart in Figure 3-4 on the x-axis and go vertically to the curve labeled 4, then go to the y axis to determine the CDV, which is 48 for row 1 as shown in Table 3-2.

Figure 3-4 Corrected Deduct Curves for Asphalt Airfield Pavements



**3-2.4.4 Repeat Process Until  $q = 1$ .**

Copy the DVs from row 1 to row 2, changing the smallest DV greater than 5 to 5 for airfields. For roads and parking, copy the DVs from row 1 to row 2, changing the smallest DV greater than 2 to 2. Then determine the total deduct for that row and determine the CDV for that row. Repeat this process until  $q = 1$ , as shown in Table 3-2.

**3-2.4.5 Two-Severity Distress Correction.**

A calculation step is added when there are two severities of one or more distresses in the same sample unit. This will ensure the PCI resulting from the distress with two severity levels is higher than the PCI resulting from the same distress at the same density at the higher severity level. For example, assume there is a low-severity distress (I1) at a given density and the same distress at medium severity (m1) at a given density. Evaluate the sample unit PCI (I1, m1) and PCI (0, M1) where  $M1 = (I1 + m1)$ .

The value of PCI (I1, m1) should be higher when compared to PCI (0, M1) since PCI (0, M1) has a greater distress percentage of higher severity. If this is not the case, the PCI of the sample unit will be computed based on M1 and not I1 and m1. When there are multiple distresses at two severity levels, the procedure iteratively compares the cases, for example: PCI (I1, m1 and I2, m2), PCI (M1 and I2, m2), PCI (I1, m1, M2), and PCI (M1, M2).

### 3-2.4.6 Three-Severity Distress Corrections.

When there are three severities of one distress in the same sample unit, the calculations need to be computed as shown below.

- I or L = percent density of low-severity distress percent
- m or M = percent density of medium-severity distress percent
- h or H = percent density of high-severity distress percent
- PCI (I, m, h) = PCI of the section with distress quantities of I, m, h

**Table 3-3 Three-Severity Cases**

| Start by Setting              | Distresses     | PCI Value             |
|-------------------------------|----------------|-----------------------|
|                               | <i>I, m, h</i> | PCI( <i>I, m, h</i> ) |
| $(I + m) = M \rightarrow$     | <i>0, M, h</i> | PCI( <i>0, M, h</i> ) |
| $(m + h) = H \rightarrow$     | <i>I, 0, H</i> | PCI( <i>I, 0, H</i> ) |
| $(I + h) = H \rightarrow$     | <i>0, m, H</i> | PCI( <i>0, m, H</i> ) |
| $(I + m + h) = H \rightarrow$ | <i>0, 0, H</i> | PCI( <i>0, 0, H</i> ) |

The value of PCI (I, m, h) should be higher when compared with PCI (0, M, h), PCI (I, 0, H), PCI (0, m, H), or PCI (0, 0, H). If not, the correct PCI of the sample unit should be based on the combination that provides the highest PCI.

### 3-2.5 Calculating the Sample Unit PCI.

Determine the maximum CDV after checking the multiple-severity distress correction procedure outlined above. There was no adjustment required for the example in Table 3-2, so the maximum CDV for this example is 56. Calculate the PCI by subtracting the maximum CDV from 100: PCI = 100 - max CDV. The PCI equals 100 - 56 = 44 for the example in Table 3-2.

## 3-3 CONCRETE-SURFACED PAVEMENT SAMPLE PCI CALCULATION.

### 3-3.1 Record Distresses.

Following the process outlined in paragraph 2-8.3, the inspector can populate the data directly into PAVER on a tablet or record the distresses on a paper form generated using the PAVER Inspection/Report/Forms Setup Wizard or a form similar to Figure 3-5, (see paragraphs A-9.1 through A-9.7 for paved and unpaved data forms for airfields and roads and parking). Input the data in PAVER, capturing the total quantity of each distress type at each severity level. Figure 3-5 shows entries for a sample unit on an airfield with six distress types, several at different severity levels: joint seal (65H), corner

break (62L, 62M), longitudinal and transverse cracks (63L, 63M), corner spall (75L), joint spall (74L), and shattered slab (72L). The units for the quantities are slabs.

**Figure 3-5 Concrete-Surfaced Airfield PCI Survey Data Sheet Example**

| PCC Airfield Pavement Condition Survey Data Sheet |                                      |   |                               |                           |
|---|--------------------------------------|---|-------------------------------|---------------------------|
| PID: Base X_RW1230_R03A                           |                                      |   | SURFACE TYPE:<br>PCC          |                           |
| INSPECTOR NAME: S. Smith                          |                                      |   | DATE INSPECTED: 01/29/2024    |                           |
| SECTION LENGTH:<br>2,000 ft                       | SECTION WIDTH:<br>100 ft             |   | SECTION TRUE AREA: 200,000 sf |                           |
| SLAB LENGTH:<br>25 ft                             | SLAB WIDTH:<br>25 ft                 |   | NUMBER OF SLABS: 320          |                           |
| PCC Surfaced Airfield Distress Codes              |                                      |   |                               |                           |
| 61. Blowup {1}                                    | 65. Joint Seal Damage {5}            |   | 69. Pumping {9}               | 73. Shrinkage Cracks {13} |
| 62. Corner Break {2}                              | 66. Patching, Small {6} (< 5 ft)     |   | 70. Scaling {10}              | 74. Spalling, Joints {14} |
| 63. Cracks {3}                                    | 67. Patching, Large/ Utility Cut {7} |   | 71. Settlement/Faulting {11}  | 75. Spalling, Corner {15} |
| 64. Durability Cracking {4}                       | 68. Popouts {8}                      |   | 72. Shattered Slab {12}       | 76. ASR {16}              |
| SAMPLE NUMBER<br>002                              | SAMPLE AREA<br>20                    |   | SKETCH/COMMENTS               |                           |
| DISTRESS CODE                                     | L                                    | M | H                             |                           |
| 65  |                                      |   | 20                            |                           |
| 62  | 2                                    | 1 |                               |                           |
| 63  | 3                                    | 5 |                               |                           |
| 75  | 3                                    |   |                               |                           |
| 74  | 2                                    |   |                               |                           |
| 72  | 1                                    |   |                               |                           |
|   |                                      |   |                               |                           |

|     |            |     |     |
|-----|------------|-----|-----|
| 63M | 75L        |     |     |
| 62L | 63M        |     | 63L |
| 62M | 63M        | 63L | 74L |
| 62L | 63M<br>75L | 63L |     |
| 75L | 72L        | 74L | 63M |

**3-3.2 Determine Distress Density.**

Divide the total quantity of each distress type at each severity level by the total area of the sample unit and multiply by 100 to obtain the percent density of each distress type and severity in the sample unit. For example, given that the sample unit size is 20 slabs, the density of the two instances of low-severity corner breaks shown in Table 3-4 is 10.0 percent. Repeat the process for each distress at each severity. Paragraph A-9.8 has a blank density and deduct calculation form for manual computations.

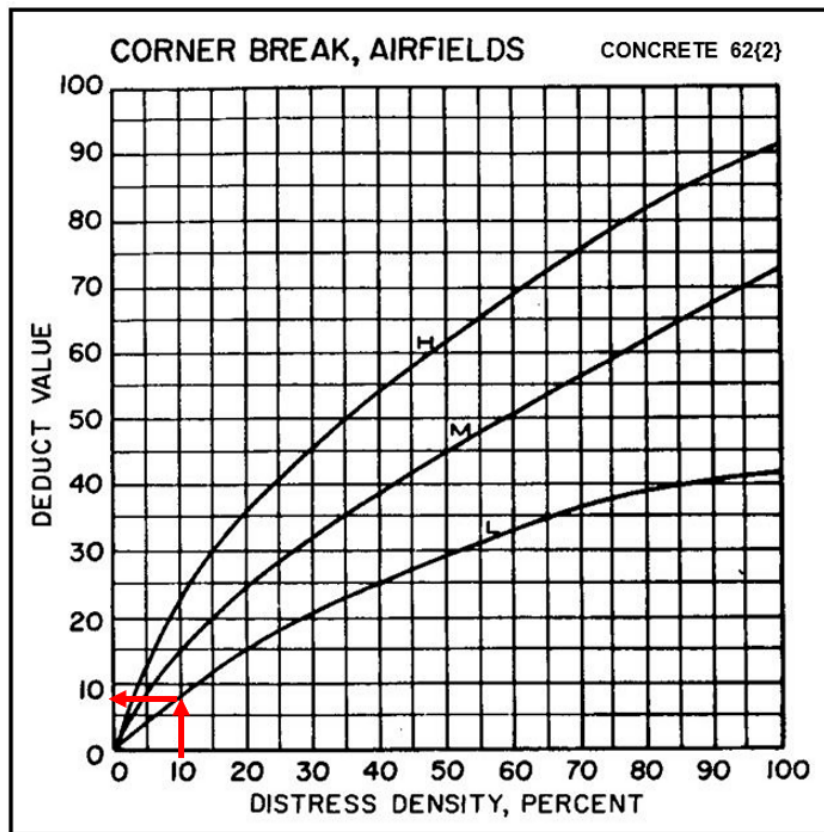
**Table 3-4 Deduct Value Calculations for Distresses Shown in Figure 3-5**

| Density and Deduct Calculation Form |                 |                  |       |                             |          |             |        |
|-------------------------------------|-----------------|------------------|-------|-----------------------------|----------|-------------|--------|
| BRANCH ID: RW1230                   |                 | SECTION ID: R03A |       | SAMPLE UNIT #: 002          |          |             |        |
| CALCULATED BY: S Smith              |                 |                  |       | DATE CALCULATED: 01/29/2024 |          |             |        |
| Distress                            | Description     | Severity         | Units | Sample Area                 | Quantity | Density (%) | Deduct |
| 65                                  | Joint Seal      | H                | slabs | 20                          | 20       | 100.00%     | 12.0   |
| 62                                  | Corner Break    | L                | slabs | 20                          | 2        | 10.00%      | 8.1    |
| 62                                  | Corner Break    | M                | slabs | 20                          | 1        | 5.00%       | 8.4    |
| 63                                  | Linear Cracking | L                | slabs | 20                          | 3        | 15.00%      | 11.3   |
| 63                                  | Linear Cracking | M                | slabs | 20                          | 5        | 25.00%      | 31.7   |
| 75                                  | Corner Spall    | L                | slabs | 20                          | 3        | 15.00%      | 5.7    |
| 74                                  | Joint Spall     | L                | slabs | 20                          | 2        | 10.00%      | 3.2    |
| 72                                  | Shattered Slab  | L                | slabs | 20                          | 1        | 5.00%       | 10.0   |
|                                     |                 |                  |       |                             |          |             |        |
|                                     |                 |                  |       |                             |          |             |        |
| TOTAL DEDUCT                        |                 |                  |       |                             |          |             | 90.4   |

**3-3.3 Determine Distress Deduct Values.**

Determine the DV for each distress type and severity level combination in the sample unit using the appropriate distress deduct value curves in Appendix A. For example, given the density of low-severity corner breaks shown in Table 3-4 is 10 percent, use the deduct curve for corner breaks by entering at the value 10 on the x-axis and proceeding up to the curve labeled L (low severity), then go to the y-axis to read the DV, which is 8. Repeat the process for each distress at each severity level to determine the total DV for the sample unit. Note that joint seal damage is not rated by density. The severity of the distress is determined by the sealant’s overall condition for a particular sample unit. The DVs are 12 points for high severity, 7 points for medium severity, and 2 points for low severity. PAVER calculates density and deducts as the user enters the distresses and quantities.

Figure 3-6 Concrete Corner Break Deduct Curve



**3-3.4 Determine Maximum Corrected Deduct Value (CDV).**

If none or only one individual DV is greater than 5 for airfields or 2 for roads and parking, use the total DV in place of the maximum CDV to determine the PCI; otherwise, determine the maximum CDV iteratively as described in the steps below.

**3-3.4.1 Determine Maximum Allowable Number of Deducts (*m*).**

Calculate the maximum allowable number of individual DVs *m*, including the fractional part, using the HDV for the sample unit in Equation 3-1 for airfields or Equation 3-2 for roads and parking. If fewer than *m* DVs are available, then all the DVs are used. For example, the HDV in Table 3-4 is 31.7 (round to 32). Use this value in Equation 3-1 for airfields to determine *m* = 7.44, as shown below. Use the highest seven deducts in Table 3-4 and a fractional part of the lowest (eighth) deduct (3.2). The eighth deduct is adjusted to 1.4 (3.2 \* 0.44 = 1.4).

$$m_i = 1 + \left(\frac{9}{95}\right)(100 - 32) = 7.44$$

### 3-3.4.2 List Individual Deduct Values in Descending Order.

List  $m$  individual DVs in descending order as shown in the first row in Table 3-5 2 (see paragraphs A-9.9 and A-9.10 for blank PCI calculation forms). For this example, the values from Table 3-4 are sorted in row 1 as follows: 31.7, 12.0, 11.3, 10.0, 8.4, 8.1, 5.7, and 1.4 (fractional part of 3.2). The total DV for row 1 is 88.6.

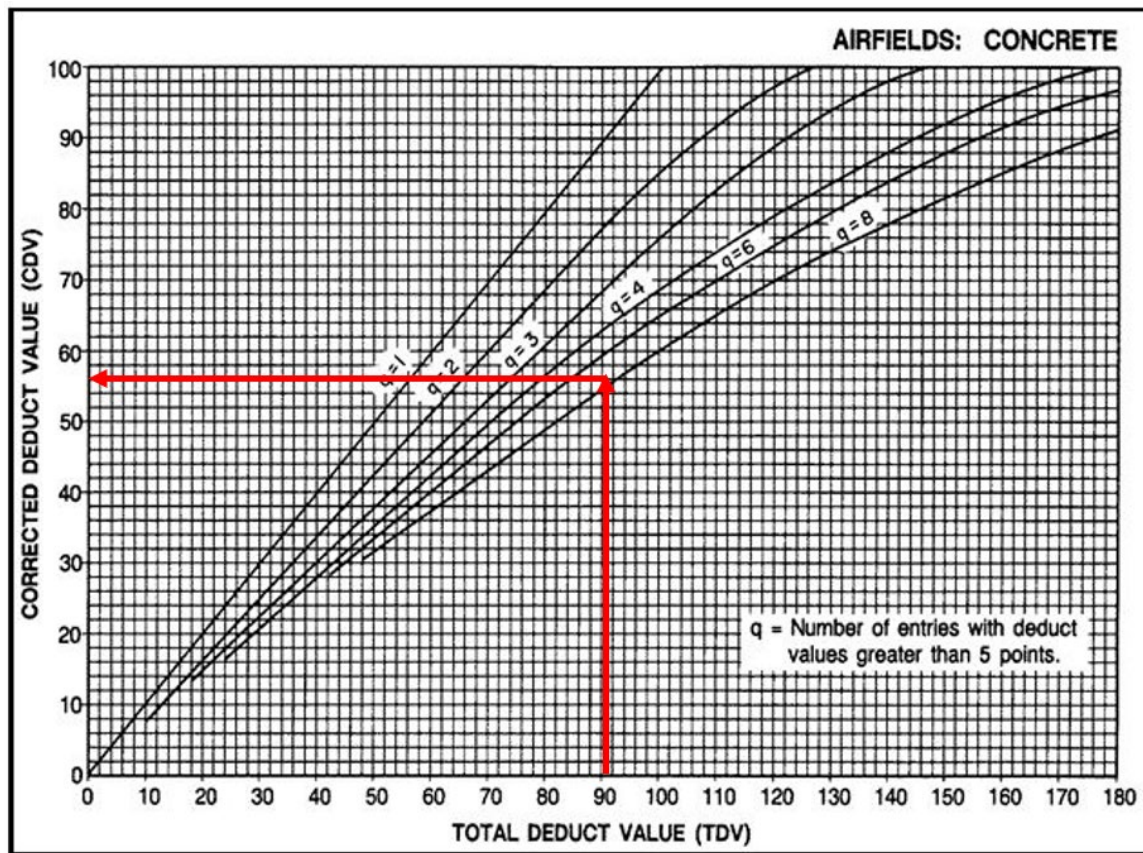
**Table 3-5 PCI Calculation Form**

| PCI CALCULATION FORM   |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
|--|---------------------------------------|------|------|------------------|-----|-----|-----|-----------------|--|--------------|------------------|------------------------------|--|
| BRANCH ID: RW1230  |                                       |      |      | SECTION ID: RO3A |     |     |     | SAMPLE UNIT 002 |  |              |                  |                              |  |
| CALCULATED BY: S. Smith  |                                       |      |      | DATE 01/29/2024  |     |     |     |                 |  |              |                  |                              |  |
| Calculate $m$ , maximum number of deduct values allowed where $m = 1 + (9 / 95) * (100 - HDV)$ with Minimum = 1 and Maximum = 10 |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| Iteration Number   | Deduct Values (See notes 1, 2, and 3) |      |      |                  |     |     |     |                 |  | DEDUCT TOTAL | q Value (Note 4) | Corrected Deduct Value (CDV) |  |
| 1  | 31.7                                  | 12.0 | 11.3 | 10.0             | 8.4 | 8.1 | 5.7 | 1.4             |  | 88.6         | 7                | 56                           |  |
| 2  | 31.7                                  | 12.0 | 11.3 | 10.0             | 8.4 | 8.1 | 5.0 | 1.4             |  | 87.9         | 6                | 58                           |  |
| 3  | 31.7                                  | 12.0 | 11.3 | 10.0             | 8.4 | 5.0 | 5.0 | 1.4             |  | 84.8         | 5                | 58                           |  |
| 4  | 31.7                                  | 12.0 | 11.3 | 10.0             | 5.0 | 5.0 | 5.0 | 1.4             |  | 81.4         | 4                | 57                           |  |
| 5  | 31.7                                  | 12.0 | 11.3 | 5.0              | 5.0 | 5.0 | 5.0 | 1.4             |  | 76.4         | 3                | 58                           |  |
| 6  | 31.7                                  | 12.0 | 5.0  | 5.0              | 5.0 | 5.0 | 5.0 | 1.4             |  | 70.1         | 2                | 60                           |  |
| 7  | 31.7                                  | 5.0  | 5.0  | 5.0              | 5.0 | 5.0 | 5.0 | 1.4             |  | 63.1         | 1                | 63.1                         |  |
| 8  |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| 9  |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| 10   |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| Notes:   |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| 1. Arrange Deduct Values from Highest Value to Lowest Value  |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| 2. Do not list more values than $m$ Deduct Values (round to the next higher integer if a fraction/decimal)                       |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| 3. The last (lowest) value listed may be a fraction of one of the Deduct Values in the Condition Survey Data Sheet               |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| 4. $q$ is the number of Deduct Values Greater than (but not equal to) 5.0  |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| <b>MAXIMUM CDV = 63.1</b>  |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |
| <b>Corrected Pavement Condition Index (PCI) = 100 - MAXIMUM CDV = 36.9</b>   |                                       |      |      |                  |     |     |     |                 |  |              |                  |                              |  |

### 3-3.4.3 Determine $q$ and Corrected Deduct Value.

The  $q$  value is the number of DVs greater than 5.0 for airfields or greater than 2.0 for roads and parking.  $q$  is then used to determine the CDV using the appropriate airfield or road and parking corrected deduct curve from Appendix A. Figure 3-7 shows the corrected deduct curves for concrete airfields chart from Figure A-286. There are seven DVs greater than 5 in Table 3-5. Given the total DV of 88.6 for row 1 in Table 3-5, enter the chart in Figure 3-7 on the x-axis and go vertically to the area midway between the curves labeled 6 and 8, then go to the y axis to determine the CDV, which is 56 for row 1 as shown in Table 3-5.

Figure 3-7 Corrected Deduct Value Curves for Concrete Airfield Pavement



### 3-3.4.4 Repeat Process Until $q = 1$ .

Copy the DVs from row 1 to row 2, changing the smallest DV greater than 5 to 5 for airfields. For roads and parking, copy the DVs from row 1 to row 2, changing the smallest DV greater than 2 to 2. Then determine the total deduct for that row and determine the CDV for that row. Repeat this process until  $q = 1$  as shown in Table 3-5.

### 3-3.4.5 Two-Severity Distress Correction.

A calculation step is added when there are two severities of one or more distresses in the same sample unit. This will ensure the PCI resulting from the distress with two severity levels is higher than the PCI resulting from the same distress at the same density at the higher severity level. For example, assume there is a low-severity distress (l1) at a given density and the same distress at medium severity (m1) at a given density. Evaluate the sample unit PCI (l1, m1) and PCI (0, M1) where  $M1 = (l1 + m1)$

The value of PCI (l1, m1) should be higher when compared to PCI (0, M1) since PCI (0, M1) has a greater distress percentage of higher severity. So, if this is not the case, the PCI of the sample unit will be computed based on M1 and not l1 and m1. When there are multiple distresses at two severity levels, the procedure iteratively

compares the cases, for example: PCI (I1, m1 and I2, m2), PCI (M1 and I2, m2), PCI (I1, m1, M2), and PCI (M1, M2).

### 3-3.4.6 Three-Severity Distress Corrections.

When there are three severities of one distress in the same sample unit, the calculations need to be computed as shown below.

- I or L = percent density of low-severity distress percent
- m or M = percent density of medium-severity distress percent
- h or H = percent density of high-severity distress percent
- PCI (I, m, h) = PCI of the section with distress quantities of I, m, h

**Table 3-6 Three-Severity Cases.**

| Start by Setting              | Distresses     | PCI Value             |
|-------------------------------|----------------|-----------------------|
|                               | <i>I, m, h</i> | PCI( <i>I, m, h</i> ) |
| $(I + m) = M \rightarrow$     | <i>0, M, h</i> | PCI( <i>0, M, h</i> ) |
| $(m + h) = H \rightarrow$     | <i>I, 0, H</i> | PCI( <i>I, 0, H</i> ) |
| $(I + h) = H \rightarrow$     | <i>0, m, H</i> | PCI( <i>0, m, H</i> ) |
| $(I + m + h) = H \rightarrow$ | <i>0, 0, H</i> | PCI( <i>0, 0, H</i> ) |

The value of PCI (I, m, h) should be higher when compared with PCI (0, M, h), PCI (I, 0, H), PCI (0, m, H), or PCI (0, 0, H). So, the correct or new PCI of the sample unit should be based on the combination that provides the highest PCI.

### 3-3.5 Calculating Sample Unit PCI.

Determine the maximum CDV after checking the multiple-severity distress correction procedure outlined above. There was no adjustment required for the example in Table 3-5, so the maximum CDV for this example is 63.1. Calculate the PCI by subtracting the maximum CDV from 100: PCI = 100 – max CDV. The PCI for this sample unit equals 100 – 63.1 = 36.9 for the example in Table 3-5.

## 3-4 UNSURFACED ROAD SAMPLE PCI CALCULATION.

### 3-4.1 Record Distresses.

Following the process outlined in paragraph 2-8.2, the inspector can populate the data directly into PAVER on a tablet or record the distresses on a paper form generated using the PAVER Inspection/Report/Forms Setup Wizard or a form similar to Figure 3-8 (see paragraphs A-9.1 through A-9.7 for paved and unpaved data forms for airfields and roads and parking). Input the data in PAVER, capturing the total quantity of each distress type at each severity level. Figure 3-8 shows entries for a sample unit on an

unsurfaced road with four distress types, one at a different severity level: improper cross-section (81M), inadequate roadside drainage (82H), dust (note there is no quantity), and ruts (86M and 86H). The units for the quantities may be either in square feet (square meters) or linear feet (linear meters).

**Figure 3-8 Unsurfaced Road Condition Survey Data Sheet Example**

| Unsurfaced Road and Parking Condition Survey Data Sheet |                                |                                     |        |  |
|---|--------------------------------|-------------------------------------|--------|--|
| PID: <i>Base X_URPerimeter_01</i>                       |                                | SURFACE TYPE: <i>GR</i>             |        |  |
| INSPECTOR NAME: <i>S. Smith</i>                         |                                | DATE INSPECTED: <i>20 Feb 2024</i>  |        |  |
| SECTION LENGTH:<br><i>1,000 ft</i>                      | SECTION WIDTH:<br><i>25 ft</i> | SECTION TRUE AREA: <i>25,000 SF</i> |        |  |
| Unsurfaced Road and Parking Distress Codes              |                                |                                     |        |  |
| 81. Improper Cross Section (Linear Ft)                  |                                | 85. Potholes (Count)                |        |  |
| 82. Inadequate Roadside Drainage (Sq Ft)                |                                | 86. Ruts (Sq Ft)                    |        |  |
| 83. Corrugations (Sq Ft)                                |                                | 87. Loose Aggregate (Linear Ft)     |        |  |
| 84. Dust  |                                |                                     |        |  |
| SAMPLE NUMBER   | SAMPLE AREA                    |                                     |        | SKETCH/COMMENTS  |
| <i>003</i>  | <i>2,500</i>                   |                                     |        |  |
| DISTRESS CODE   | L                              | M                                   | H      | <p><i>Erosion into road</i></p> <p><i>Standing water in ditches in several areas</i></p> |
| 81  |                                | 100 ft                              |        |  |
| 82  |                                |                                     | 200 sf |  |
| 84  | ✓                              |                                     |        |  |
| 86  |                                | 490 sf                              | 910 sf |  |
|   |                                |                                     |        |  |
|   |                                |                                     |        |  |

**3-4.2 Determine Distress Density.**

Divide the total quantity of each distress type at each severity level by the total area of the sample unit and multiply by 100 to obtain the percent density of each distress type and severity in the sample unit. For example, given that the sample unit size is 2,500 square feet, the density of 910 square feet of high severity ruts shown in Table 3-7 is 36.4 percent. Repeat the process for each distress at each severity. Paragraph A-9.8 has a blank density and deduct calculation form for manual computations.

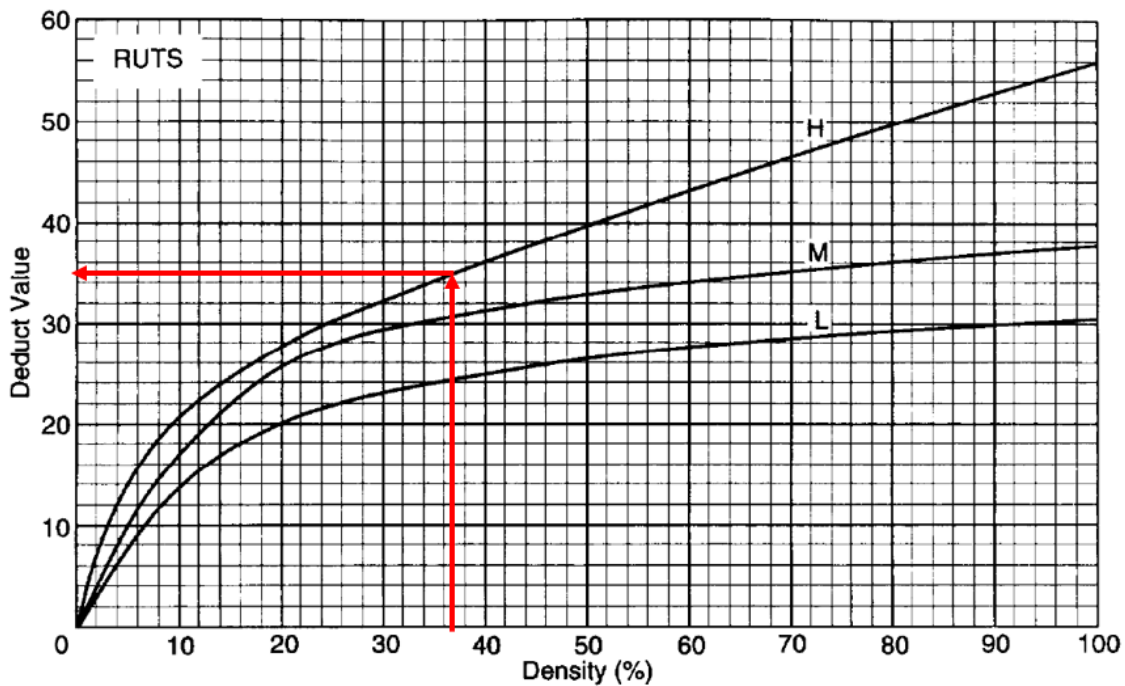
Table 3-7 Density Calculation for Distresses Shown in Figure 3-8

| Density and Deduct Calculation Form |                              |                       |       |                                    |          |             |        |
|-------------------------------------|------------------------------|-----------------------|-------|------------------------------------|----------|-------------|--------|
| BRANCH ID: <i>URPerimeter</i>       |                              | SECTION ID: <i>01</i> |       | SAMPLE UNIT #: <i>003</i>          |          |             |        |
| CALCULATED BY: <i>S Smith</i>       |                              |                       |       | DATE CALCULATED: <i>02/20/2024</i> |          |             |        |
| Distress                            | Description                  | Severity              | Units | Sample Area                        | Quantity | Density (%) | Deduct |
| 81                                  | Improper Cross Section       | M                     | lf    | 2,500                              | 100      | 4.0%        | 10.0   |
| 82                                  | Inadequate Roadside Drainage | H                     | sf    | 2,500                              | 200      | 8.0%        | 22.6   |
| 84                                  | Dust                         | L                     | sf    | 2,500                              | 2500     | 100.0%      | 2.0    |
| 86                                  | Ruts                         | M                     | sf    | 2,500                              | 490      | 19.6%       | 25.6   |
| 86                                  | Ruts                         | H                     | sf    | 2,500                              | 910      | 36.4%       | 35.1   |
|                                     |                              |                       |       |                                    |          |             |        |
|                                     |                              |                       |       |                                    |          |             |        |
|                                     |                              |                       |       |                                    |          |             |        |
|                                     |                              |                       |       |                                    |          |             |        |
|                                     |                              |                       |       |                                    |          |             |        |
|                                     |                              |                       |       |                                    |          |             |        |
| TOTAL DEDUCT                        |                              |                       |       |                                    |          |             | 95.3   |

**3-4.3 Determine Distress Deduct Values.**

Determine the DV for each distress type and severity level combination in the sample unit using the appropriate distress DV curves in Appendix A. Figure 3-9 shows the rut deduct curve for unpaved roads and parking from Figure A-297. For example, given the density of high-severity ruts shown in Table 3-7 is 36.4 percent, use the deduct curve for ruts by entering the value 36.4 on the x-axis and proceeding up to the curve labeled H (high severity), then go to the y-axis to read the DV, 35.1. Repeat the process for each distress at each severity level to determine the total DV for the sample unit. PAVER automates the process by computing the density and DVs as the user enters the distresses and quantities and summing the deducts to determine the total deduct, which is 95.3 for this example.

Figure 3-9 Rut Deduct Curve for Unpaved Roads and Parking.



### 3-4.4 Determine Maximum Corrected Deduct Value (CDV).

If none or only one individual DV is greater than 5 for airfields or 2 for roads and parking, use the total DV in place of the maximum CDV to determine the PCI; otherwise, determine the maximum CDV iteratively as described in the steps below.

#### 3-4.4.1 Determine Maximum Allowable Number of Deducts ( $m$ ).

Calculate the maximum allowable number of individual DVs  $m$ , including the fractional part, using the HDV for the sample unit in Equation 3-3 for roads and parking. If fewer than  $m$  DVs are available, then all the DVs are used.

#### Equation 3-3. Allowable Number of Deducts for Unsurfaced Roads and Parking

$$m_i = 1 + \left(\frac{9}{98}\right)(100 - HDV_i)$$

Where:

$m_i$  = Allowable number of deducts, including fractions (rounded up), for sample unit  $i$   
 $HDV_i$  = Highest individual DV for sample unit  $i$

For example, the HDV in Table 3-7 (determined from Figure 3-8) is 35.1 (round to 36). Use this value in Equation 3-3 to determine the allowable number of deducts  $m$  is equal to 5.88 as shown below. Since there are only five DVs, all of them are used.

$$m_i = 1 + \left(\frac{9}{98}\right)(100 - 36) = 5.88$$

**3-4.4.2 Determine Maximum Allowable Number of Deducts (*m*).**

List *m* individual DVs in descending order as shown in the first row in Table 3-8 (see paragraphs A-9.9 and A-9.10 for blank PCI calculation forms). For this example, the values from Table 3-7 are sorted in row 1 as follows: 35.1, 25.6, 22.6, 10.0, and 2.0. The total DV is 95.3.

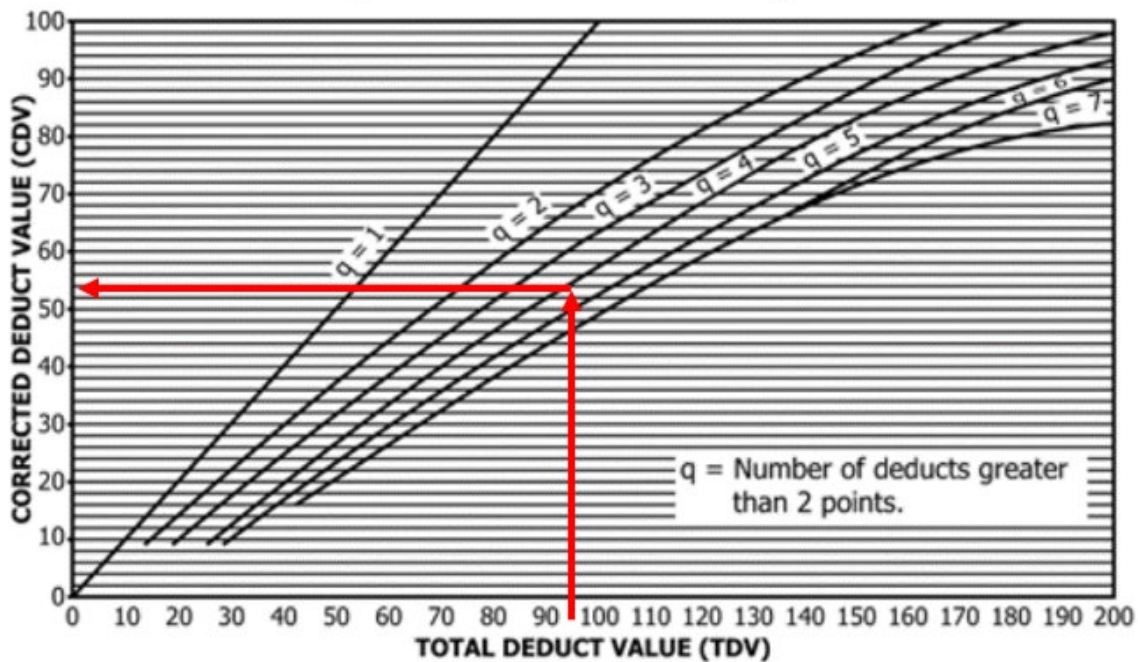
**Table 3-8 PCI Calculation Form**

| UNSURFACED ROAD URCI CALCULATION FORM   |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
|---|---------------------------------------|------|-----------------|------|-----|--|-----------------|--|--|--------------|------------------|------------------------------|
| BRANCH ID: URPerimeter  |                                       |      | SECTION ID: 01  |      |     |  | SAMPLE UNIT 002 |  |  |              |                  |                              |
| CALCULATED BY: S. Smith   |                                       |      | DATE 02/20/2024 |      |     |  |                 |  |  |              |                  |                              |
| Calculate <i>m</i> , maximum number of deduct values allowed where $m = 1 + (9/98)*(100-HDV)$ with Minimum = 1 and Maximum = 10 |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| Iteration Number  | Deduct Values (See notes 1, 2, and 3) |      |                 |      |     |  |                 |  |  | DEDUCT TOTAL | q Value (Note 4) | Corrected Deduct Value (CDV) |
| 1   | 35.1                                  | 25.6 | 22.6            | 10.0 | 2.0 |  |                 |  |  | 95.3         | 4                | 54                           |
| 2   | 35.1                                  | 25.6 | 22.6            | 2.0  | 2.0 |  |                 |  |  | 87.3         | 3                | 56                           |
| 3   | 35.1                                  | 25.6 | 2.0             | 2.0  | 2.0 |  |                 |  |  | 66.7         | 2                | 50                           |
| 4   | 35.1                                  | 2.0  | 2.0             | 2.0  | 2.0 |  |                 |  |  | 43.1         | 1                | 44                           |
| 5   |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| 6   |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| 7   |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| 8   |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| 9   |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| 10  |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| Notes:  |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| 1. Arrange Deduct Values from Highest Value to Lowest Value   |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| 2. Do not list more values than <i>m</i> Deduct Values (round to the next higher integer if a fraction/decimal)                 |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| 3. The last (lowest) value listed may be a fraction of one of the Deduct Values in the Condition Survey Data Sheet              |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| 4. <i>q</i> is the number of Deduct Values Greater than (but not equal to) 2.0  |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| MAXIMUM CDV = 56  |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |
| Corrected Pavement Condition Index (PCI) = 100 - MAXIMUM CDV = 44   |                                       |      |                 |      |     |  |                 |  |  |              |                  |                              |

**3-4.4.3 Determine *q* and Corrected Deduct Value.**

The *q* value is the number of DVs greater than 2 for unsurfaced roads and parking. *q* is then used to determine the CDV using the unsurfaced road and parking corrected deduct curve from Appendix A, as shown in Figure 3-9. There are four DVs greater than 2 in Table 3-8. Given the total DV of 95.3 for row 1, enter the chart in Figure 3-10 on the x-axis and go vertically to the curve labeled 4, then go to the y axis to determine the CDV, which is 54 for row 1 as shown in Table 3-8.

Figure 3-10 URCI Example



**3-4.4.4 Determine  $q$  and Corrected Deduct Value.**

Copy the DVs from row 1 to row 2, changing the smallest DV greater than 2 to 2 for unsurfaced roads. Then determine the total deduct for that row and determine the CDV for that row. Repeat this process until  $q = 1$  as shown in Table 3-8.

**3-4.4.5 Determine  $q$  and Corrected Deduct Value.**

A calculation step is added when there are two severities of one or more distresses in the same sample unit. This will ensure the PCI resulting from the distress with two severity levels is higher than the PCI resulting from the same distress at the same density at the higher severity level. For example, assume there is a low-severity distress (l1) at a given density and the same distress at medium severity (m1) at a given density. Evaluate the sample unit PCI (l1, m1) and PCI (0, M1) where  $M1 = (l1 + m1)$

The value of PCI (l1, m1) should be higher when compared to PCI (0, M1) since PCI (0, M1) has a greater distress percentage of higher severity. So, if this is not the case, the PCI of the sample unit will be computed based on M1 and not l1 and m1. When there are multiple distresses at two severity levels, the procedure iteratively compares the cases, for example: PCI (l1, m1 and l2, m2), PCI (M1 and l2, m2), PCI (l1, m1, M2), and PCI (M1, M2).

**3-4.4.6 Determine  $q$  and Corrected Deduct Value.**

When there are three severities of one distress in the same sample unit, the calculations need to be computed as shown below.

- l or L = percent density of low-severity distress percent
- m or M = percent density of medium-severity distress percent
- h or H = percent density of high-severity distress percent
- PCI (l, m, h) = PCI of the section with distress quantities of l, m, h

**Table 3-9 Three-Severity Cases**

| Start by Setting              | Distresses     | PCI Value             |
|-------------------------------|----------------|-----------------------|
|                               | <i>l, m, h</i> | PCI( <i>l, m, h</i> ) |
| $(l + m) = M \rightarrow$     | <i>0, M, h</i> | PCI( <i>0, M, h</i> ) |
| $(m + h) = H \rightarrow$     | <i>l, 0, H</i> | PCI( <i>l, 0, H</i> ) |
| $(l + h) = H \rightarrow$     | <i>0, m, H</i> | PCI( <i>0, m, H</i> ) |
| $(l + m + h) = H \rightarrow$ | <i>0, 0, H</i> | PCI( <i>0, 0, H</i> ) |

The value of PCI (l, m, h) should be higher when compared with PCI (0, M, h), PCI (l, 0, H), PCI (0, m, H), or PCI (0, 0, H). So, the correct or new PCI of the sample unit should be based on the combination that provides the highest PCI.

### 3-4.5 Calculating the Sample Unit URCl.

Determine the maximum CDV after checking the multiple-severity distress correction procedure outlined above. For the example in this section, the check indicated the PCI resulting from the same distress at the same density at the higher severity level is higher than the PCI resulting from the distress with two severity levels. Specifically, when combined, the density (56 percent) of the rut distress at high severity results in a DV of 42 as shown in Table 3-10. Repeating the process outlined in paragraphs 3-4.4.2 through 3-4.4.4 results in a maximum CDV of 48 for this example. Calculate the PCI by subtracting the maximum CDV from 100:  $PCI = 100 - \text{max CDV}$ . The PCI for this sample unit equals  $100 - 48.0 = 52$  for this example.

Table 3-10 Multiple Severity Adjustment Example

| UNSURFACED ROAD URCI CALCULATION FORM   |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
|---|---------------------------------------|------|------------------------|-----|--|--|-----------------|--|--|--|--------------|------------------|------------------------------|
| BRANCH ID: <i>URPerimeter</i>   |                                       |      | SECTION ID: <i>01</i>  |     |  |  | SAMPLE UNIT 002 |  |  |  |              |                  |                              |
| CALCULATED BY: <i>S. Smith</i>  |                                       |      | DATE <i>02/20/2024</i> |     |  |  |                 |  |  |  |              |                  |                              |
| Calculate <i>m</i> , maximum number of deduct values allowed where $m = 1 + (9 / 98) * (100 - HDV)$ with Minimum = 1 and Maximum = 10 |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| Iteration Number  | Deduct Values (See notes 1, 2, and 3) |      |                        |     |  |  |                 |  |  |  | DEDUCT TOTAL | q Value (Note 4) | Corrected Deduct Value (CDV) |
| 1   | 42.0                                  | 22.6 | 10.0                   | 2.0 |  |  |                 |  |  |  | 76.6         | 3                | 48                           |
| 2   | 42.0                                  | 22.6 | 2.0                    | 2.0 |  |  |                 |  |  |  | 68.6         | 2                | 48                           |
| 3   | 42.0                                  | 2.0  | 2.0                    | 2.0 |  |  |                 |  |  |  | 48.0         | 1                | 48                           |
| 4   |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 5   |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 6   |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 7   |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 8   |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 9   |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 10  |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| Notes:  |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 1. Arrange Deduct Values from Highest Value to Lowest Value   |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 2. Do not list more values than <i>m</i> Deduct Values (round to the next higher integer if a fraction/decimal)                       |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 3. The last (lowest) value listed may be a fraction of one of the Deduct Values in the Condition Survey Data Sheet                    |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| 4. <i>q</i> is the number of Deduct Values Greater than (but not equal to) 2.0  |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| MAXIMUM CDV = 48  |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |
| Corrected Pavement Condition Index (PCI) = 100 - MAXIMUM CDV = 52   |                                       |      |                        |     |  |  |                 |  |  |  |              |                  |                              |

**3-5 INTERLOCKING CONCRETE PAVER PCI CALCULATION.**

**3-5.1 Record Distresses.**

PAVER does not currently calculate the PCI for interlocking concrete pavers, so the inspector records the distresses on paper forms like the ones in paragraph A-9 (see paragraphs A-9.1 through A-9.7 for paved and unpaved data forms for airfields and roads and parking). Input the data in PAVÉR, capturing the total quantity of each distress type at each severity level. Figure 3-11 shows entries for a sample unit on a road with six distress types: damaged pavers (101L), depressions (102L), edge restraint (103L), excessive joint width (104M), joint sand loss/pumping (108L), and rutting (111M). The units for the quantities may be either in square feet (square meters) or linear feet (linear meters).

Figure 3-11 Interlocking Concrete Paver PCI Survey Data Sheet Example

| Interlocking Concrete Pavers Road and Parking Condition Survey Data Sheet |                                |                              |       |                 |
|---|--------------------------------|------------------------------|-------|-----------------|
| PID: Base X_MAIN St_01  |                                | SURFACE TYPE: PVB            |       |                 |
| INSPECTOR NAME: S. Smith  |                                | DATE INSPECTED: 3 April 2024 |       |                 |
| SECTION LENGTH:<br>400 ft   | SECTION WIDTH:<br>25 ft        | SECTION TRUE AREA: 10,000 SF |       |                 |
| Interlocking Concrete Pavers for Roads and Parking Distress Codes         |                                |                              |       |                 |
| 101. Damaged Pavers   | 105. Faulting                  | 109. Missing Pavers          |       |                 |
| 102. Depressions  | 106. Heaving                   | 110. Patching                |       |                 |
| 103. Edge Restraint   | 107. Horizontal Creep          | 111. Rutting                 |       |                 |
| 104. Excessive Joint Width  | 108. Joint Sand Loss / Pumping |                              |       |                 |
| SAMPLE NUMBER   | 001                            | SAMPLE AREA                  | 2,500 |                 |
|   |                                |                              |       | SKETCH/COMMENTS |
| DISTRESS CODE   | L                              | M                            | H     |                 |
| 101   | 22 sf                          |                              |       |                 |
| 102   | 6 sf                           |                              |       |                 |
| 103   | 44 sf                          |                              |       |                 |
| 104   |                                | 65 sf                        |       |                 |
| 108   | 9 sf                           |                              |       |                 |
| 111   | 10 sf                          |                              |       |                 |
|   |                                |                              |       |                 |

**3-5.2 Determine Distress Density.**

Divide the total quantity of each distress type at each severity level by the total area of the sample unit and multiply by 100 to obtain the percent density of each distress type and severity in the sample unit. For example, given that the sample unit size is 2,500 square feet, the density of the 65 square feet of excessive joint width shown in Table 3-11 is 2.6 percent. Repeat the process for each distress at each severity. Paragraph A-9.8 has a blank density and deduct calculation form for manual computations.

**Table 3-11 Density Calculation for Distresses Shown in Figure 3-11**

| Density and Deduct Calculation Form |                             |                       |       |                                    |          |             |        |
|-------------------------------------|-----------------------------|-----------------------|-------|------------------------------------|----------|-------------|--------|
| BRANCH ID: <i>Main St</i>           |                             | SECTION ID: <i>01</i> |       | SAMPLE UNIT #: <i>001</i>          |          |             |        |
| CALCULATED BY: <i>S Smith</i>       |                             |                       |       | DATE CALCULATED: <i>04/03/2024</i> |          |             |        |
| Distress                            | Description                 | Severity              | Units | Sample Area                        | Quantity | Density (%) | Deduct |
| 101                                 | Damaged Pavers              | L                     | sf    | 2,500                              | 22       | 0.9%        | 1.0    |
| 102                                 | Depressions                 | L                     | sf    | 2,500                              | 6        | 0.2%        | 1.5    |
| 103                                 | Edge Restraint              | L                     | ft    | 2,500                              | 44       | 1.8%        | 1.5    |
| 104                                 | Excessive Joint Width       | M                     | sf    | 2,500                              | 65       | 2.6%        | 14.0   |
| 108                                 | Joint Sand Loss/<br>Pumping | L                     | sf    | 2,500                              | 9        | 0.4%        | 1.0    |
| 111                                 | Rutting                     | M                     | sf    | 2,500                              | 10       | 0.40%       | 8.0    |
|                                     |                             |                       |       |                                    |          |             |        |
|                                     |                             |                       |       |                                    |          |             |        |
|                                     |                             |                       |       |                                    |          |             |        |
|                                     |                             |                       |       |                                    |          |             |        |
| TOTAL DEDUCT                        |                             |                       |       |                                    |          |             | 27     |

**3-5.3 Determine Distress Density.**

Determine the DV for each distress type and severity level combination in the sample unit using the appropriate distress DV curves in Appendix A. For example, given the density of excessive joint width shown in Table 3-11 is 2.6 percent, use the deduct curve for excessive joint width by entering the value 2.6 on the x-axis and proceeding up to the curve labeled M (medium severity), then go to the y-axis to read the DV, 14.0, as shown in Figure 3-12. Repeat the process for each distress at each severity level to determine the total DV for the sample unit.

Figure 3-12 Excessive Joint Width Distress Deduct Curve



**3-5.4 Determine Maximum Corrected Deduct Value (CDV).**

If none or only one individual DV is greater than 2 for roads and parking, use the total DV in place of the maximum CDV to determine the PCI; otherwise, determine the maximum CDV iteratively as described in the steps below.

**3-5.4.1 Determine Distress Density.**

Calculate the maximum allowable number of individual DVs  $m$ , including the fractional part, using the HDV for the sample unit in Equation 3-4 for roads and parking. If fewer than  $m$  DVs are available, then all the DVs are used.

**Equation 3-4. Allowable Number of Deducts for Roads and Parking**

$$m_i = 1 + \left(\frac{9}{98}\right) (100 - HDV_i)$$

Where:

$m_i$  = Allowable number of deducts, including fractions (rounded up), for sample unit  $i$   
 $HDV_i$  = Highest individual DV for sample unit  $i$

For example, the HDV in Table 3-11 (determined from Figure 3-11), is 14.0. Use this value in Equation 3-4 for roads and parking to determine  $m = 8.90$  as shown below. If there were more than eight deducts, use the highest eight deducts and a fractional part of the lowest (ninth) deduct. The ninth deduct is adjusted to  $DA = (D9 * 0.90)$ . In this example there are only six deducts, so all are used.

$$m_i = 1 + \left(\frac{9}{98}\right)(100 - 14) = 8.90$$

**3-5.4.2 List Individual Deduct Values in Descending Order.**

List  $m$  individual DVs in descending order as shown in the first row in Table 3-12 (see paragraphs A-9.9 and A-9.10 for blank PCI calculation forms). For this example, the values from Table 3-11 are sorted in row 1 as follows: 14.0, 8.0, 1.5, 1.5, 1.0, and 1.0. The total DV for row 1 is 27.0.

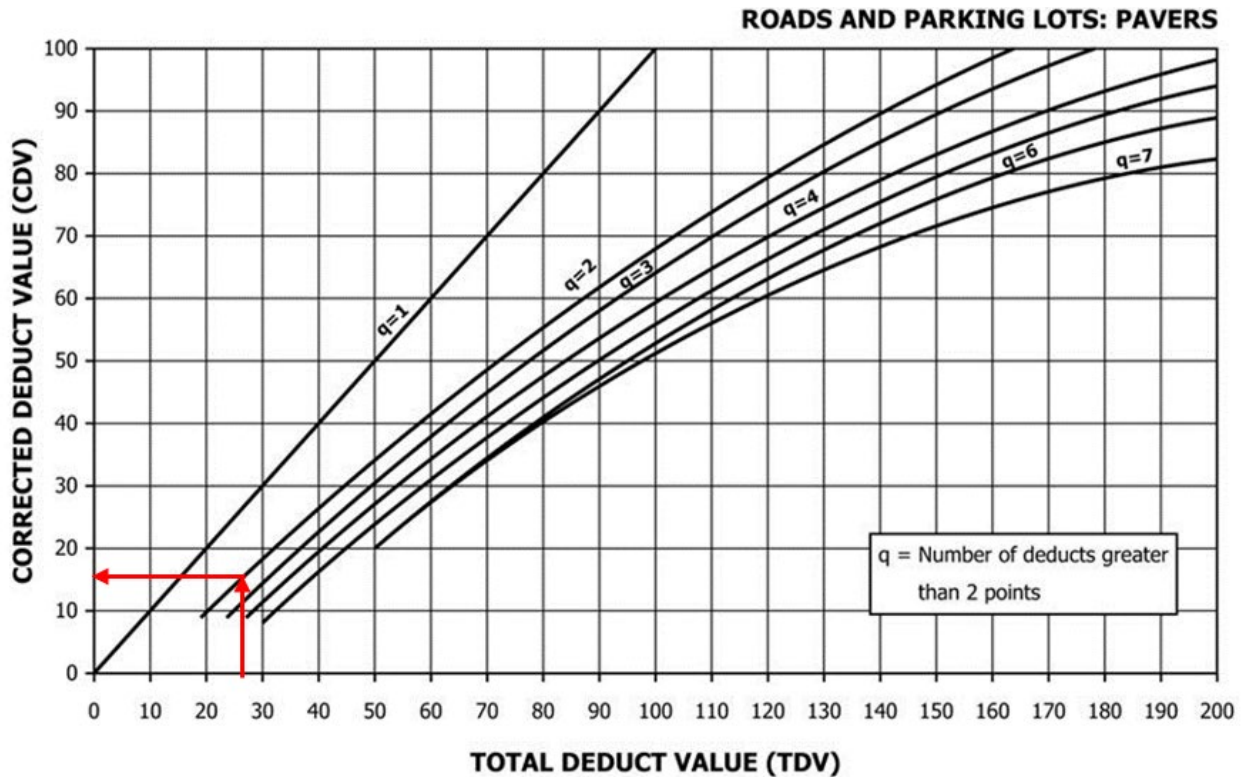
**Table 3-12 PCI Calculation Form**

| INTERLOCKING CONCRETE PAVERS ROAD PCI CALCULATION FORM   |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
|--|---------------------------------------|-----|------------------------|-----|-----|-----|-----------------|--|--------------|------------------|------------------------------|----|
| BRANCH ID: <i>Main St</i>  |                                       |     | SECTION ID: <i>01</i>  |     |     |     | SAMPLE UNIT 001 |  |              |                  |                              |    |
| CALCULATED BY: <i>S. Smith</i>   |                                       |     | DATE <i>04/03/2024</i> |     |     |     |                 |  |              |                  |                              |    |
| Calculate $m$ , maximum number of deduct values allowed where $m = 1 + (9/98)*(100-HDV)$ with Minimum = 1 and Maximum = 10 |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| Iteration Number   | Deduct Values (See notes 1, 2, and 3) |     |                        |     |     |     |                 |  | DEDUCT TOTAL | q Value (Note 4) | Corrected Deduct Value (CDV) |    |
| 1  | 14.0                                  | 8.0 | 1.5                    | 1.5 | 1.0 | 1.0 |                 |  |              | 27.0             | 2                            | 16 |
| 2  | 14.0                                  | 2.0 | 1.5                    | 1.5 | 1.0 | 1.0 |                 |  |              | 21.0             | 1                            | 11 |
| 3  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 4  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 5  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 6  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 7  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 8  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 9  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 10   |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| Notes:   |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 1. Arrange Deduct Values from Highest Value to Lowest Value  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 2. Do not list more values than $m$ Deduct Values (round to the next higher integer if a fraction/decimal)                 |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 3. The last (lowest) value listed may be a fraction of one of the Deduct Values in the Condition Survey Data Sheet         |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| 4. $q$ is the number of Deduct Values Greater than (but not equal to) 2.0  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| MAXIMUM CDV = 16   |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |
| Corrected Pavement Condition Index (PCI) = 100 - MAXIMUM CDV = 84  |                                       |     |                        |     |     |     |                 |  |              |                  |                              |    |

**3-5.4.3 Determine  $q$  and Corrected Deduct Value.**

The  $q$  value is the number of DVs greater than 2 for roads and parking.  $q$  is then used to determine the CDV using the road and parking corrected deduct curve from Figure A-344 and shown in Figure 3-13. There are two DVs greater than 2 in Table 3-12. Given the total DV of 27 for row 1, enter the chart in Figure 3-13 on the x-axis and go vertically to the curve labeled 2, then go to the y axis to determine the CDV, which is 16 for row 1.

Figure 3-13 Correction Curves for Interlocking Concrete Pavers



**3-5.4.4 Repeat Process Until  $q = 1$ .**

Copy the DVs from row 1 to row 2, changing the smallest DV greater than 2 to 2. Then determine the total deduct for the CDV for that row. Repeat this process until  $q = 1$  as shown in Table 3-12. Use the highest CDV to determine the PCI.

**3-5.4.5 Multiple-Severity Distress Correction.**

The multiple-severity distress correction procedure used for paved airfields and paved and unpaved parking is not included in ASTM E2840.

**3-6 SEMI-PREPARED AIRFIELD CONDITION INDEX INSPECTION.**

Cursory SPACI inspection and calculation procedures are not available in PAVER and are sufficiently different than their paved and unpaved airfield and road and parking counterparts that they are discussed in their entirety in this section. Use asphalt or concrete PCI procedures for paved landing zones (LZ).

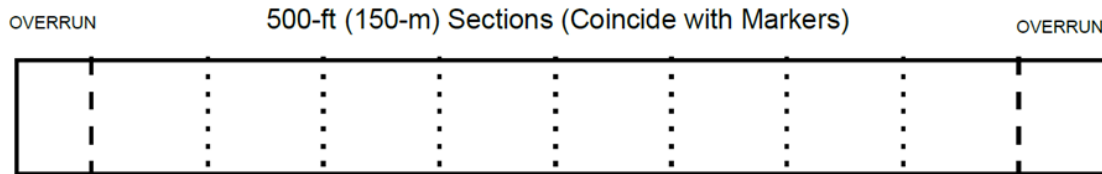
**3-6.1 Segmentation.**

Divide the entire field into sections and sample areas.

- Each sample area located on the runway or taxiway is 250 feet (76 meters) long and the width of the runway or taxiway.

- Make each hammerhead and overrun a section.
- Divide the aprons into sections of approximately 25,000 square feet (2,322 square meters).
- As time permits, increase sampling using 5,000 ± 2,000 square feet (465 ± 186 square meters) sample units.

**Figure 3-14 Example Semi-Prepared Runway Layout**



### 3-6.2 Select Sample Units to Inspect.

As a minimum for contingency operations, inspect the sections in the touchdown area, in the primary braking area at approximately 1,000 to 1,500 feet (300 to 460 meters), at the point of aircraft rotation at approximately 2,000 to 2,500 feet (600 to 750 meters), and at the last 500 feet (150 meters) of the runway. (The point of rotation may move due to pressure and altitude changes.) These sections include the areas most likely to be damaged by landing, braking, stopping, acceleration, and takeoff for the runway in use. Inspect and monitor additional areas where degradation develops.

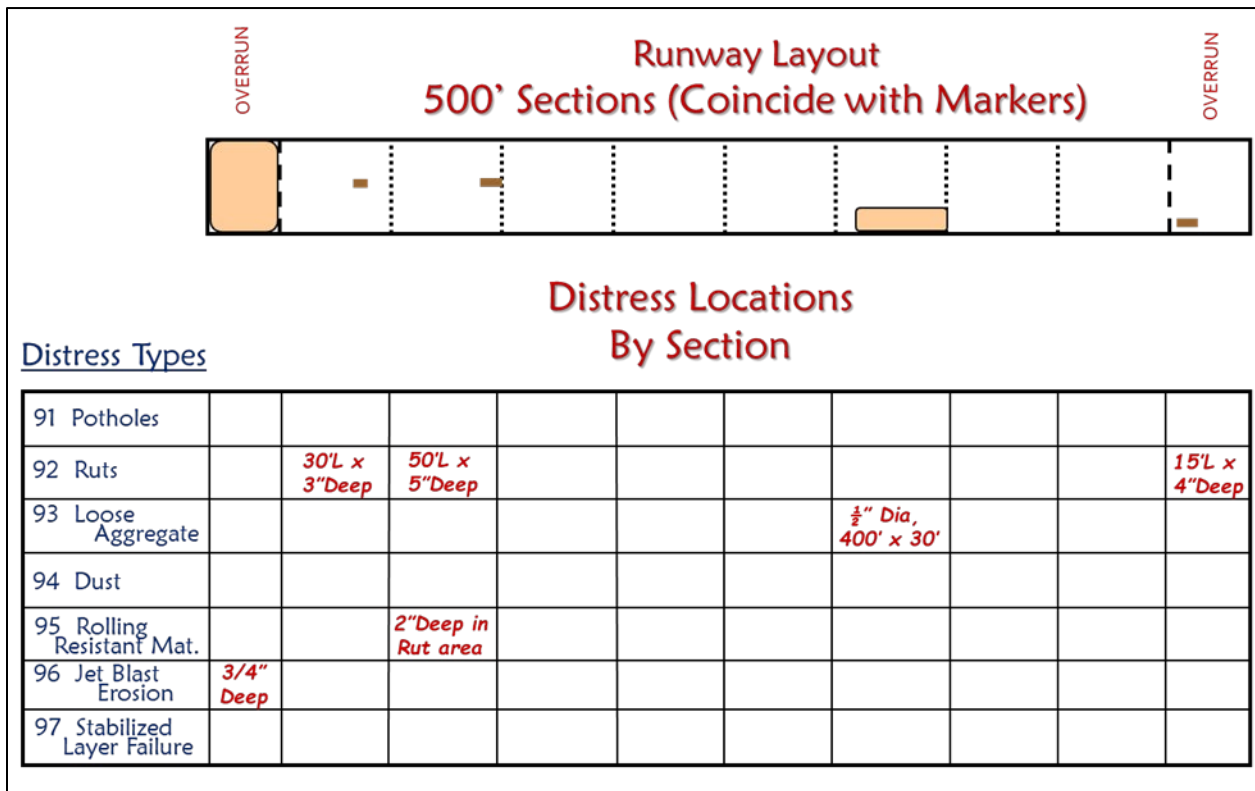
### 3-6.3 Inspect Sample Areas and Record Distresses.

Conduct as detailed and accurate an inspection as time and conditions permit. At a minimum, record the occurrence (not the quantity) of each distress type at each severity level in each sample inspected. Figure 3-15 shows an example with entries for a sample unit on an unsurfaced airfield with four distress types as defined in paragraph A-8: ruts (92 amber), loose aggregate (93 green), dust (94 amber), and rolling resistant material (95 amber). When time permits, use a more detailed inspection sheet like the one in Figure 3-16 to record more specific distress information. Note that the columns in the distress data table correspond to the plan view.

Figure 3-15 SPACI Survey Data Sheet Example (Limited Time)

|               |    |    |                    |    |    |    |    |               |  |
|---------------|----|----|--------------------|----|----|----|----|---------------|--|
| Sample Number | 01 |    | Sample Description |    |    |    |    | 1+00 to 1+500 |  |
| Distress Type | 91 | 92 | 93                 | 94 | 95 | 96 | 97 |               |  |
| Severity      | G  |    | ✓                  |    |    |    |    |               |  |
|               | A  | ✓  |                    | ✓  | ✓  |    |    |               |  |
|               | R  |    |                    |    |    |    |    |               |  |

Figure 3-16 SPACI Survey Data Sheet Example



**3-6.4 Inspect Sample Areas and Record Distresses.**

Assign DVs to each identified distress type as defined in paragraph A-8.

- Add the DVs for all distresses to determine the total DV as shown in Figure 3-17.
- The DVs for runway and taxiway samples are different than the DVs for apron and hammerhead samples.
- Note that if any distress is red, the LZ safety officer will determine the suitability for operations.

Figure 3-17 SPACI Survey Sample Deduct Sheet Example

| Distress Type | Severity | Deduct Value |
|---------------|----------|--------------|
| 91            | ● ● ●    |              |
| 92            | ● ● ●    | 18           |
| 93            | ● ● ●    | 4            |
| 94            | ● ● ●    | 4            |
| 95            | ● ● ●    | 22           |
| 96            | ● ● ●    |              |
| 97            | ● ● ●    |              |

Total Deduct Value = **48**

q = **2**

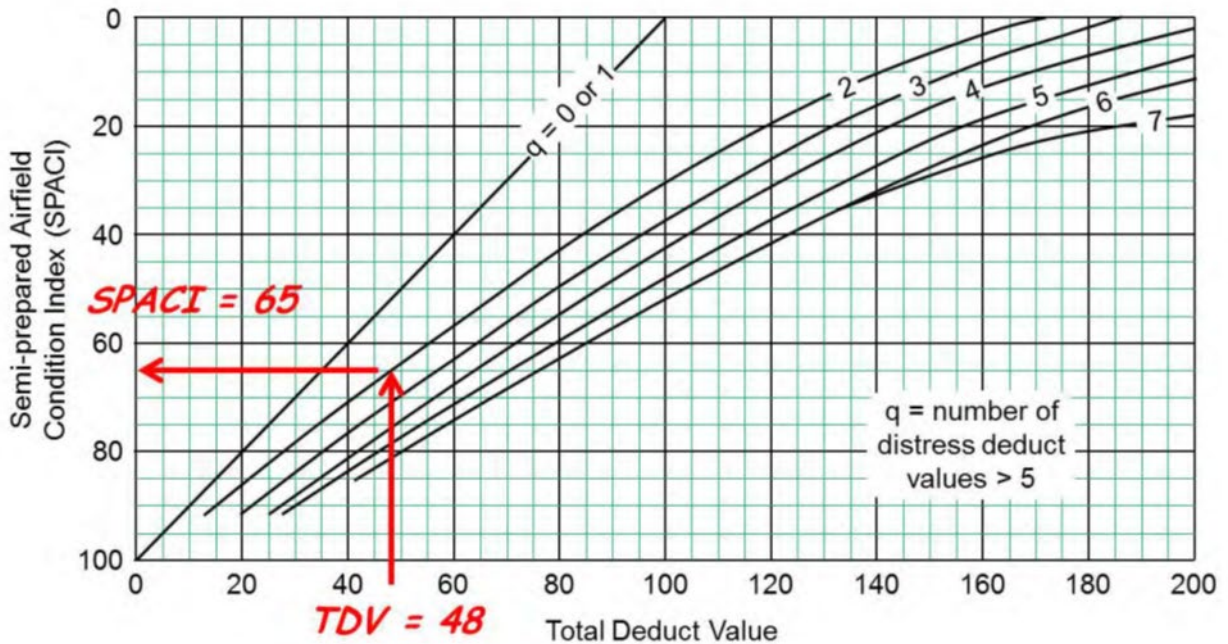
SPACI = **65**

Note: If any distress is red, the landing zone safety officer will determine the suitability for operations.

**3-6.5 Determine Sample SPACI Value.**

Determine the *q* value for the sample, which is the number of distresses with a deduct greater than 5, then use the corrected SPACI curve from Figure A-347 to determine the SPACI value as shown in Figure 3-18. Alternatively, use Tables A-348 or A-349 instead of the corrected SPACI curve to determine the SPACI value.

Figure 3-18 Corrected SPACI Curve Example



**3-6.6 Determine the Sample Section SPACI Value.**

Average sample area SPACI values to determine section SPACI. For example, if samples were inspected at the touchdown, maximum braking, turnaround, and point of rotation areas on the runway and the individual sample area SPACI values were 63, 67, 55, and 71, then the runway SPACI is 64.

**3-6.7 Determine the Sample Airfield SPACI Value.**

Average section SPACIs to determine airfield SPACI, if desired. A SPACI of 76 to 100 is rated "green." A SPACI of 26 to 75 is rated "amber." A SPACI of 0 to 25 is rated "red." Maintain training LZs in "green" condition. Maintain contingency LZs in "green" or "amber" condition. Regardless of the overall SPACI rating, if any individual distress is rated as "red," the LZ safety officer will determine the feasibility of each operation.

**CHAPTER 4 SECTION PCI CALCULATION AND EXTRAPOLATED DISTRESSES**

**4-1 SECTION PCI CALCULATION WITH NO ADDITIONAL SAMPLE UNITS.**

If all surveyed sample units are selected using either the standard or simplified procedure and are all equal in size, the PCI of the section is determined by averaging the PCIs of the inspected sample units. If the inspected sample units are not equal in size, use area-weighted averaging as shown in Equation 4-1.

**Equation 4-1. Area-Weighted Averaging for Unequally Sized Sample Units**

$$PCI_S = \overline{PCI}_r = \frac{\sum_{i=1}^n (PCI_{ri} \times A_{ri})}{\sum_{i=1}^n A_{ri}}$$

Where:

$PCI_S$  = PCI of pavement section

$\overline{PCI}_r$  = Area-weighted average PCI of random (or representative) sample units

$PCI_{ri}$  = PCI of random sample unit number  $i$

$A_{ri}$  = Area of the random sample unit  $i$

$n$  = Total number of inspected random sample units

**4-2 SECTION PCI CALCULATION WITH ADDITIONAL SAMPLE UNITS.**

If additional sample units are inspected in addition to the random or representative units, the section PCI is computed using Equations 4-2 and 4-3.

**Equation 4-2. Area-Weighted Average PCI for Additional Sample Units**

$$\overline{PCI}_a = \frac{\sum_{i=1}^m (PCI_{ai} \times A_{ai})}{\sum_{i=1}^m (A_{ai})}$$

**Equation 4-3. Section PCI for Additional Sample Units**

$$PCI_S = \frac{\overline{PCI}_r (A_s - \sum_{i=1}^m A_{ai}) + (\overline{PCI}_a \times \sum_{i=1}^m A_{ai})}{A_s}$$

Where:

$\overline{PCI}_a$  = Area-weighted average PCI of additional sample units

$PCI_{ai}$  = PCI of additional sample unit number  $i$

$A_{ai}$  = Area of additional sample unit  $i$

$A_s$  = Total section area

$m$  = Number of additional sample units surveyed

$PCI_S$  = Area-weighted PCI of pavement section

#### 4-3 SECTION PCI CALCULATION EXAMPLE.

If, in a section of 60,000 square feet (5,574 square meters), five random sample units were inspected and determined to have PCIs of 56 (5,000 square feet [465 square meters]), 72 (5,000 square feet [465 square meters]), 65 (5,000 square feet [465 square meters]), 69 (4,000 square feet [372 square meters]), and 61 (4,000 square feet [372 square meters]), and two additional sample units with PCIs of 42 (3,500 square feet [325 square meters]) and 39 (3,500 square feet [325 square meters]) were included, the PCI of the section would be:

$$PCI_r = \frac{(56 \times 5,000) + (72 \times 5,000) + (65 \times 5,000) + (69 \times 4,000) + (61 \times 4,000)}{5,000 + 5,000 + 5,000 + 4,000 + 4,000}$$

$$PCI_r = 64.57$$

$$PCI_a = \frac{(42 \times 3,500) + (39 \times 3,500)}{3,500 + 3,500}$$

$$PCI_a = 40.5$$

$$PCI_s = \frac{64.57(60,000 - 7,000) + 40.5 \times 6,500}{60,000}$$

$$PCI_s = 61$$

#### 4-4 EXTRAPOLATING PAVEMENT SECTION DISTRESS QUANTITIES.

When a pavement has been inspected by sampling, it is necessary to extrapolate the quantities and densities of distress over the entire pavement section to determine total quantities for the section. If all sample units surveyed were selected at random, the extrapolated quantity of a given distress at a given severity level is determined as shown in the following example for an asphalt-surfaced airfield with medium-severity alligator cracking:

- Surface type: AC
- Section area: 49,000 square feet (4,552 square meters)
- Total number of sample units in section: 10

##### 4-4.1 Determine Total Distress Quantity for Inspected Samples.

Five sample units were surveyed at random and the amount of medium-severity alligator cracking was determined as shown in Table 4-1.

**Table 4-1 Medium-Severity Alligator Cracking in Five Surveyed Sample Units**

| Sample Unit ID Number | Sample Unit Area ft <sup>2</sup> (m <sup>2</sup> ) | Medium-Severity Alligator Cracking ft <sup>2</sup> (m <sup>2</sup> ) |
|-----------------------|--|--|
| 02                    | 5,000 (465)  | 200 (18.6)   |
| 04                    | 5,000 (465)  | 400 (37.2)   |
| 06                    | 5,000 (465)  | 300 (27.9)   |
| 08                    | 5,000 (465)  | 100 (9.3)  |
| 10                    | 4,000 (372)  | 200 (18.6)   |
| <b>Total Random</b>   | <b>24,000 (2230)</b>                               | <b>1,200 (111.5)</b>   |

**4-4.2 Determine Total Distress Quantity for Additional Samples.**

The average density for medium-severity alligator cracking is 1,200 divided by 24,000, or 0.05. The extrapolated quantity is determined by multiplying density by section area ( $0.05 \times 49,000 = 2,450$  square feet [227.6 square meters]). If additional sample units were included in the survey, the extrapolation process is slightly different. In the above example, assume that sample unit number 01 was surveyed as an additional unit and that the amount of medium-severity alligator cracking was measured as shown in Table 3-4.

**Table 4-2 Medium-Severity Alligator Cracking in Additional Sample Unit**

| Additional Sample Unit ID Number | Sample Unit Area ft <sup>2</sup> (m <sup>2</sup> ) | Medium-Severity Alligator Cracking ft <sup>2</sup> (m <sup>2</sup> ) |
|----------------------------------|--|--|
| 01                               | 5,000 (465)  | 2,000 (186)  |
| <b>Total Additional</b>          | <b>5,000 (465)</b>                                 | <b>2,000 (186)</b>   |

**4-4.3 Determine Extrapolated Distress Quantity.**

Since 5,000 square feet (465 square meters) were surveyed as additional in this example, the section's randomly represented area is 49,000 – 5,000 square feet (4,552 – 465 square meters) or 44,000 square feet (4,087 square meters). The extrapolated distress quantity is obtained by multiplying the distress density by the section's randomly represented area, then adding the amount of additional distress. In this example, the extrapolated distress quantity equals ( $0.05 \times 44,000$  square feet (4,087 square meters) + 2,000 square feet (186 square meters) or 4,200 square feet (390 square meters).

## APPENDIX A DISTRESS DEFINITIONS AND DEDUCT CURVES

### A-1 INTRODUCTION.

This appendix contains distress definitions and measurement methods for flexible (bituminous concrete), rigid pavements (jointed PCC pavements), interlocking concrete (pavers) road and parking lots, and unpaved (unsurfaced) surfaces. This information is used to determine the PCI.

**Note:** Each distress definition in this manual aligns with PAVER distress names, definitions, and codes, which are shown in parenthesis after each distress name. The distress names and definitions also align with distress definitions in ASTM D5340 for airfields and ASTM D6433 and ASTM E2840 for roads and parking.

### A-2 ASPHALT-SURFACED ROAD AND PARKING DISTRESSES.

Several questions are commonly asked about identifying and measuring some distresses during field condition surveys and validation of the PCI. The answers to these questions for each distress are included under the heading “How to Measure.” For convenience, the most frequently raised issues are addressed below.

**Table A-1 Frequent Issues in Asphalt Pavement Distress Identification**

| Situation  | Action   | Remarks   |
|--|--|---|
| Alligator cracking and rutting in same area                      | Record each separately at respective severity level  |   |
| Bleeding counted in area   | Polished aggregate is not counted in same area   |   |
| Spalling   | Used to define severity level  | Breaking of asphalt or loss of materials around cracks or joints  |
| Crack severity   | If a crack varies in severity along its entire length, record individual severity levels   | If severity levels cannot be divided easily into distinct portions, rate it at the highest severity level |
| Any distress (including cracking and potholes) in a patched area | Do not record  | Effect of distress is considered in patch severity level  |
| Polished aggregate in very small amount                          | Do not record  | Polished aggregate is only counted when there is a significant amount                                     |
| Asphalt overlay over concrete                                    | Block cracking and joint reflection cracking are recorded separately                       | AC over PCC could have, for example, 100 percent block cracking and 100 feet of joint reflection cracking |
| Weathering (surface wear) and raveling in the same sample area   | Weathering (surface wear) is not recorded if medium- or high-severity raveling is recorded | Raveling is always recorded   |

**Table A-2 Ride Quality Assessment**

| <b>Ride Quality Assessment</b>  |  |                    |               |                           |
|---|--|--------------------|---------------|---------------------------|
| Ride quality must be assessed in order to establish a severity level for the following distress types   |  |                    |               |                           |
| <b>Bumps</b>  | <b>Shoving</b>   | <b>Corrugation</b> | <b>Swells</b> | <b>Railroad Crossings</b> |
| The inspector should drive at the posted speed in a sedan that is representative of cars typically seen in local traffic. Pavement sections near stop signs should be rated at a deceleration speed appropriate for the intersection. To assess ride quality for these distresses, the inspector should use the following severity level definitions: |  |                    |               |                           |
| <b>Low</b>  | Vehicle vibrations (e.g., from corrugation) are noticeable, but no reduction in speed is necessary for comfort or safety; and/ or individual bumps or settlements cause the vehicle to bounce slightly but create little discomfort                                    |                    |               |                           |
| <b>Medium</b>   | Vehicle vibrations are significant and some reduction in speed is necessary for safety and comfort; and/ or individual bumps or settlements cause the vehicle to bounce significantly, creating some discomfort.   |                    |               |                           |
| <b>High</b>   | Vehicle vibrations are so excessive that speed must be reduced considerably for safety and comfort; and/ or individual bumps or settlements cause the vehicle to bounce excessively, creating substantial discomfort, safety hazard, or high potential vehicle damage. |                    |               |                           |

**A-2.1 Alligator or Fatigue Cracking (1).**

Alligator or fatigue cracking is a series of interconnecting cracks caused by fatigue failure of the asphalt concrete surface under repeated traffic loading. Cracking begins at the bottom of the asphalt surface (or stabilized base) where tensile stress and strain are highest under a wheel load. The cracks propagate to the surface initially as a series of parallel longitudinal cracks. After repeated traffic loading, the cracks connect, forming many sided, sharp-angled pieces that develop a pattern resembling chicken wire or the skin of an alligator. The pieces are generally less than 1.5 feet (0.5 meter) on the longest side. Alligator cracking occurs only in areas subjected to repeated traffic loading, such as wheel paths. Pattern-type cracking that occurs over an entire area not subjected to loading is called "block cracking," which is not a load-associated distress.

**A-2.1.1 Severity Levels.**

**L** Fine, longitudinal hairline cracks running parallel to each other with no or only a few interconnecting cracks. The cracks are not spalled.

**M** Further development of light alligator cracks into a pattern or network of cracks that may be lightly spalled.

**H** Network or pattern cracking has progressed so that the pieces are well defined and spalled at the edges. Some of the pieces may rock under traffic.

**A-2.1.2 How to Measure.**

Alligator cracking is measured in square feet (square meters) of surface area. The major difficulty in measuring this type of distress is that two or three levels of severity often exist within one distressed area. If these portions can be easily distinguished from each other, they should be measured and recorded separately. However, if the different levels of severity cannot be easily divided, the entire area should be rated at the highest severity present. If alligator cracking and rutting occur in the same area, each is recorded separately at its respective severity level.

**Figure A-1 Low-Severity Alligator Cracking**



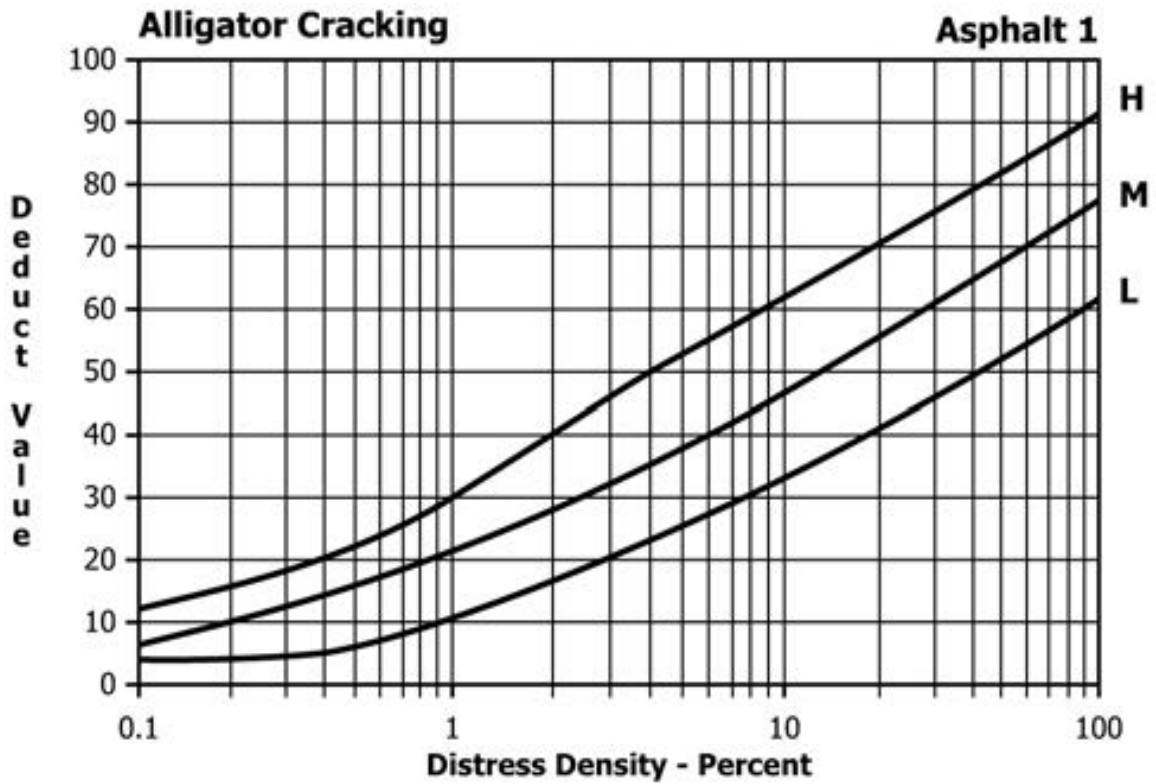
**Figure A-2 Medium-Severity Alligator Cracking**



Figure A-3 High-Severity Alligator Cracking



Figure A-4 Alligator Cracking Deduct Curve



## **A-2.2 Bleeding (2).**

Bleeding is a film of bituminous material on the pavement surface that creates a shiny, glass-like, reflecting surface that usually becomes quite sticky. Bleeding is caused by excessive amounts of asphaltic cement or tars in the mix, excess application of a bituminous sealant, and/or low air void content. It occurs when asphalt fills the voids of the mix during hot weather and then expands onto the pavement surface. Since the bleeding process is not reversible during cold weather, asphalt or tar will accumulate on the surface.

### **A-2.2.1 Severity Levels.**

**L** Bleeding has only occurred to a very slight degree and is noticeable only during a few days of the year. Asphalt does not stick to shoes or vehicles.

**M** Bleeding has occurred to the extent that asphalt sticks to shoes and vehicles during only a few weeks of the year.

**H** Bleeding has occurred extensively and considerable asphalt sticks to shoes and vehicles during at least several weeks of the year.

### **A-2.2.2 How to Measure.**

Bleeding is measured in square feet (square meters) of surface area. If bleeding is counted, polished aggregate should not be counted.

**Figure A-5 Low-Severity Bleeding**



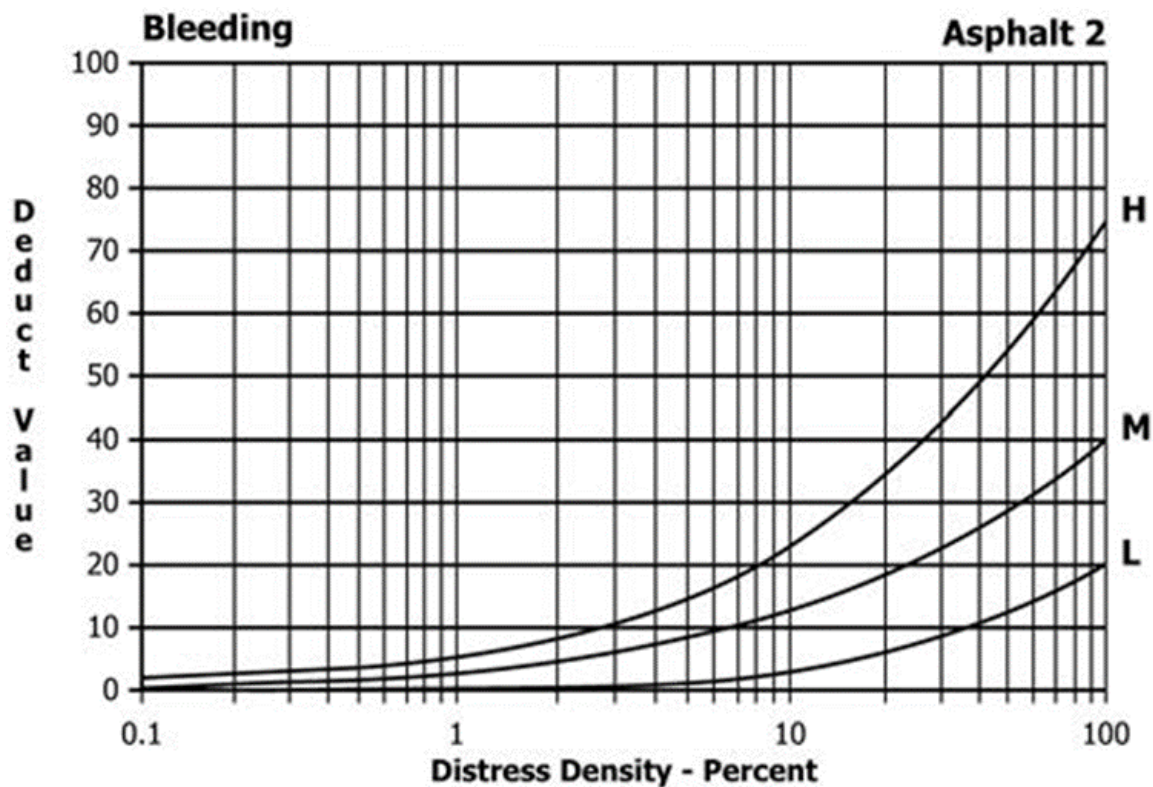
**Figure A-6 Medium-Severity Bleeding**



**Figure A-7 High-Severity Bleeding**



Figure A-8 Bleeding Deduct Curve



### A-2.3 Block Cracking (3).

Block cracks are interconnected cracks that divide the pavement into approximately rectangular pieces. The blocks may range in size from approximately 1 by 1 foot (0.3 by 0.3 meter) to 10 by 10 feet (3 by 3 meters). Block cracking is mainly caused by shrinkage of the asphalt concrete and daily temperature cycling (which results in daily stress/strain cycling). It is not load-associated. Block cracking usually indicates the asphalt has significantly hardened. Block cracking normally occurs over a large portion of the pavement area, but sometimes will occur only in non-traffic areas. This type of distress differs from alligator cracking in that alligator cracks form smaller, many-sided pieces with sharp angles. Also, unlike block cracking, alligator cracks are caused by repeated traffic loadings and are therefore found only in traffic areas (i.e., wheel paths).

#### A-2.3.1 Severity Levels.

- L** Blocks are defined by low-severity\* cracks.
- M** Blocks are defined by medium-severity\* cracks.
- H** Blocks are defined by high-severity\* cracks.

\* See definitions of longitudinal and transverse cracking (paragraph A-2.10).

**A-2.3.2 How to Measure.**

Block cracking is measured in square feet (square meters) of surface area. It usually occurs at one severity level in a given pavement section. However, if areas of different severity levels can be easily distinguished from one another, they should be measured and recorded separately.

**Figure A-9 Low-Severity Block Cracking**



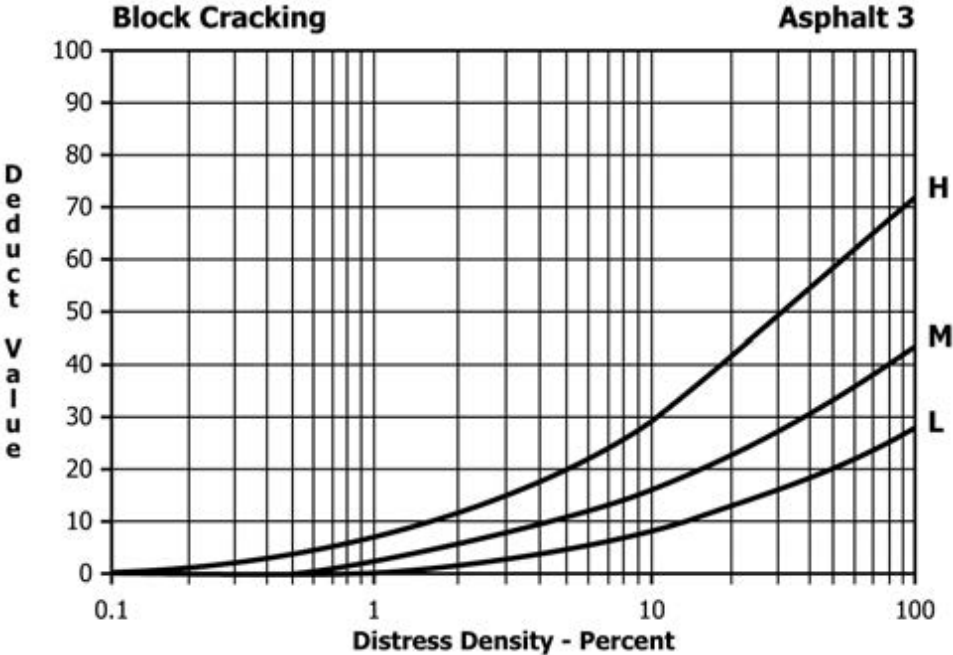
**Figure A-10 Medium-Severity Block Cracking**



Figure A-11 High-Severity Block Cracking



Figure A-12 Block Cracking Deduct Curve



#### **A-2.4 Bumps and Sags (4).**

Bumps are small, localized, upward displacements of the pavement surface. They are different from shoves in that shoves are caused by unstable pavement. Bumps can be caused by several factors, including:

- Buckling or bulging of underlying PCC slabs in AC overlay over PCC pavement
- Frost heave (ice, lens growth)
- Infiltration and buildup of material in a crack in combination with traffic loading (sometimes called "tenting")

Sags are small, abrupt, downward displacements of the pavement surface. If bumps appear in a pattern perpendicular to traffic flow and are spaced at less than 10 feet (3 meters), the distress is called corrugation. Distortion and displacement that occur over large areas of the pavement surface, causing large and/or long dips in the pavement should be recorded as "swelling."

##### **A-2.4.1 Severity Levels.**

- L** Bump or sag causes low-severity ride quality\*.
- M** Bump or sag causes high-severity ride quality\*.
- H** Bump or sag causes high-severity ride quality\*.

\* See Table A-2 for ride quality definition.

##### **A-2.4.2 How to Measure.**

Bumps or sags are measured in linear feet (linear meters). If the bump occurs in combination with a crack, the crack is also recorded.

**Figure A-13 Low-Severity Bump or Sag**



**Figure A-14 Medium-Severity Bump or Sag**



Figure A-15 High-Severity Bump or Sag



Figure A-16 Bump or Sag Deduct Curves (English)

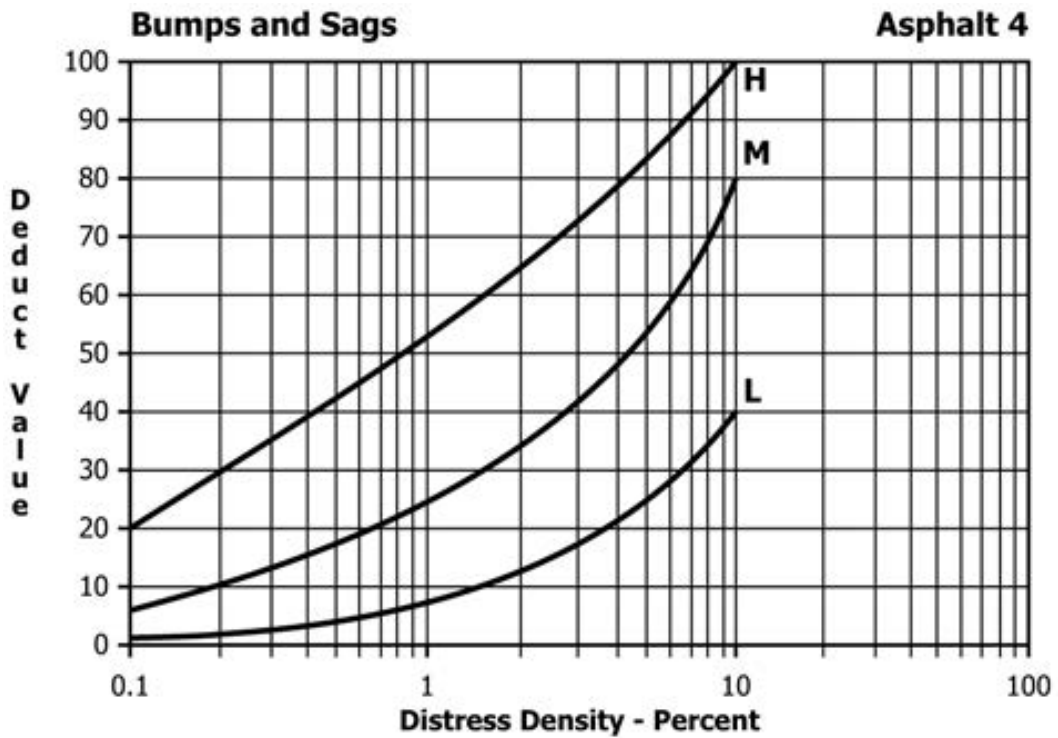
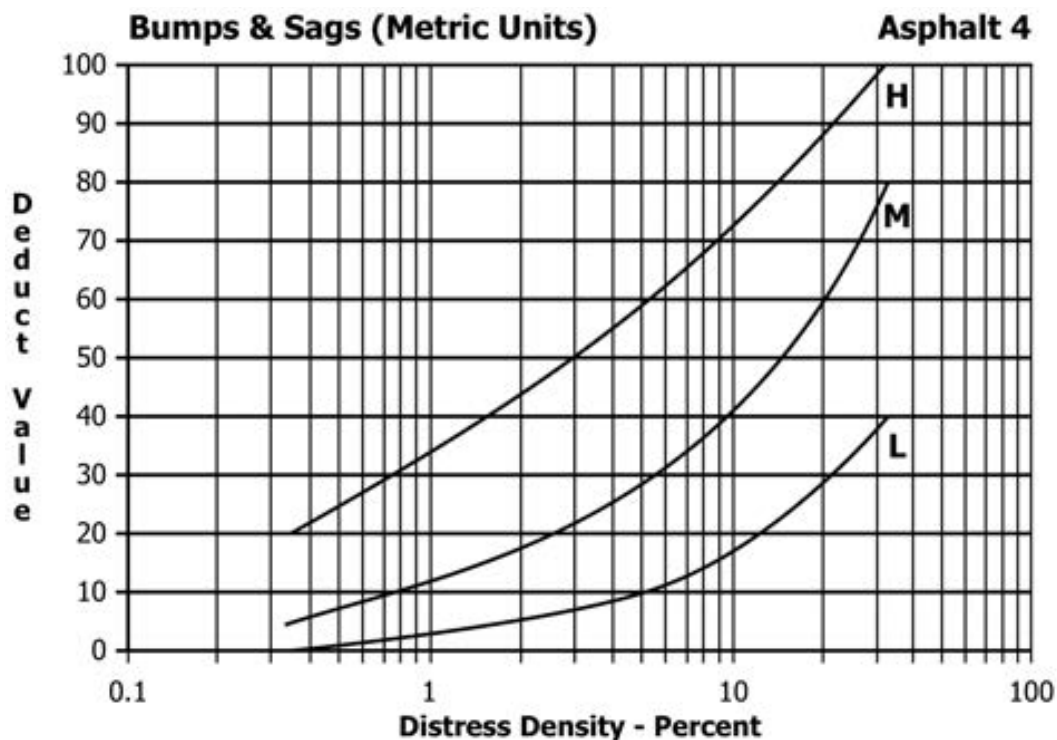


Figure A-17 Bump or Sag Deduct Curves (Metric)



### A-2.5 Corrugation (5).

Corrugation (also known as "washboarding") is a series of closely spaced ridges and valleys (ripples) occurring at fairly regular intervals, usually less than 10 feet (3 meters) along the pavement. The ridges are perpendicular to the traffic direction. This type of distress is usually caused by traffic action combined with an unstable pavement surface or base.

#### A-2.5.1 Severity Levels.

**L** Corrugation produces low-severity ride quality\*.

**M** Corrugation produces medium-severity ride quality\*.

**H** Corrugation produces high-severity ride quality\*.

\* See Table A-2 for ride quality definition.

#### A-2.5.2 How to Measure.

Corrugation is measured in square feet (square meters) of surface area.

**Figure A-18 Low-Severity Corrugation**



**Figure A-19 Medium-Severity Corrugation**

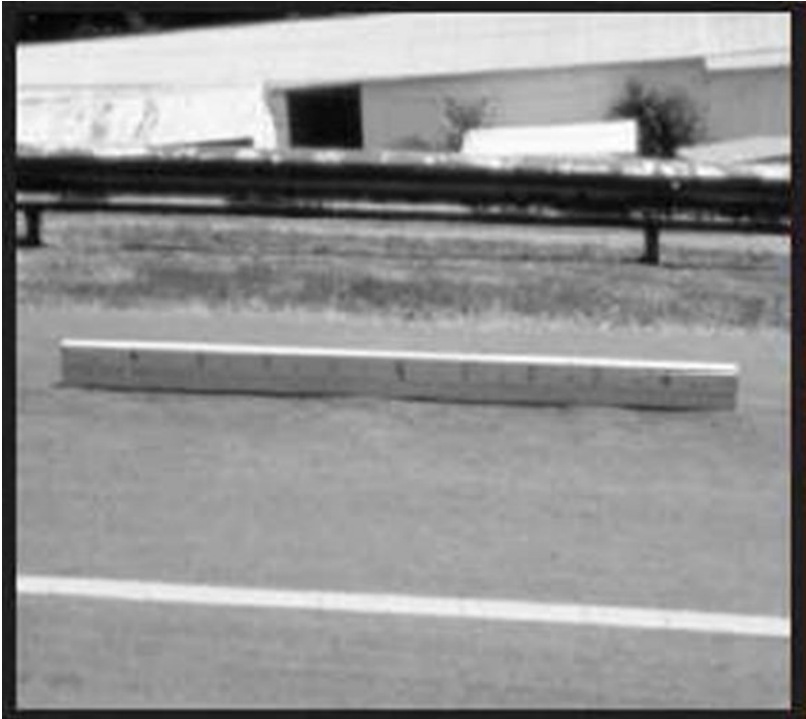
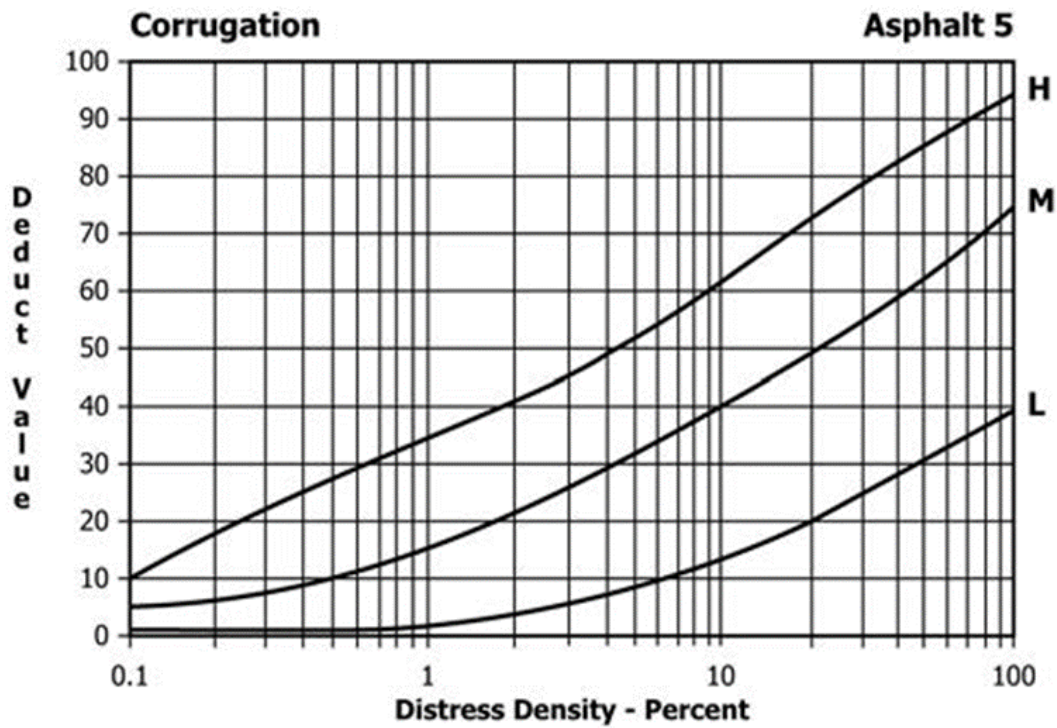


Figure A-20 High-Severity Corrugation



Figure A-21 Corrugation Deduct Curve



## **A-2.6 Depression (6).**

Depressions are localized pavement surface areas with elevations slightly lower than those of the surrounding pavement. In many instances, light depressions are not noticeable until after a rain, when ponding water creates a "birdbath" area; on dry pavement, depressions can be spotted by looking for stains caused by ponding water. Depressions are created by settlement of the foundation soil or as a result of improper construction. Depressions cause some roughness, and when deep enough or filled with water, can cause hydroplaning.

### **A-2.6.1 Severity Levels.**

**L** 0.5 to 1 inch (13 to 25 millimeters).

**M** 1 to 2 inches (25 to 50 millimeters).

**H** More than 2 inches (50 millimeters).

### **A-2.6.2 How to Measure.**

Depressions are measured in square feet (square meters) of surface area.

**Figure A-22 Low-Severity Depression.**



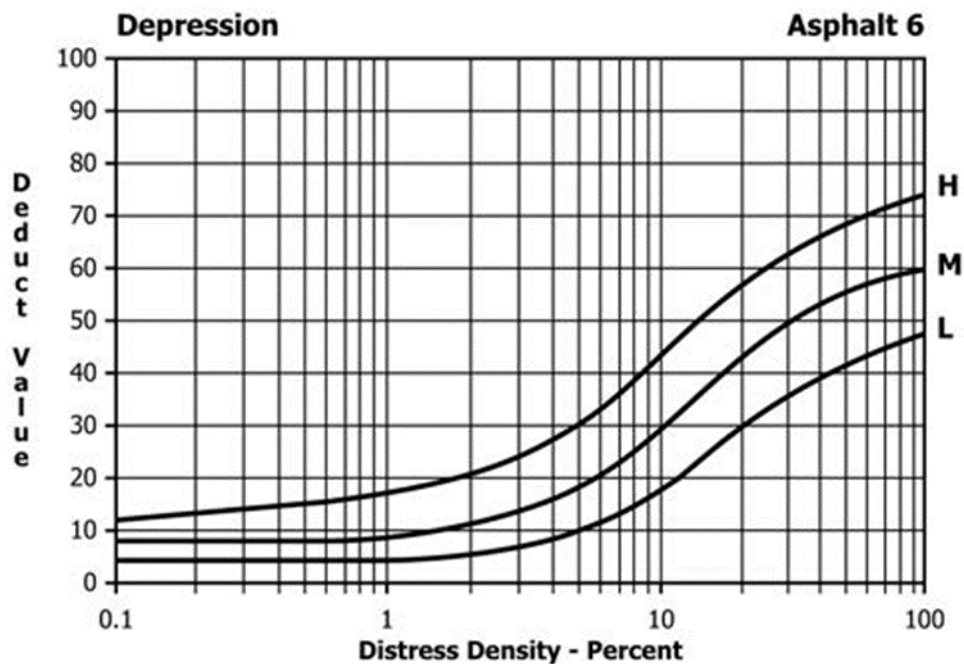
Figure A-23 Medium-Severity Depression



Figure A-24 High-Severity Depression



Figure A-25 Depression Deduct Curve



### A-2.7 Edge Cracking (7).

Edge cracks are parallel to and usually within 1 to 1.5 feet (0.3 to 0.5 meter) of the outer edge of the pavement. This distress is accelerated by traffic loading and can be caused by frost-weakened base or subgrade near the edge of the pavement. The area between the crack and pavement edge is classified as raveled if it is broken up, sometimes to the extent that pieces are removed.

#### A-2.7.1 Severity Levels.

- L** Low or medium cracking with no breakup or raveling.
- M** Medium cracks with some breakup and raveling.
- H** Considerable breakup or raveling along the edge.

#### A-2.7.2 How to Measure.

Edge cracking is measure in linear feet (linear meters).

Figure A-26 Low-Severity Edge Cracking



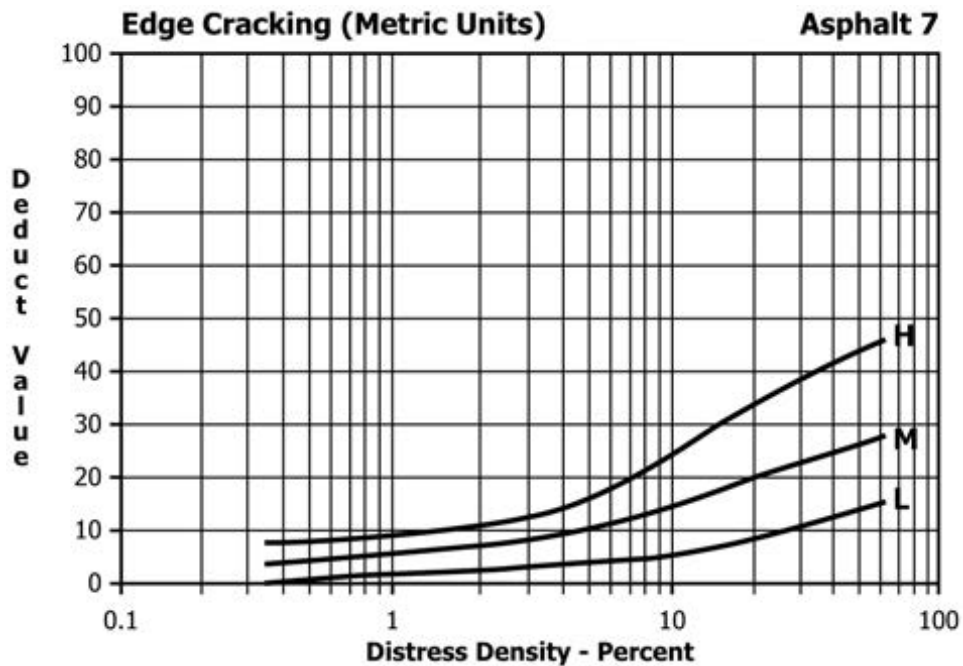
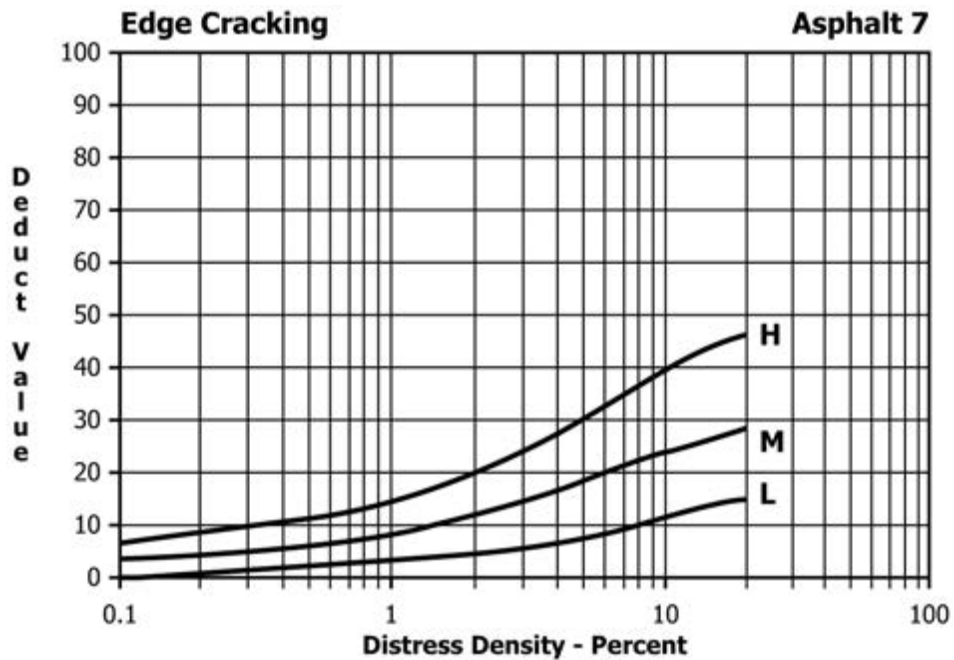
Figure A-27 Medium-Severity Edge Cracking



Figure A-28 High-Severity Edge Cracking



Figure A-29 Edge Cracking Deduct Curves



**A-2.8 Joint Reflection Cracking (8).**

This distress occurs only on asphalt-surfaced pavements that have been laid over a PCC slab. It does not include reflection cracks from any other type of base (i.e., cement- or lime-stabilized); these cracks are caused mainly by thermal- or moisture-induced movement of the PCC slab beneath the AC surface. This distress is not load-related; however, traffic loading may cause a breakdown of the AC surface near the crack. If the

pavement is fragmented along a crack, the crack is said to be spalled. A knowledge of slab dimension beneath the AC surface will help identify these distresses.

#### **A-2.8.1 Severity Levels.**

**L** One of the following conditions exists: (1) non-filled crack width is less than 0.375 inch (10 millimeters) or (2) filled crack of any width (filler in satisfactory condition).

**M** One of the following conditions exists: (1) non-filled crack width is greater than or equal to 0.375 inch (10 millimeters) and less than 3 inches (75 millimeters); (2) non-filled crack width less than or equal to 3 inches (75 millimeters) surrounded by light secondary cracking; or (3) filled crack of any width surrounded by light secondary cracking.

**H** One of the following conditions exists: (1) any crack filled or non-filled surrounded by medium- or high-severity secondary cracking; (2) non-filled cracks greater than 3 inches (75 millimeters); or (3) crack of any width where approximately 4 inches (100 millimeters) of pavement around the crack are severely raveled or broken.

#### **A-2.8.2 How to Measure.**

Joint reflection cracking is measured in linear feet (linear meters). The length and severity level of each crack should be identified and recorded separately. For example, a crack that is 50 feet (15 meters) long may have 10 feet (3 meters) of high-severity cracks, which are all recorded separately. If a bump occurs at the reflection crack, it is also recorded.

**Figure A-30 Low-Severity Joint Reflection Cracking**



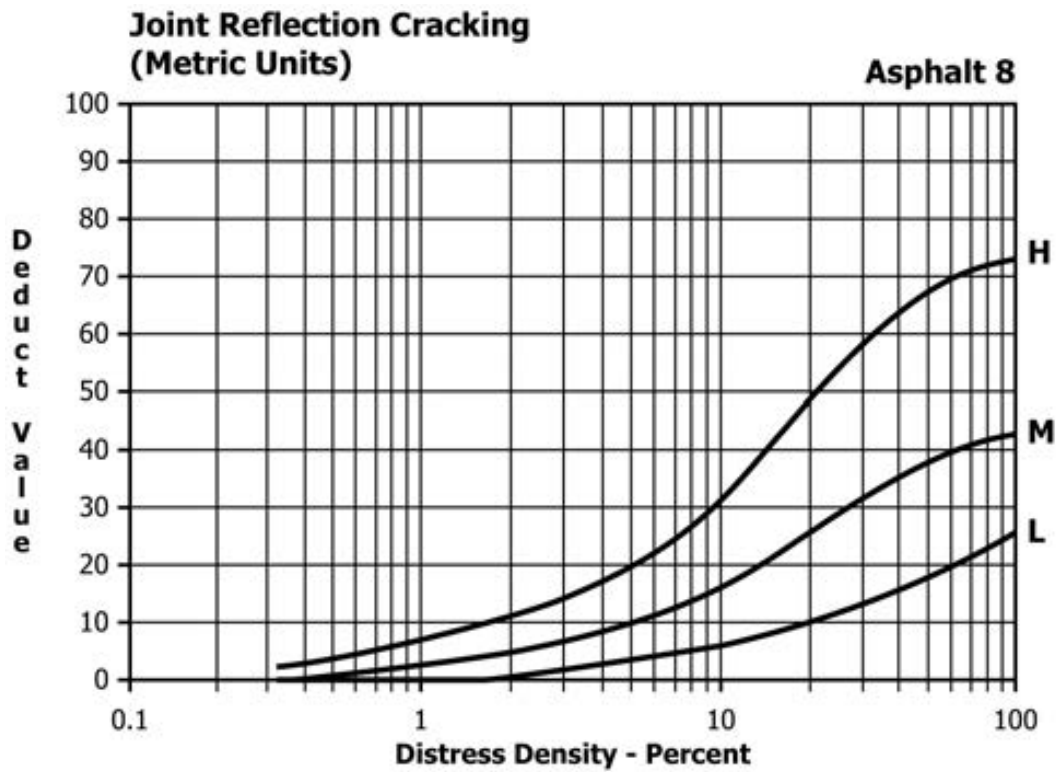
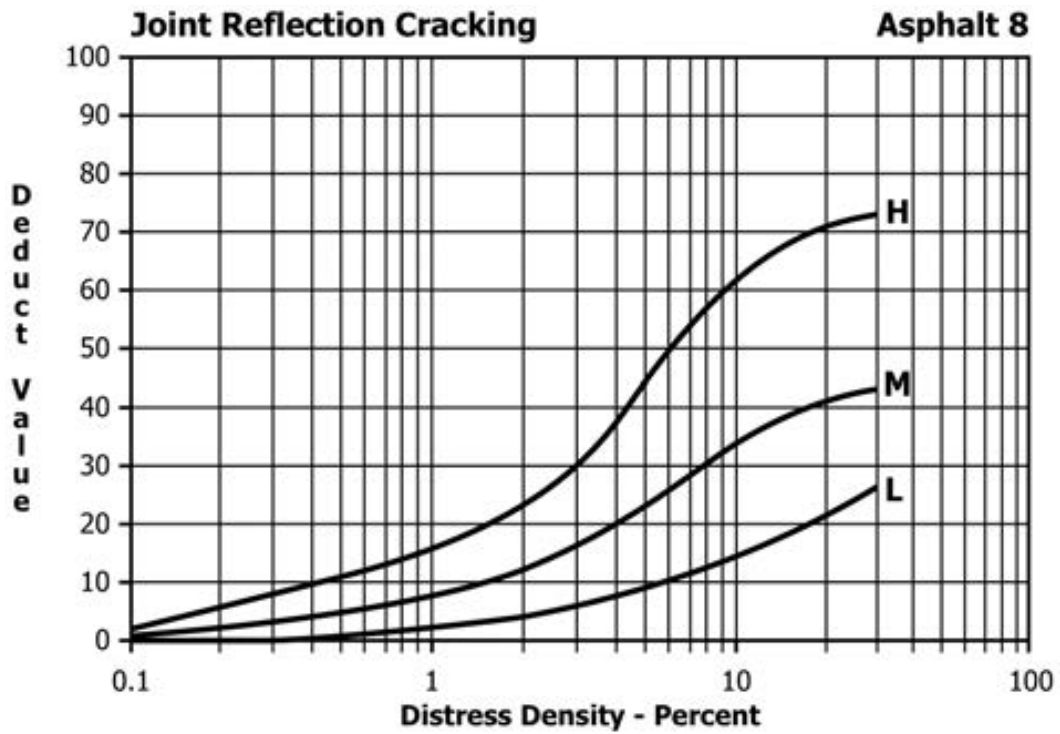
**Figure A-31 Medium-Severity Joint Reflection Cracking**



**Figure A-32 High-Severity Joint Reflection Cracking**



Figure A-33 Joint Reflection Cracking Deduct Curves



## **A-2.9 Lane/Shoulder Drop-Off (9).**

Lane/shoulder drop-off is a difference in elevation between the pavement edge and the shoulder. This distress is caused by shoulder erosion, shoulder settlement, or by building up the roadway without adjusting the shoulder level.

### **A-2.9.1 Severity Levels.**

**L** The difference in elevation between the pavement edge and shoulder is  $> 1$  inch (25 millimeters) and  $\leq 2$  inches (50 millimeters).

**M** The difference in elevation is  $> 2$  inches (50 millimeters) and  $\leq 4$  inches (100 millimeters).

**H** The difference in elevation is  $> 4$  inches (100 millimeters).

### **A-2.9.2 How to Measure.**

Lane/shoulder drop-off is measured in linear feet (linear meters).

**Figure A-34 Low-Severity Lane/Shoulder Drop Off**



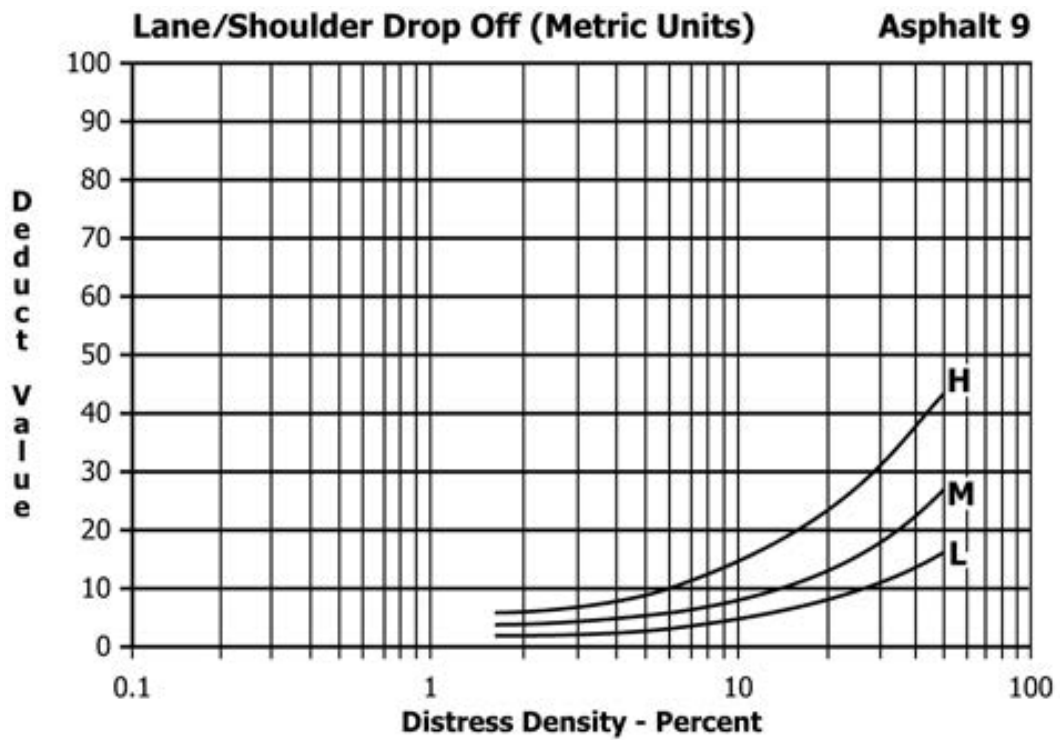
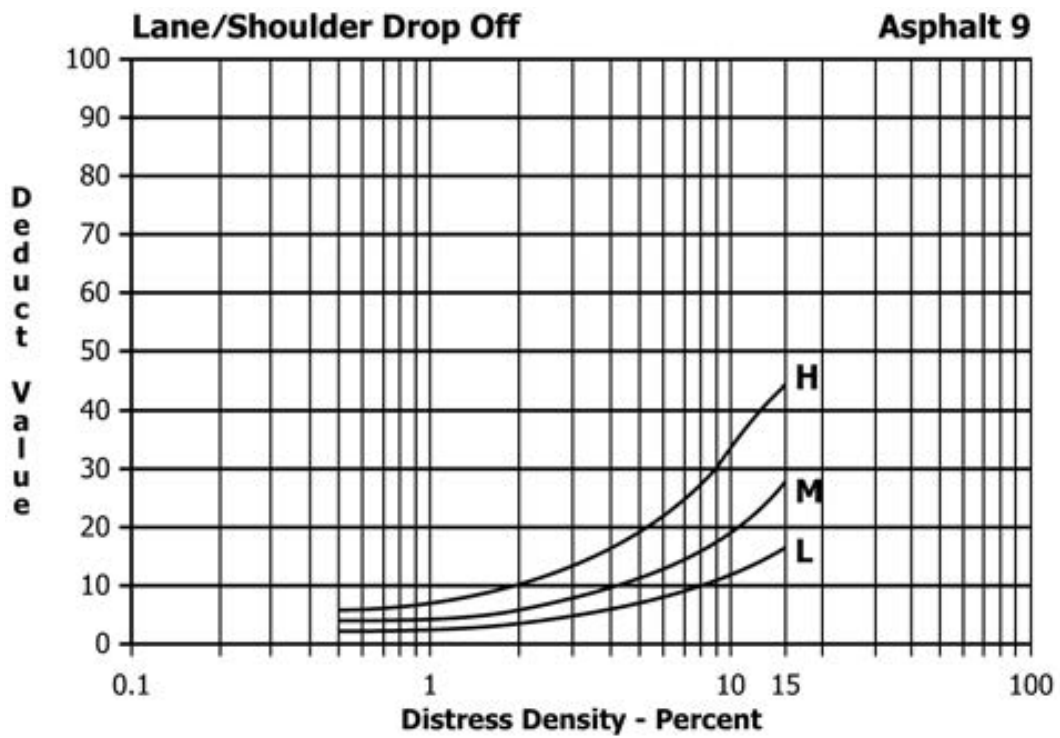
**Figure A-35 Medium-Severity Lane/Shoulder Dropoff**



**Figure A-36 High-Severity Lane/Shoulder Dropoff**



Figure A-37 Lane/Shoulder Dropoff Deduct Curves



## **A-2.10 Longitudinal and Transverse Cracking (10).**

Longitudinal cracks are parallel to the pavement's centerline or laydown direction. They may be caused by:

- A poorly constructed paving lane joint
- Shrinkage of the AC surface due to low temperatures or hardening of the asphalt and/or daily temperature cycling
- A reflective crack caused by cracking beneath the surface course, including cracks in PCC slabs (but not PCC joints)

Transverse cracks extend across the pavement at approximately right angles to the pavement centerline or direction of laydown. These types of cracks are not usually load-associated.

### **A-2.10.1 Severity Levels.**

**L** One of the following conditions exists: (1) non-filled crack width is less than 0.375 inch (10 millimeters) or (2) filled crack of any width (filler in satisfactory condition).

**M** One of the following conditions exists: (1) non-filled crack width is greater than or equal to 0.375 inch (10 millimeters) and less than 3 inches (75 millimeters); (2) non-filled crack is less than or equal to 3 inches (75 millimeters) surrounded by light and random cracking; or (3) filled crack is of any width surrounded by light random cracking.

**H** One of the following conditions exists: (1) any crack, filled or non-filled, surrounded by medium- or high-severity random cracking, (2) non-filled crack greater than 3 inches (75 millimeters); or (3) a crack of any width where approximately 4 inches (100 millimeters) of pavement around the crack is severely broken.

### **A-2.10.2 How to Measure.**

Do not count joint reflective cracking in asphalt over concrete pavements as longitudinal and transverse cracking. Longitudinal and transverse cracks are measured in linear feet (linear meters). The length and severity of each crack should be recorded. If the crack does not have the same severity level along its entire length, each portion of the crack having a different severity level should be recorded separately.

**Figure A-38 Low-Severity Longitudinal and Transverse Cracking**



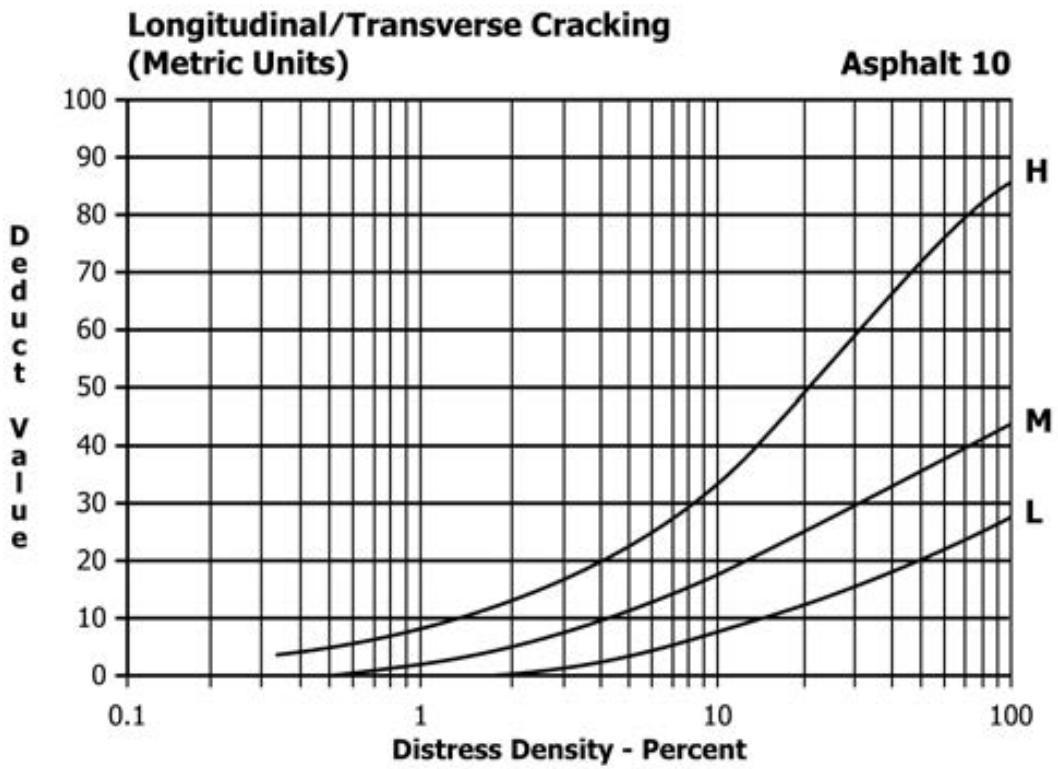
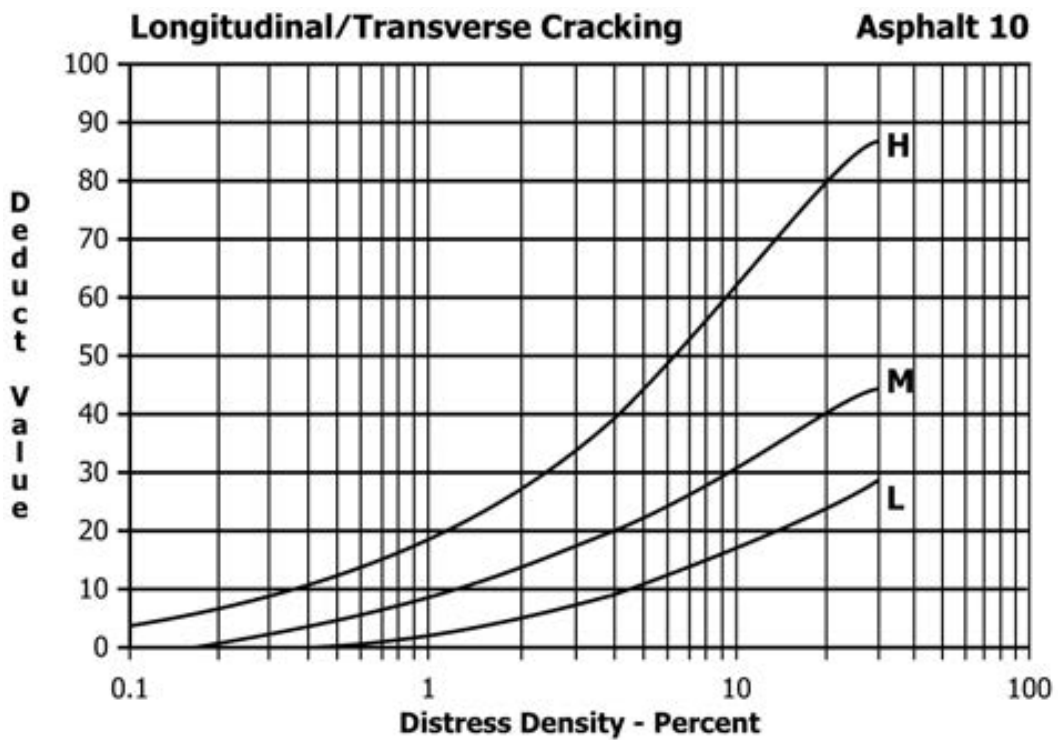
**Figure A-39 Medium-Severity Longitudinal and Transverse Cracking**



Figure A-40 High-Severity Longitudinal and Transverse Cracking



Figure A-41 Longitudinal and Transverse Cracking Deduct Curves



## **A-2.11 Patching and Utility Cut Patching (11).**

A patch is an area of pavement that has been replaced with new material to repair the existing pavement. A patch is considered a defect no matter how well it is performing (a patched area or adjacent area usually does not perform as well as an original pavement section). Generally, some roughness is associated with this distress.

### **A-2.11.1 Severity Levels.**

**L** Patch is in good condition and satisfactory. Ride quality is rated as low severity or better.

**M** Patch is moderately deteriorated and/or ride quality is rated as medium severity.

**H** Patch is badly deteriorated and/or ride quality is rated as high severity. Needs replacement soon.

### **A-2.11.2 How to Measure.**

Patching is rated in square feet (square meters) of surface area. However, if a single patch has areas of differing severity, these areas should be measured and recorded separately. For example, a 27-square-foot (2.5-square-meter) patch may have 11 square feet (1 square meter) of medium severity and 16 square feet (1.5 square meter) of low severity. These areas would be recorded separately. Any distress found in a patched area will not be recorded; however, its effect on the patch will be considered when determining the patch's severity level. No other distresses (e.g., shoving and cracking) are recorded within a patch; even if the patch material is shoving or cracking, the area is rated only as a patch. If a large amount of pavement has been replaced, it should not be recorded as a patch, but considered as new pavement (e.g., replacement of a complete intersection).

Figure A-42 Low-Severity Patch and Utility Cut Patching



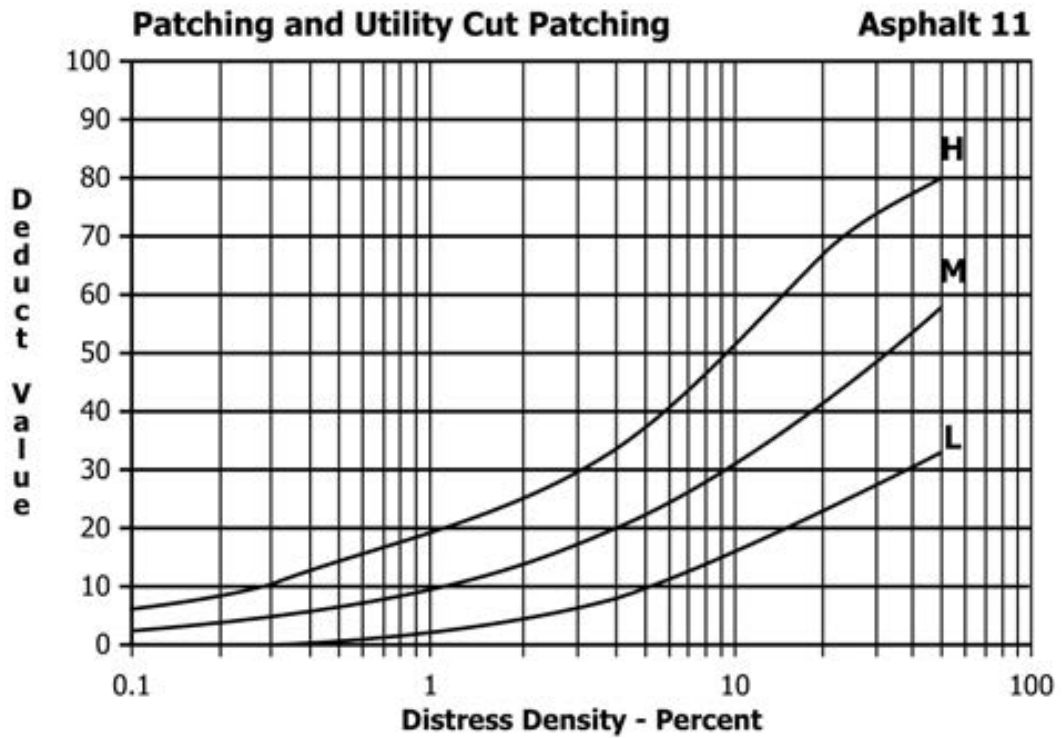
Figure A-43 Medium-Severity Patch and Utility Cut Patching



Figure A-44 High-Severity Patch and Utility Cut Patching



Figure A-45 Patch and Utility Cut Patching Deduct Curve



## **A-2.12 Polished Aggregate (12).**

This distress is caused by repeated traffic applications. Polished aggregate is present when close examination of a pavement reveals that the portion of aggregate extending above the asphalt is either very small or there are no rough or angular aggregate particles to provide good skid resistance. When the aggregate in the surface becomes smooth to the touch, adhesion with vehicle tires is considerably reduced. When the portion of aggregate extending above the surface is small, the pavement texture does not significantly contribute to reducing vehicle speed. Polished aggregate should be counted when close examination reveals that the aggregate extending above the asphalt is negligible and the surface aggregate is smooth to the touch. This type of distress is indicated when the number on a skid resistance test is low or has dropped significantly from a previous rating.

### **A-2.12.1 Severity Levels.**

No degrees of severity are defined. However, the degree of polishing should be clearly evident in the sample unit in that the aggregate surface should be smooth to the touch.

### **A-2.12.2 How to Measure.**

Polished aggregate is measured in square feet (square meters) of surface area. If bleeding is counted, polished aggregate should not be counted.

**Figure A-46 Polished Aggregate**

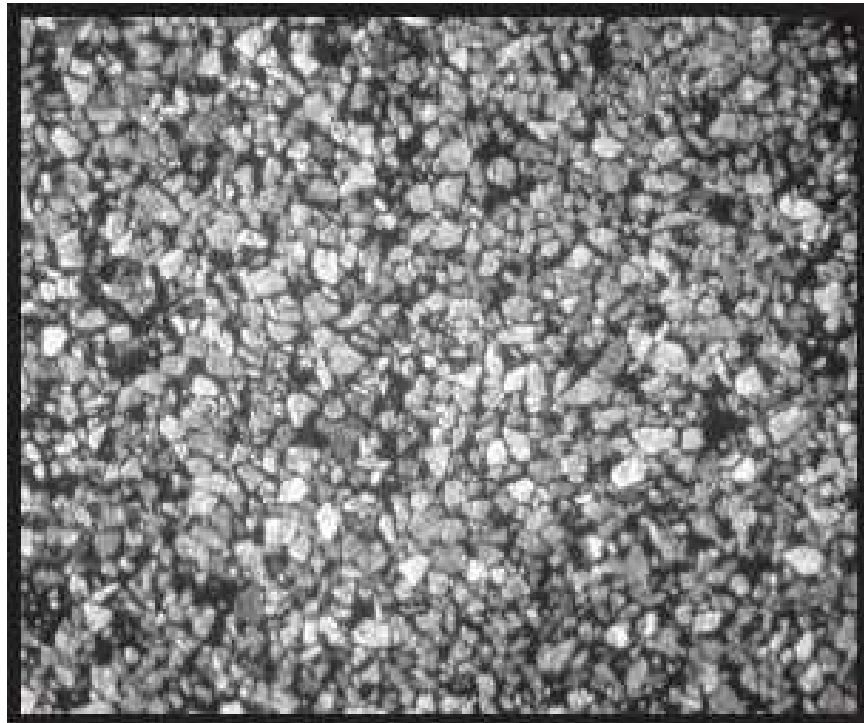
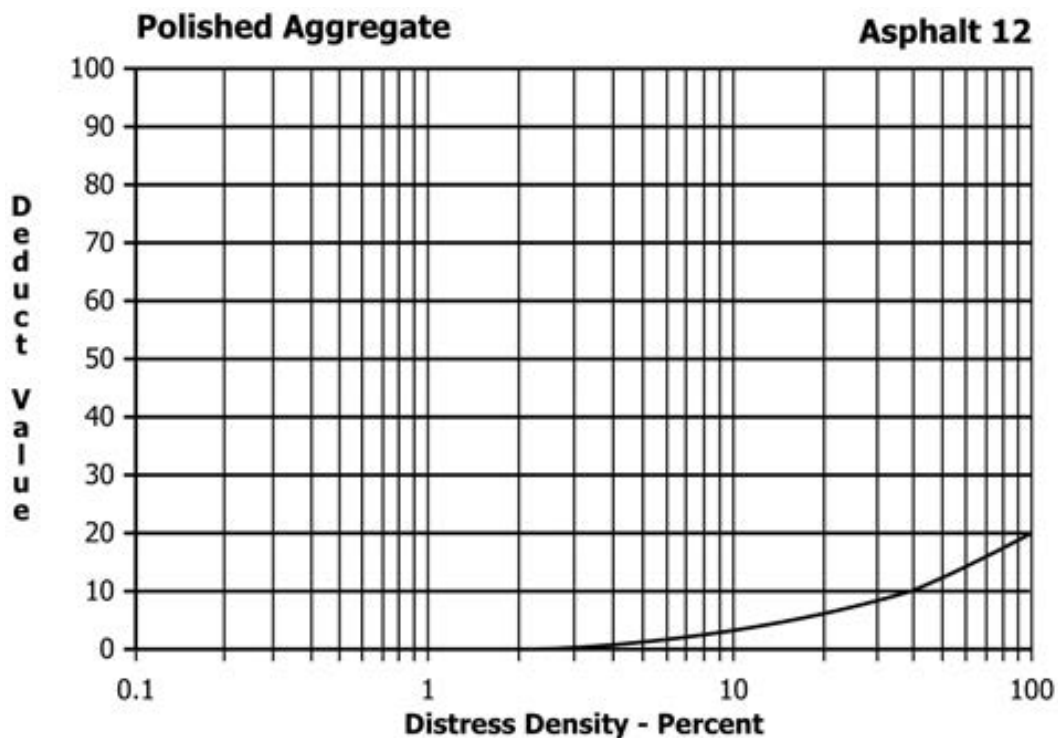


Figure A-47 Polished Aggregate Deduct Curve



**A-2.13 Potholes (13).**

Potholes are small, usually less than 30 inches (760 millimeters) in diameter, bowl-shaped depressions in the pavement surface. They generally have sharp edges and vertical sides near the top of the hole. When holes are created by high-severity alligator cracking, they should be identified as potholes, not as weathering.

**A-2.13.1 Severity Levels.**

The levels of severity for potholes less than 30 inches (760 millimeters) in diameter are based on both the diameter and the depth of the pothole, according to Table A-3. If the pothole is more than 30 inches (760 millimeters) in diameter, the area should be determined in square feet and divided by 5 square feet (0.5 square meter) to find the equivalent number of holes. If the depth is 1 inch (25 millimeters) or less, the holes are considered medium severity. If the depth is more than 1 inch (25 millimeters), they are considered high severity.

**A-2.13.2 How to Measure.**

Potholes are measured by counting the number that are low, medium, and high severity, and recording them separately.

Table A-3 Pothole Severity Levels

| Maximum Depth Of Pothole        | Average Diameter (in.) (mm)   |                                |                                 |
|---------------------------------|-------------------------------|--------------------------------|---------------------------------|
|                                 | 4 to 8 in.<br>(100 to 200 mm) | 8 to 18 in.<br>(200 to 460 mm) | 18 to 30 in.<br>(460 to 760 mm) |
| 1/2 to ≤ 1 in.<br>(13 to 25 mm) | L                             | L                              | M                               |
| > 1 to ≤ 2 in.<br>(25 to 50 mm) | L                             | M                              | H                               |
| > 2 in.<br>(50 mm)              | M                             | M                              | H                               |

Figure A-48 Low-Severity Pothole



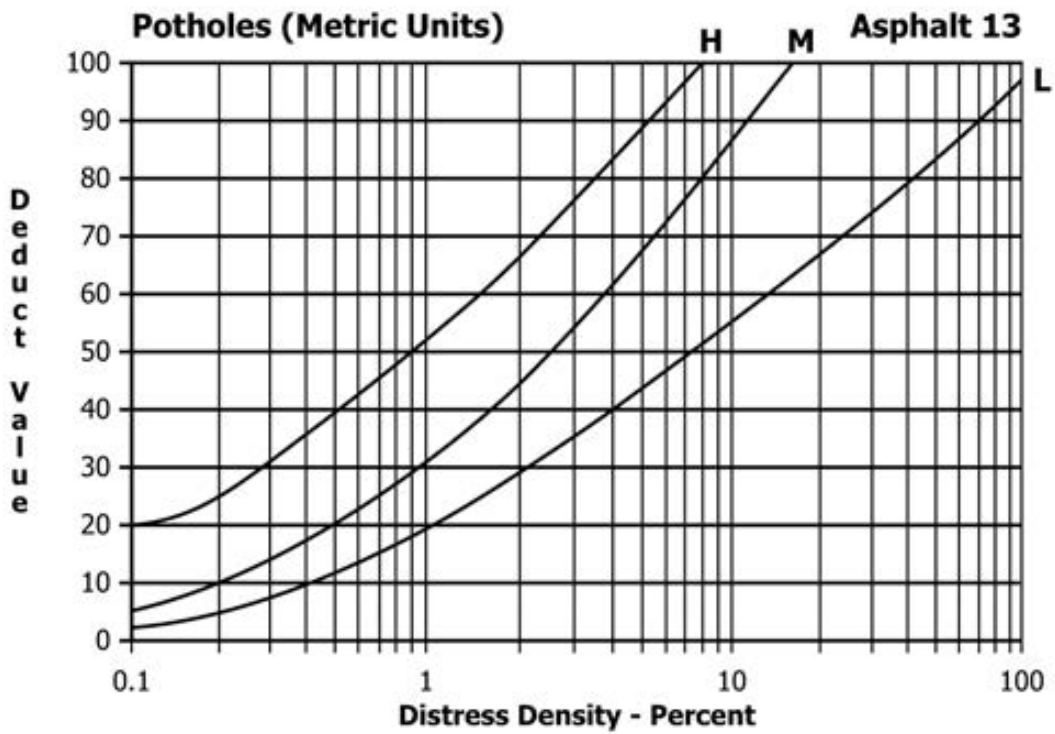
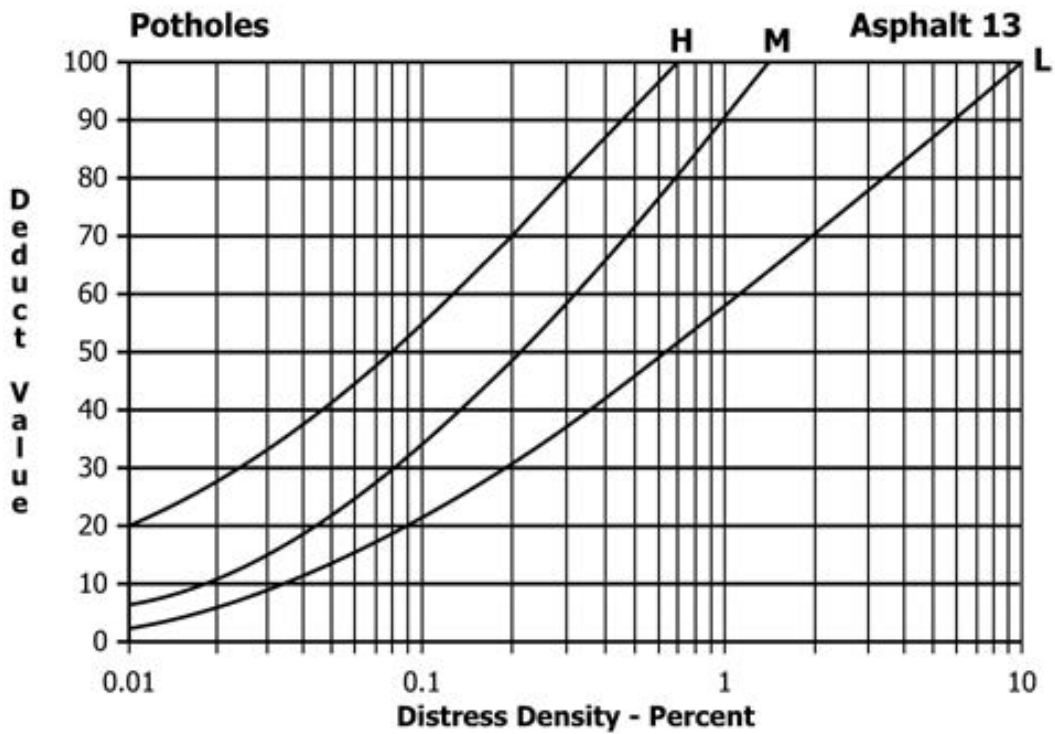
**Figure A-49 Medium-Severity Pothole**



**Figure A-50 High-Severity Pothole**



Figure A-51 Pothole Deduct Curves



**A-2.14 Railroad Crossing (14).**

Railroad crossing defects are depressions or bumps around and/or between tracks.

**A-2.14.1 Severity Levels.**

**L** Railroad crossing causes low-severity ride quality\*.

**M** Railroad crossing causes medium-severity ride quality\*.

**H** Railroad crossing causes high-severity ride quality\*.

\* See Table A-2 for ride quality assessment.

**A-2.14.2 How to Measure.**

The area of the crossing is measured in square feet (square meters) of surface area. If the crossing does not affect ride quality, it should not be counted. Any large bump created by the tracks should be counted as part of the crossing.

**Figure A-52 Low-Severity Railroad Crossing**



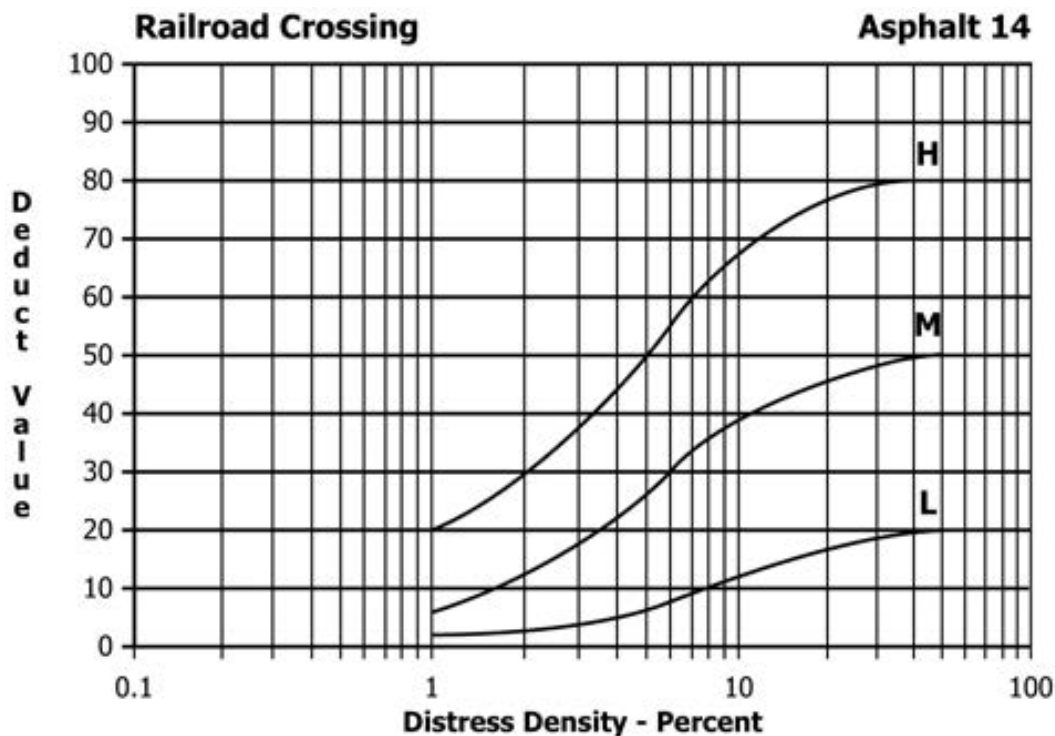
**Figure A-53 Medium-Severity Railroad Crossing**



**Figure A-54 High-Severity Railroad Crossing**



Figure A-55 Railroad Crossing Deduct Curve



### A-2.15 Rutting (15).

A rut is a surface depression in the wheel paths. Pavement uplift may occur along the sides of the rut, but in many instances, ruts are noticeable only after a rainfall when the paths are filled with water. Rutting stems from a permanent deformation in any of the pavement layers or subgrades, usually caused by consolidated or lateral movement of the materials due to traffic load.

#### A-2.15.1 Severity Levels.

**L** 0.25 to 0.5 inch (6 to 13 millimeters).

**M** > 0.5 to 1 inch (13 to 25 millimeters).

**H** > 1 inch (25 millimeters).

#### A-2.15.2 How to Measure.

Rutting is measured in square feet (square meters) of surface area and its severity is determined by the mean depth of the rut (see above). The mean rut depth is calculated by laying a straight edge across the rut, measuring its depth, then using measurements taken along the length of the rut to compute its mean depth in inches (millimeters).

Figure A-56 Low-Severity Rutting

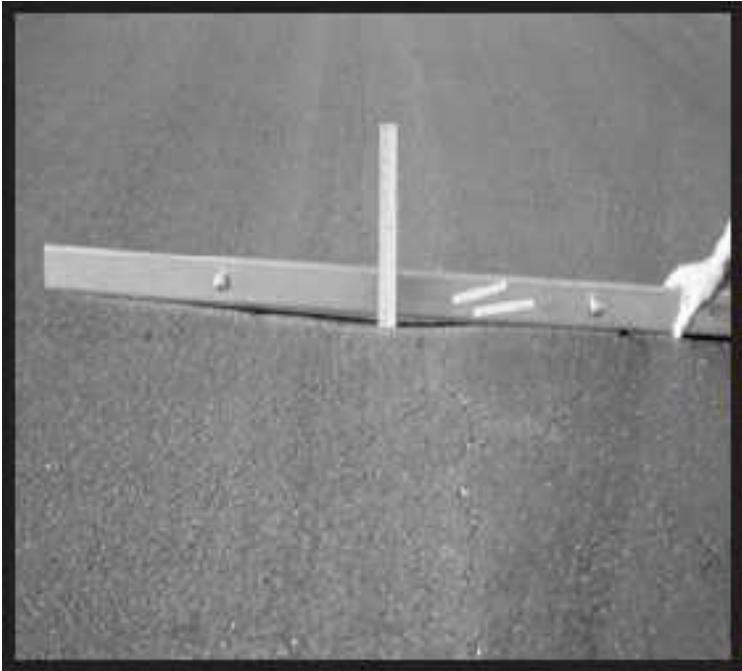


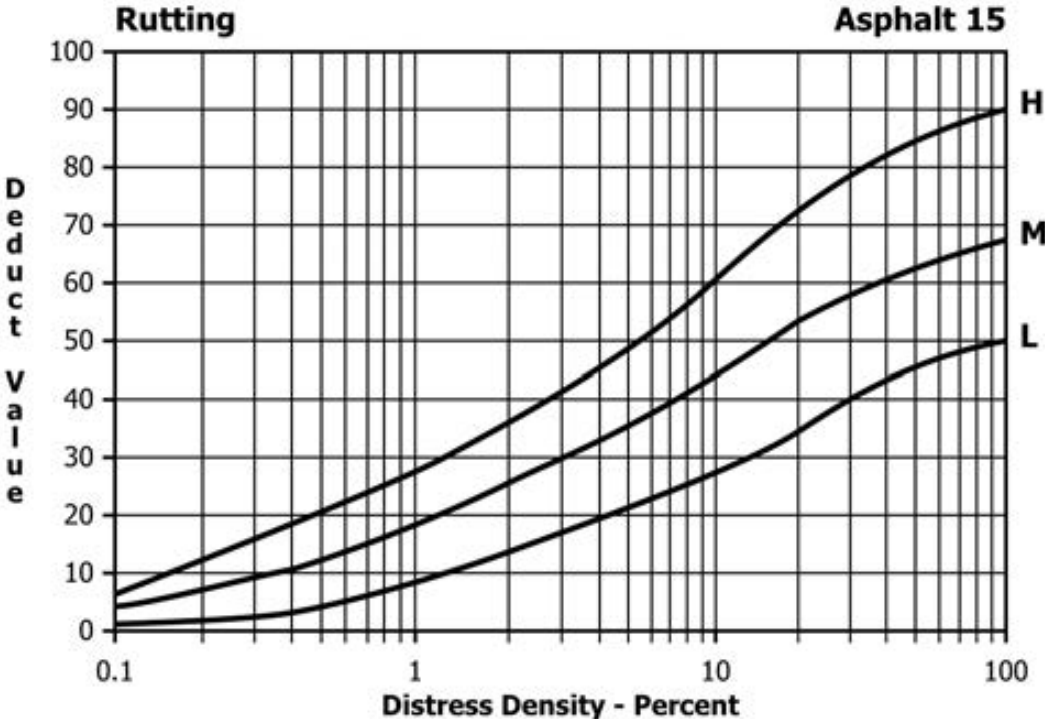
Figure A-57 Medium-Severity Rutting



Figure A-58 High-Severity Rutting



Figure A-59 Rutting Deduct Curve



## **A-2.16 Shoving (16).**

Shoving is a permanent displacement of a localized area of the pavement surface caused by traffic loading. When traffic pushes against the pavement, it produces a short, abrupt wave in the pavement surface. This distress typically occurs only in unstable liquid asphalt mix (cutback or emulsion) pavements.

### **A-2.16.1 Severity Levels.**

- L** Shove causes low-severity ride quality\*.
- M** Shove causes medium-severity ride quality\*.
- H** Shove causes high-severity ride quality\*.

\* See Table A-2 for ride quality assessment.

### **A-2.16.2 How to Measure.**

Shoves are measured in square feet (square meters) of surface area. Shoves occurring in patches are considered in rating the patch, not as a separate distress.

**Figure A-60 Low-Severity Shoving**



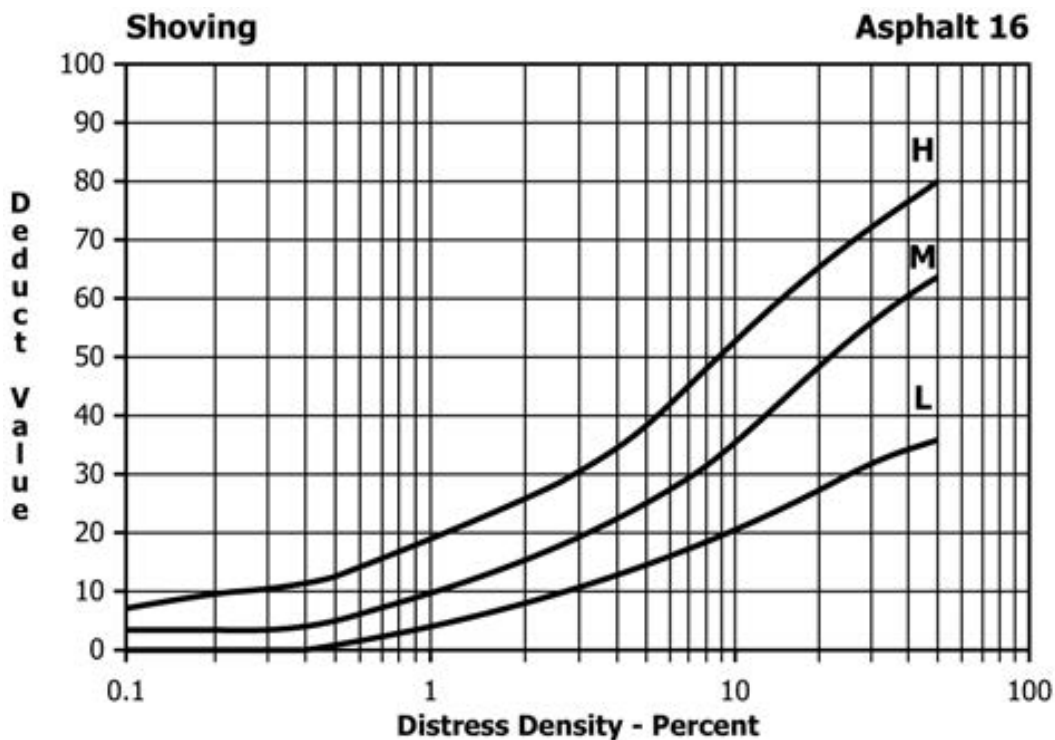
**Figure A-61 Medium-Severity Shoving**



**Figure A-62 High-Severity Shoving**



Figure A-63 Shoving Deduct Curve



**A-2.17 Slippage Cracking (17).**

Slippage cracks are crescent- or half-moon-shaped cracks, having two ends pointed in the direction of travel. They are produced when braking or turning wheels cause the pavement surface to slide or deform. This distress usually occurs in overlaps when there is a poor bond between the surface and the next layer of the pavement structure.

**A-2.17.1 Severity Levels.**

**L** Average crack width is < 0.375 inch (10 millimeters).

**M** One of the following conditions exists: (1) average crack width is  $\geq 0.375$  and < 1.5 inches ( $\geq 10$  and < 38 millimeters); (2) the area around the crack is moderately spalled and/or surrounded with secondary cracks.

**H** One of the following conditions exists: (1) the average crack width is  $\geq 1.5$  inches (38 millimeters), or (2) the area around the crack is broken into easily removed pieces.

**A-2.17.2 How to Measure.**

The area associated with a given slippage crack is measured in square feet (square meters) and rated according to the highest level of severity in the area.

Figure A-64 Low-Severity Slippage Cracking



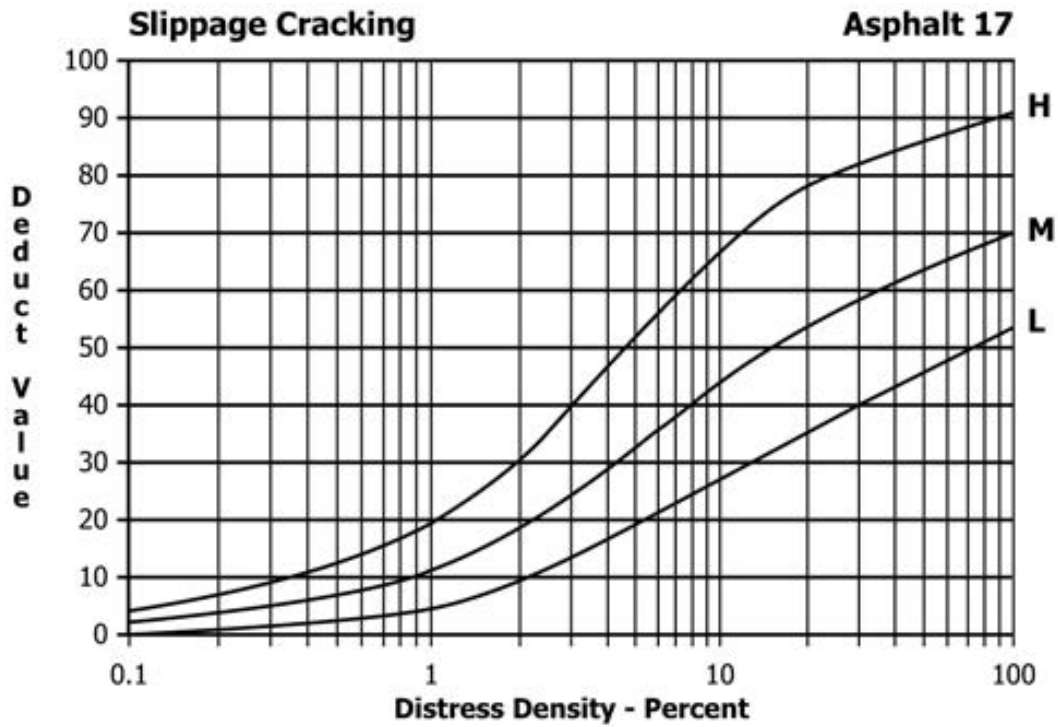
Figure A-65 Medium-Severity Slippage Cracking



Figure A-66 High-Severity Slippage Cracking



Figure A-67 Slippage Cracking Deduct Curve



**A-2.18 Swell (18).**

Swell is characterized by an upward bulge in the pavement's surface—a long, gradual wave more than 10 feet (3 meters) long. Swelling can be accompanied by surface cracking. This distress is usually caused by frost action in the subgrade or by swelling soil.

**A-2.18.1 Severity Levels.**

**L** Swell causes low-severity ride quality\*. Low severity swells are not always easy to see but can be detected by driving at the speed limit over the pavement section. An upward motion will occur at the swell if it is present.

**M** Swell causes medium severity ride quality\*.

**H** Swell causes high severity ride quality\*.

\* See Table A-2 for ride quality assessment.

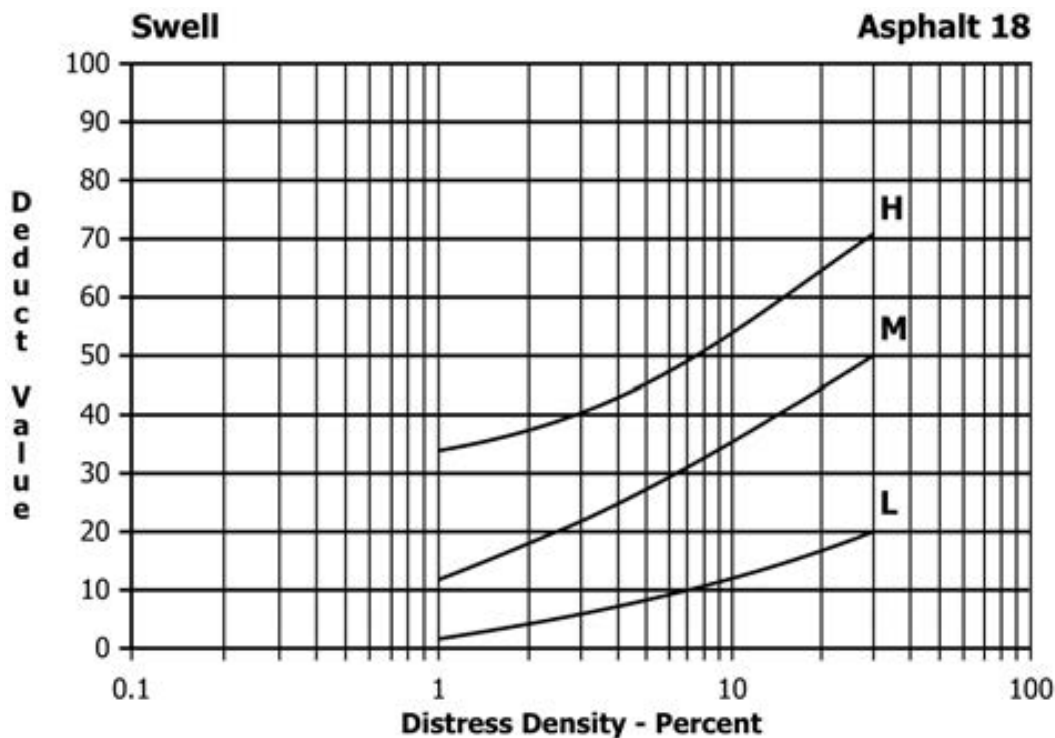
**A-2.18.2 How to Measure.**

The surface area of the swell is measured in square feet (square meters).

**Figure A-68 Swell**



Figure A-69 Swell Deduct Curve



**A-2.19 Raveling (19).**

Raveling is the dislodging of coarse aggregate particles. Raveling may be caused by insufficient asphalt binder, poor mixture quality, insufficient compaction, segregation, or stripping.

**A-2.19.1 Dense Mixed Severity Levels.**

As used herein, coarse aggregate refers to the predominant coarse aggregate size of the asphalt mix, and aggregate clusters refers to when more than one adjoining coarse aggregate piece is missing. If in doubt about a severity level, examine three representative areas of one square yard each (square meters) and count the number of missing aggregate particles/ clusters.

**M** Considerable loss of coarse aggregate, greater than 20 per square yard (square meter), and/or clusters of missing coarse aggregate are present.

**H** Surface is very rough and pitted; may be completely removed in places.

**A-2.19.2 How to Measure.**

Raveling is measured in square feet (square meters) of surface area. Mechanical damage caused by such things as hook drags, tire rims, or snowplows is counted as raveling. If raveling is present, weathering (surface wear) is not recorded.

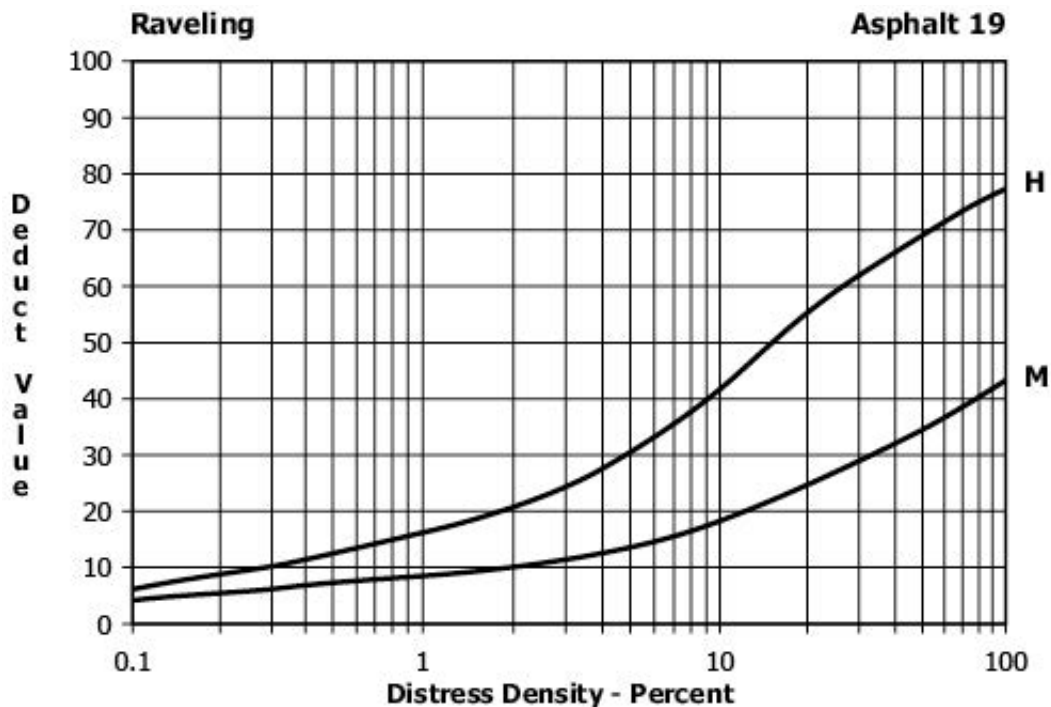
**Figure A-70 Medium-Severity Raveling**



**Figure A-71 High-Severity Raveling**



Figure A-72 Raveling Deduct Curve



**A-2.20 Weathering (Surface Wear) (20).**

Weathering is the wearing away of the asphalt binder and fine aggregate matrix.

**A-2.20.1 Severity Levels.**

As used herein, coarse aggregate refers to predominant coarse aggregate size of the asphalt mix. Loss or dislodging of coarse aggregate is covered under raveling.

Surface wear is normally caused by oxidation, inadequate compaction, insufficient asphalt content, excessive natural sand, surface water erosion, and traffic. Weathering occurs faster in areas with high solar radiation

**L** Asphalt surface beginning to show signs of aging, which may be accelerated by climatic conditions. Loss in the fine aggregate matrix is noticeable and may be accompanied by fading of the asphalt color. Edges of the coarse aggregates are beginning to be exposed (less than 0.05 inch or 1 millimeter). Pavement may be relatively new (as new as six months old).

**M** Loss of fine aggregate matrix is noticeable and edges of coarse aggregate have been exposed up to one-fourth width (of the longest side) of the coarse aggregate due to the loss of fine aggregate matrix.

**H** Edges of coarse aggregate have been exposed greater than one-fourth width (of the longest side) of the coarse aggregate. There is considerable loss of fine aggregate matrix, leading to potential or some loss of coarse aggregate.

**A-2.20.2 How to Measure.**

Surface wear is measured in square feet (square meters). Surface wear is not recorded where medium- and/or high-severity raveling is recorded.

**Figure A-73 Low-Severity Weathering**



Figure A-74 Medium-Severity Weathering



Figure A-75 High-Severity Weathering



Figure A-76 Weathering Deduct Curve

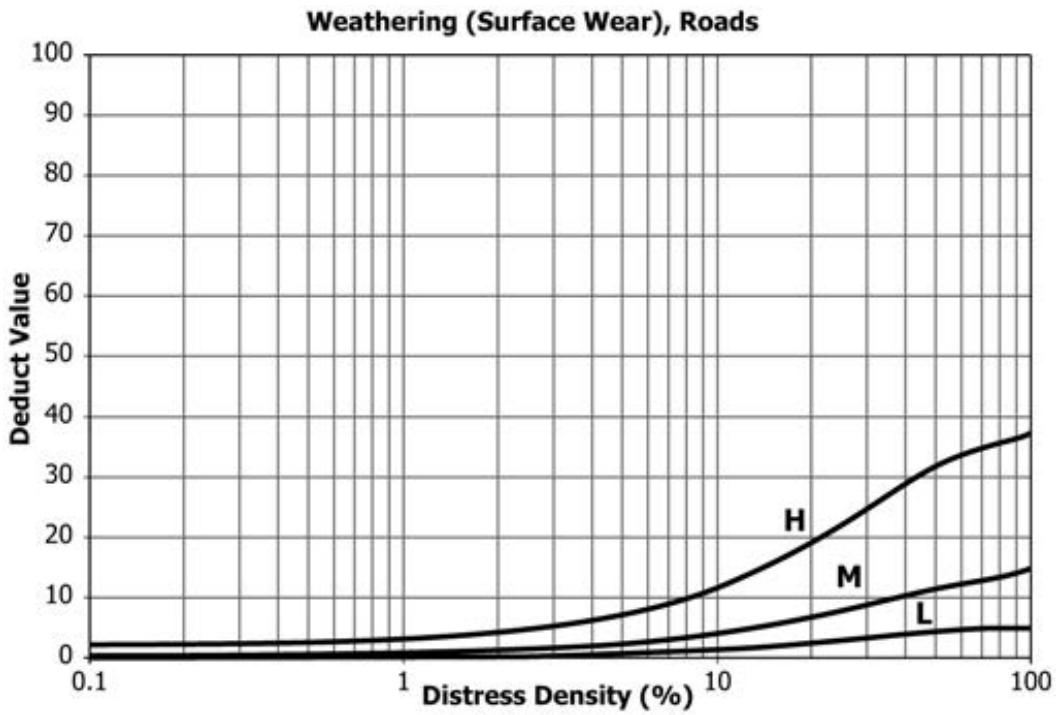
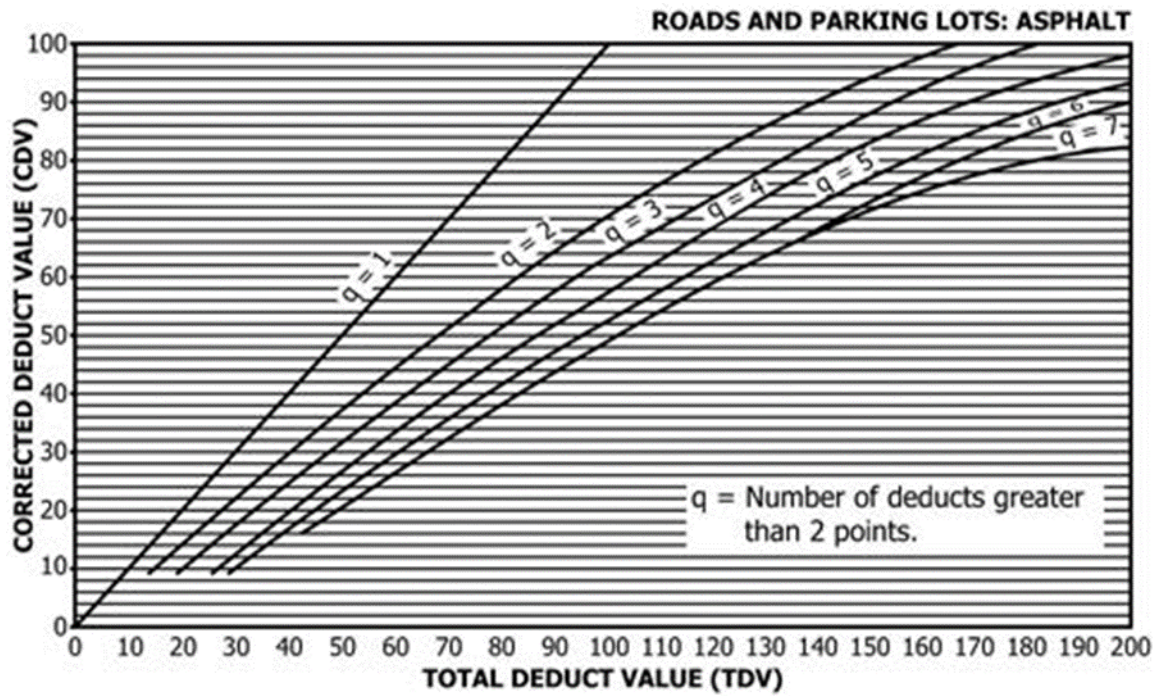


Figure A-77 Corrected Deduct Value Curves AC Roads and Parking



**A-3 JOINTED CONCRETE ROAD AND PARKING DISTRESSES.**

During the field condition surveys and validation of the PCI, several questions are commonly asked about the identification and measurement of some of the distresses. The answers to these questions for each distress are included under the heading “How to Measure.” For convenience, however, the most frequently raised issues are addressed below.

**Table A-4 Frequent Issues in Concrete Pavement Distress Identification**

| Situation                            | Action  | Remarks  |
|--------------------------------------|---|--|
| Faulting                             | Faulting is counted only at joints  | Faulting associated with cracking is not counted separately since it is incorporated into the severity level definitions of cracks |
| Joint seal damage                    | This is not counted on a slab-by-slab basis   | Assign a severity level based on the overall condition of the joint seal in the sample unit  |
| Shrinkage cracks                     | Do not count shrinkage cracks to determine if a slab is broken into four or more pieces | Count cracks in reinforced concrete slabs that are less than 0.125 inch (3 millimeters) wide as shrinkage cracks                   |
| Low-severity scaling (i.e., crazing) | Count only if possible future scaling is likely to occur                                |  |

**Table A-5 PCC Ride Quality Assessment**

| <b>Ride Quality Assessment</b>  |  |
|---|--|
| Ride quality must be assessed in order to establish a severity level for the following distress types   |  |
| <b>Blowup / Buckling</b>  | <b>Railroad Crossings</b>  |
| The inspector should drive at the posted speed in a sedan that is representative of cars typically seen in local traffic. Pavement sections near stop signs should be rated at a deceleration speed appropriate for the intersection. To assess ride quality for these distresses, the inspector should use the following severity level definitions: |  |
| <b>Low</b>  | Vehicle vibrations (e.g., from corrugation) are noticeable, but no reduction in speed is necessary for comfort or safety; and/ or individual bumps or settlements cause the vehicle to bounce slightly but create little discomfort                                    |
| <b>Medium</b>   | Vehicle vibrations are significant and some reduction in speed is necessary for safety and comfort; and/ or individual bumps or settlements cause the vehicle to bounce significantly, creating some discomfort.   |
| <b>High</b>   | Vehicle vibrations are so excessive that speed must be reduced considerably for safety and comfort; and/ or individual bumps or settlements cause the vehicle to bounce excessively, creating substantial discomfort, safety hazard, or high potential vehicle damage. |

**A-3.1 Blowup/Buckling (21).**

Blowups or buckles occur in hot weather, usually at a transverse crack or joint that is not wide enough to permit slab expansion. The insufficient width is usually caused by infiltration of incompressible materials into the joint space. When expansion cannot relieve enough pressure, a localized upward movement of the slab edges (buckling) or shattering will occur in the vicinity of the joint. Blowups can also occur at utility cuts and drainage inlets.

**A-3.1.1 Severity Levels.**

- L** Buckling or shattering causes low-severity ride quality\*.
- M** Buckling or shattering causes medium-severity ride quality\*.
- H** Buckling or shattering causes high severity-ride quality\*.

\* See Table A-5 for ride quality definition.

**A-3.1.2 How to Count.**

At a crack, a blowup is counted as being in one slab. However, if the blowup occurs at a joint and affects two slabs, the distress should be recorded as occurring in two slabs. When a blowup renders the pavement impassable, it should be repaired immediately.

**Figure A-78 Low-Severity Blowup/Buckling**



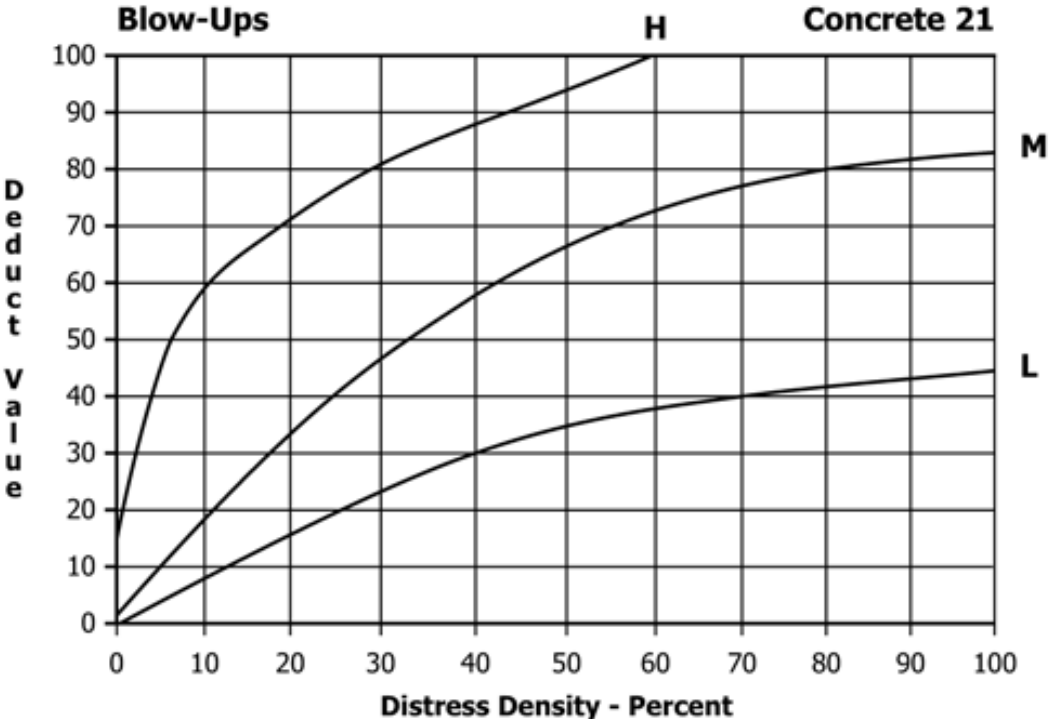
**Figure A-79 Medium-Severity Blowup/Buckling**



Figure A-80 High-Severity Blowup/Buckling



Figure A-81 Blowup/Buckling Deduct Curve



### **A-3.2 Corner Break (22).**

A corner break is a crack that intersects the joints at a distance less than or equal to half the slab length on both sides, measured from the corner of the slab. For example, a slab measuring 11.5 by 20 feet (3.5 by 6 meters) that has a crack 5 feet (1.5 meters) on one side and 11.5 feet (3.5 meters) on the other side, is not considered a corner break—it is a diagonal crack. However, a crack that intersects 4 feet (1.2 meters) on one side and 8 feet (2.5 meters) on the other is considered a corner break. A corner break differs from a corner spall in that the crack extends vertically through the entire slab thickness, whereas a corner spall intersects the joint at an angle. Load repetition combined with loss of support and curling stresses usually cause corner breaks.

#### **A-3.2.1 Severity Levels.**

**L** Break is defined by a low-severity\* crack. A low severity crack is  $\leq 0.5$  inch (13 millimeters); cracks of any width with satisfactory filler; no faulting. The area between the break and the joints is not cracked or may be lightly cracked.

**M** Break is defined by a medium-severity\* crack and/or the area between the break and the joints has a medium-severity crack. A medium-severity crack is a non-filled crack  $> 0.5$  inch and  $\leq 2$  inches (13 millimeters to 50 millimeters), a non-filled crack  $\leq 2$  inches (50 millimeters) with faulting  $\leq 0.375$  inch (10 millimeters), or a filled crack with faulting  $\leq 0.375$  inch (10 millimeters).

**H** Break is defined by a high-severity\* crack and/or the area between the break and the joints is highly cracked. A high severity crack is a non-filled crack  $> 2$  inches (50 millimeters) wide, or any filled or non-filled crack with faulting  $> 0.375$  inch (10 millimeters).

\*The crack severity definitions are for non-reinforced slabs. For reinforced slabs, see linear cracking (paragraph A-3.8).

#### **A-3.2.2 How to Count.**

Distressed slab is recorded as one slab if it:

- Contains a single corner break.
- Contains more than one break of a particular severity.
- Contains two or more breaks of different severities. For two or more breaks, the highest level of severity should be recorded. For example, a slab containing both low- and medium-severity corner breaks should be counted as one slab with a medium-severity corner break.

Figure A-82 Low-Severity Corner Break



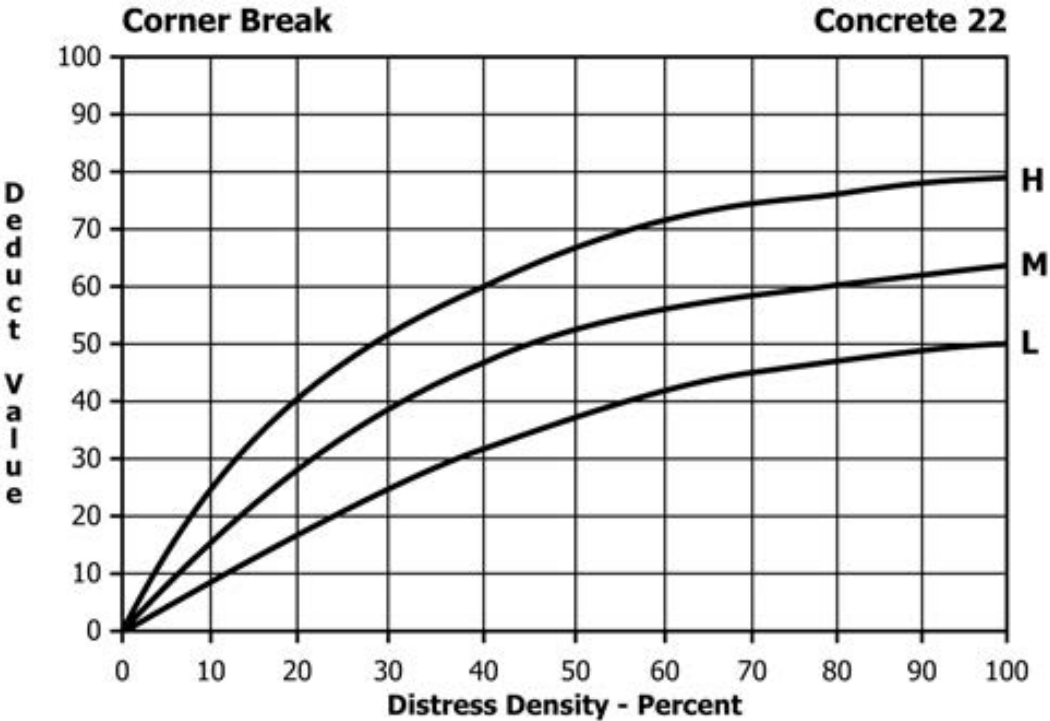
Figure A-83 Medium-Severity Corner Break



Figure A-84 High-Severity Corner Break



Figure A-85 Corner Break Deduct Curve



**A-3.3 Divided Slab (23).**

A divided slab is a slab divided by cracks into four or more pieces due to overloading and/or inadequate support. If all pieces or cracks are contained within a corner break, the distress is categorized as a severe corner break.

**A-3.3.1 Severity Levels.**

**Table A-6 Punchout Severity Levels**

| Severity Of Majority Of Cracks | Number Of Pieces In Cracked Slab |        |             |
|--------------------------------|----------------------------------|--------|-------------|
|                                | 4 to 5                           | 6 to 8 | More than 8 |
| L                              | L                                | L      | M           |
| M                              | L                                | M      | H           |
| H                              | M                                | H      | H           |

**A-3.3.2 How to Count.**

If the divided slab is medium or high severity, no other distress is counted for that slab.

**Figure A-86 Low-Severity Divided Slab**



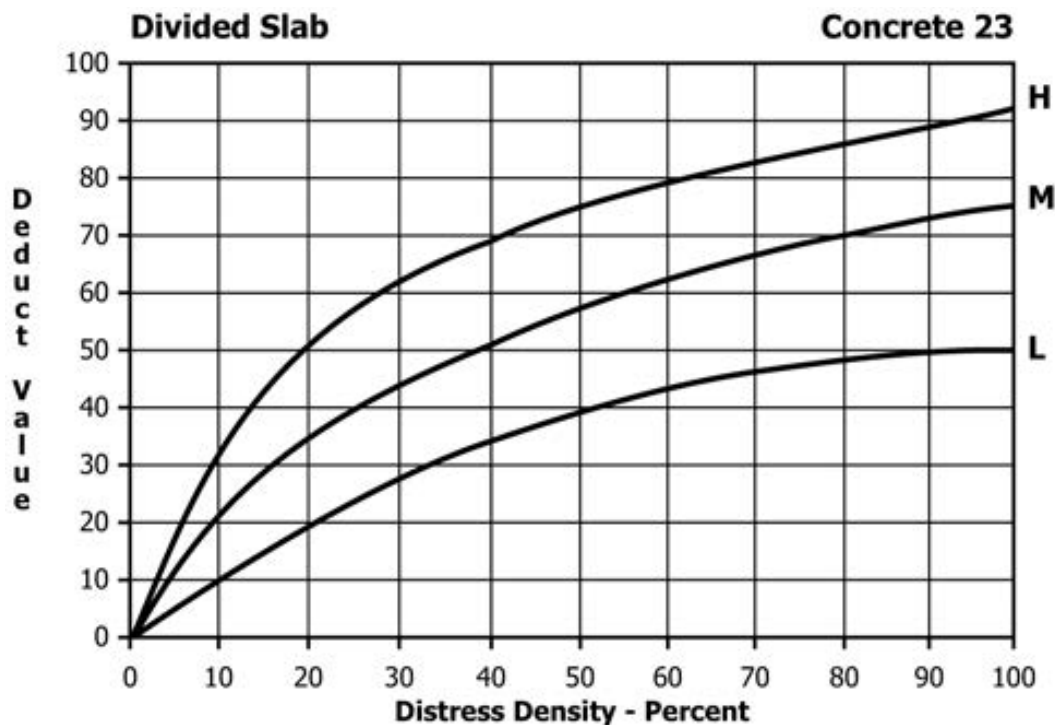
**Figure A-87 Medium-Severity Divided Slab**



**Figure A-88 High-Severity Divided Slab**



Figure A-89 Divided Slab Deduct Curve



#### A-3.4 Durability ("D") Cracking (24).

"D" cracking is caused by freeze-thaw expansion of the large aggregate which, over time, gradually breaks down the concrete. This distress usually appears as a pattern of cracks running parallel and close to a joint or linear crack. Since the concrete becomes saturated near joints and cracks, a dark-colored deposit can usually be found around fine "D" cracks. This type of distress may eventually lead to disintegration of the entire slab.

##### A-3.4.1 Severity Levels.

**L** "D" cracks cover less than 15 percent of slab area. Most of the cracks are tight, but a few pieces may be loose and/or missing.

**M** One of the following conditions exist: (1) "D" cracks cover less than 15 percent of the area and most of the pieces are loose and/or missing, or (2) "D" cracks cover more than 15 percent of the area and most of the cracks are tight, but a few pieces may be loose or missing.

**H** "D" cracks cover more than 15 percent of the area and most of the pieces have come out or could be easily removed.

**A-3.4.2 How to Count.**

When the distress is located and rated at one severity, it is counted as one slab. If more than one severity level exists, the slab is counted as having the higher severity distress. For example, if low- and medium-severity "D" cracking are on the same slab, the slab is counted as medium-severity cracking only.

**Figure A-90 Low-Severity Durability Cracking**



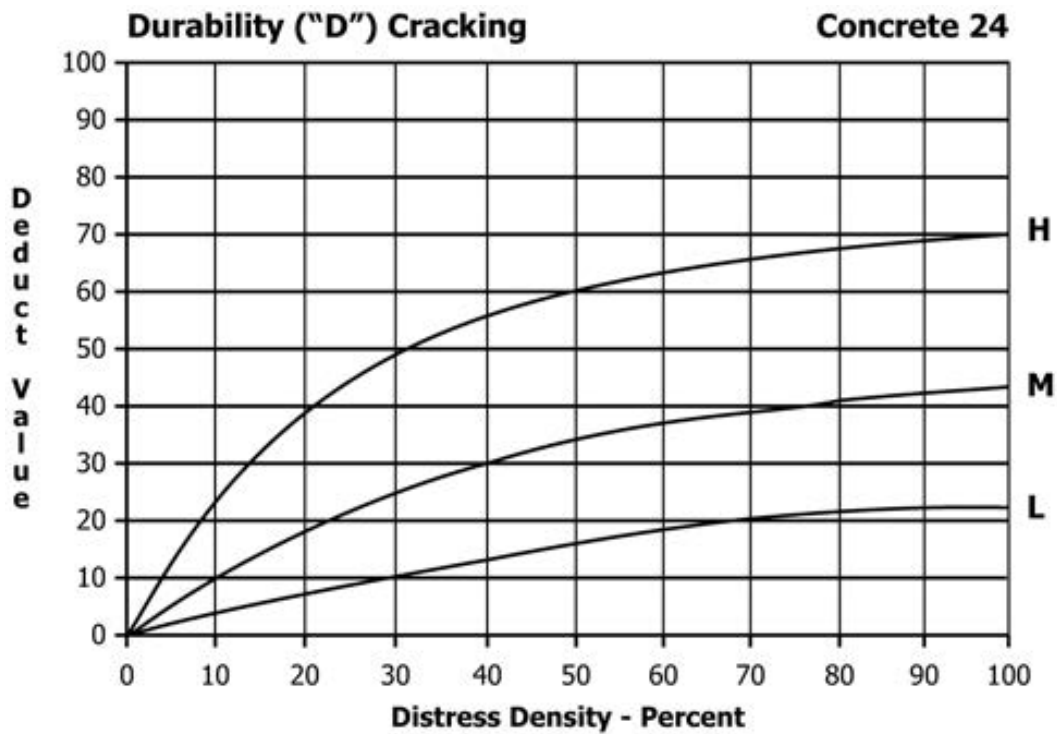
**Figure A-91 Medium-Severity Durability Cracking**



Figure A-92 High-Severity Durability Cracking



Figure A-93 Durability Cracking Deduct Curve



### A-3.5 Faulting (25).

Some common causes of faulting are:

- Settlement because of soft foundation.
- Pumping or eroding of material from under the slab.
- Curling of the slab edges due to temperature and moisture changes.

#### A-3.5.1 Severity Levels.

Severity levels are defined by the difference in elevation across the joint.

**L** Difference in elevation is  $> 0.125$  and  $\leq 0.375$  inch ( $> 3$  and  $\leq 10$  millimeters).

**M** Difference in elevation is  $> 0.375$  and  $\leq 0.75$  inch ( $> 10$  and  $\leq 19$  millimeters).

**H** Difference in elevation is  $> 0.75$  inch ( $> 19$  millimeters).

#### A-3.5.2 How to Count.

Faulting across a joint is counted as one slab. Only affected slabs are counted. Faults across a crack are not counted as a distress but are considered when defining crack severity.

**Figure A-94 Low-Severity Faulting**



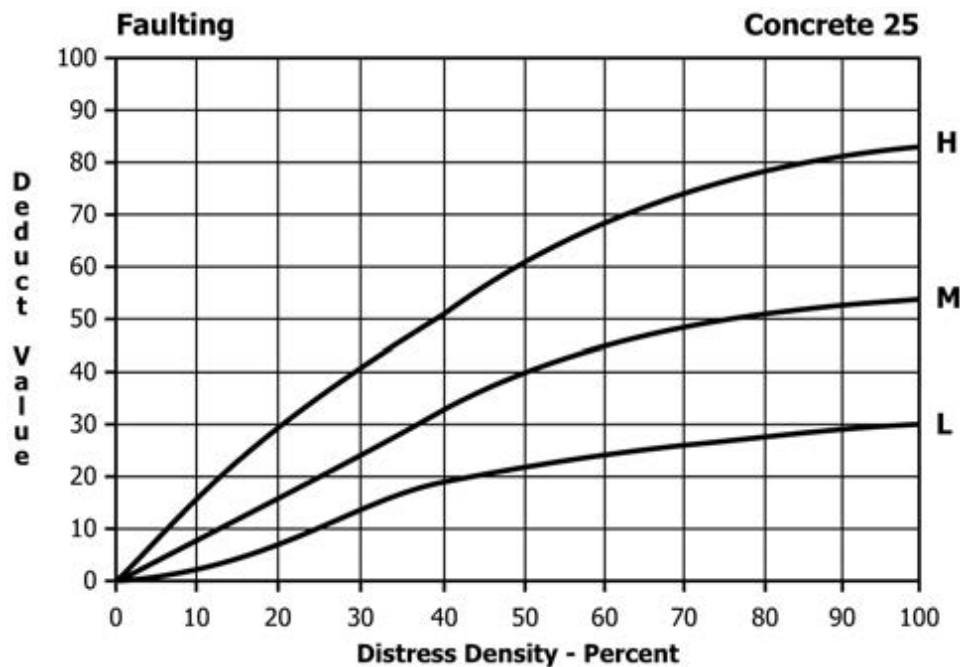
**Figure A-95 Medium-Severity Faulting**



**Figure A-96 High-Severity Faulting**



Figure A-97 Faulting Deduct Curve



### A-3.6 Joint Seal Damage (26).

Joint seal damage is any condition that enables soil or rocks to accumulate in the joints or allows significant water infiltration. Accumulation of incompressible materials prevents the slab from expanding and may result in buckling, shattering, or spalling. A pliable joint filler bonded to the edges of the slabs protects the joints from material accumulation and prevents water from seeping down and softening the foundation supporting the slab. Typical types of joint seal damage are:

- Stripping of joint sealant
- Extrusion of joint sealant
- Weed growth
- Hardening of the filler (oxidation)
- Loss of bond to the slab edges
- Lack or absence of sealant in the joint

#### A-3.6.1 Severity Levels.

**L** Joint sealant is in generally good condition throughout the section. Sealant is performing well, with only minor damage. Joint seal damage is at low severity if a few of the joints have sealer that has debonded from, but is still in contact with, the joint edge. This condition exists if a knife blade can be inserted between sealer and joint face without resistance.

**M** Joint sealant is in generally fair condition over the entire section, with one or more of the above types of damage to a moderate degree. Sealant needs replacement within two years. Joint seal damage is at medium severity if a few of the joints have any of the following conditions: (a) joint sealer is in place, but water access is possible through visible openings no more than 0.125 inch (3 millimeters) wide. If a knife blade cannot be inserted easily between sealer and joint face, this condition does not exist; (b) pumping debris are evident at the joint; (c) joint sealer is oxidized and "lifeless" but pliable (like a rope), and generally fills the joint opening; or (d) vegetation in the joint is obvious but does not obscure the joint opening.

**H** Joint sealant is in generally poor condition over the entire section, with one or more of the above types of damage to a severe degree. Sealant needs immediate replacement. Joint seal damage is at high severity if 10 percent or more of the joint sealer exceeds limiting criteria listed above, or if 10 percent or more of sealer is missing.

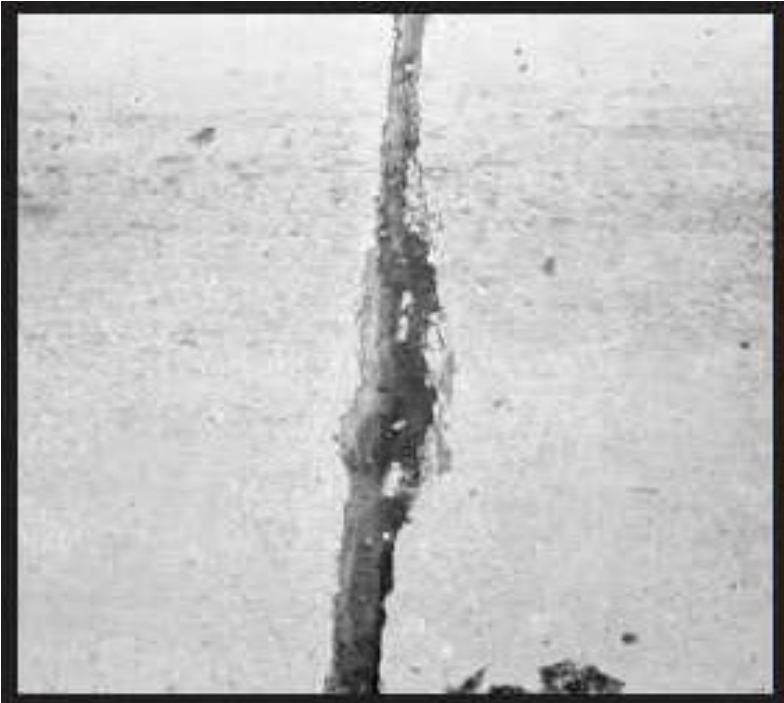
#### **A-3.6.2 How to Count.**

Joint seal damage is not counted on a slab-by-slab basis but is rated based on the overall condition of the sealant over the entire area.

**Figure A-98 Low-Severity Joint Seal Damage**



**Figure A-99 Medium-Severity Joint Seal Damage**



**Figure A-100 High-Severity Joint Seal Damage**



**Figure A-101 Joint Seal Damage Deduct Values**

| <b>Joint Seal Damage</b>   |                     | <b>Concrete 26</b> |
|--|---------------------|--------------------|
| Joint Seal damage is not rated by density. The severity of the distress is determined by the sealant's overall condition for a particular sample unit. The deduct values for the three levels of severity are: |                     |                    |
| <b>Severity</b>  | <b>Deduct Value</b> |                    |
| Low  | 2                   |                    |
| Medium   | 4                   |                    |
| High   | 8                   |                    |

**A-3.7 Lane/Shoulder Drop-Off (27).**

Lane/shoulder drop-off is the difference between the settlement or erosion of the shoulder and the pavement travel-lane edge. The elevation difference can be a safety hazard; it can also cause increased water infiltration.

**A-3.7.1 Severity Levels.**

**L** The difference between the pavement edge and shoulder is  $> 1$  and  $\leq 2$  inches ( $> 25$  and  $\leq 50$  millimeters).

**M** The difference in elevation is  $> 2$  and  $\leq 4$  inches ( $> 50$  and  $\leq 100$  millimeters).

**H** The difference in elevation is  $> 4$  inches ( $> 100$  millimeters).

**A-3.7.2 How to Count.**

The mean lane/shoulder drop-off is computed by averaging the maximum and minimum drop along the slab. Each slab exhibiting distress is measured separately and counted as one slab with the appropriate severity level.

Figure A-102 Low-Severity Lane/Shoulder Drop-off



Figure A-103 Medium-Severity Lane/Shoulder Drop-off

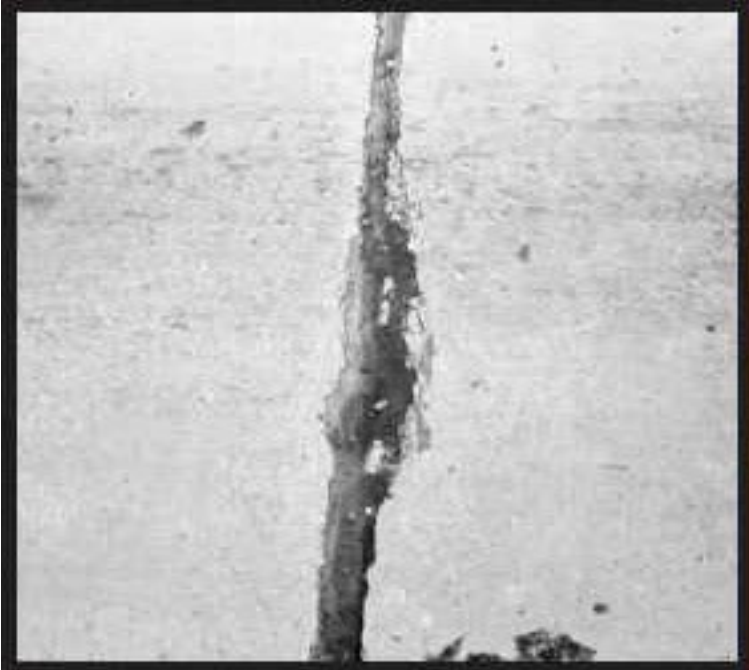
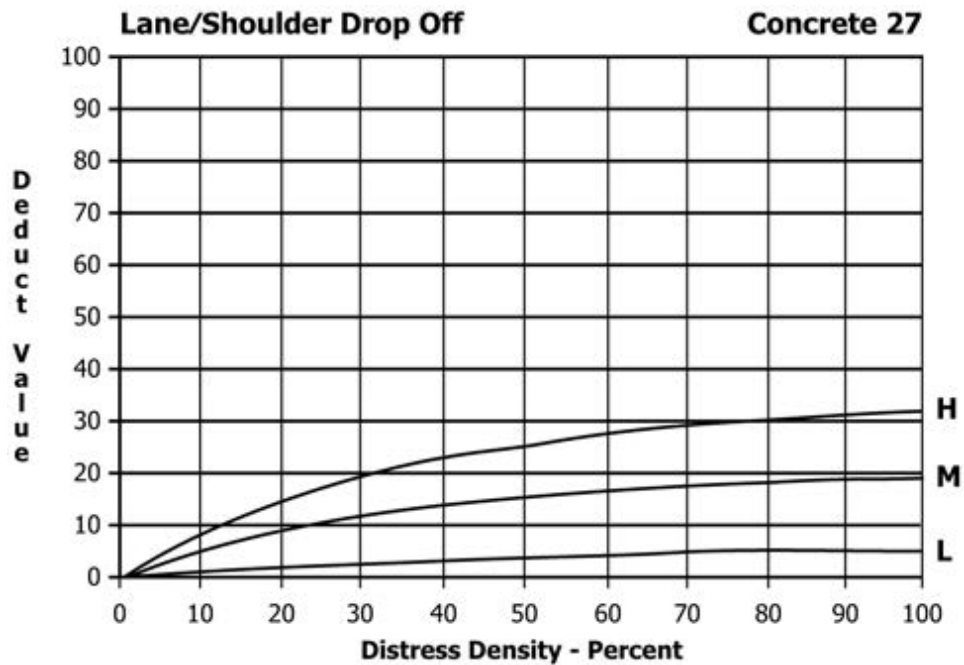


Figure A-104 High-Severity Lane/Shoulder Drop-off



Figure A-105 Lane/Shoulder Drop-off Deduct Curve



### **A-3.8 Linear Cracking (28).**

Linear cracking includes longitudinal, transverse, and diagonal cracks. These cracks divide the slab into two or three pieces and are usually caused by a combination of repeated traffic loading, thermal gradient curling, and repeated moisture loading. Slabs divided into four or more pieces are counted as divided slabs. Hairline cracks only a few feet long and not extending across the entire slab are counted as shrinkage cracks.

#### **A-3.8.1 Severity Levels.**

##### **A-3.8.1.1 Plain PCC Slabs.**

**L** Non-filled cracks  $\leq 0.5$  inch (13 millimeters) wide or filled cracks of any width with the filler in satisfactory condition. No faulting exists.

**M** One of the following conditions exists: (1) non-filled crack with a width  $> 0.5$  and  $\leq 2$  inches ( $> 13$  and  $\leq 50$  millimeters); (2) non-filled crack of any width  $\leq 2$  inches (50 millimeters) with faulting of  $\leq 0.375$  inch (10 millimeters); or (3) filled crack of any width with faulting  $\leq 0.375$  inch (10 millimeters).

**H** One of the following conditions exists: (1) non-filled crack with a width  $> 2$  inches (50 millimeters) or (2) filled or non-filled crack of any width with faulting  $> 0.375$  inch (10 millimeters).

Filled cracks with unsatisfactory filler are treated as non-filled cracks.

##### **A-3.8.1.2 Reinforced PCC Slabs.**

**L** Non-filled cracks  $\geq 0.125$  and  $< 1$  inch ( $\geq 3$  and  $< 25$  millimeters) wide; filled crack of any width with the filler in satisfactory condition. No faulting exists.

**M** One of the following conditions exists: (1) non-filled cracks with a width  $\geq 1$  and  $\leq 3$  inches ( $\geq 25$  and  $\leq 75$  millimeters) and no faulting; (2) non-filled crack of any width  $\leq 3$  inches (75 millimeters) with  $< 0.375$  inch (10 millimeters) of faulting; or (3) filled crack of any width with  $\leq 0.375$  inch (10 millimeters) faulting.

**H** One of the following conditions exists: (1) non-filled crack  $> 3$  inches (75 millimeters) wide or (2) filled or non-filled crack of any width with faulting  $> 0.375$  inch (10 millimeters).

Filled cracks with unsatisfactory filler are treated as non-filled cracks.

#### **A-3.8.2 How to Count.**

After severity has been identified, the distress is recorded as one slab. If two medium-severity cracks fall within one slab, the slab is counted as having one high-severity crack. Slabs divided into four or more pieces are counted as divided slabs. In reinforced slabs, cracks  $< 0.125$  inch (3 millimeters) wide are counted as shrinkage cracks. Slabs

longer than 29.5 feet (9 meters) are divided into “virtual slabs” of approximately equal length, with joints assumed to be in perfect condition.

**Figure A-106 Low-Severity Linear Cracking**



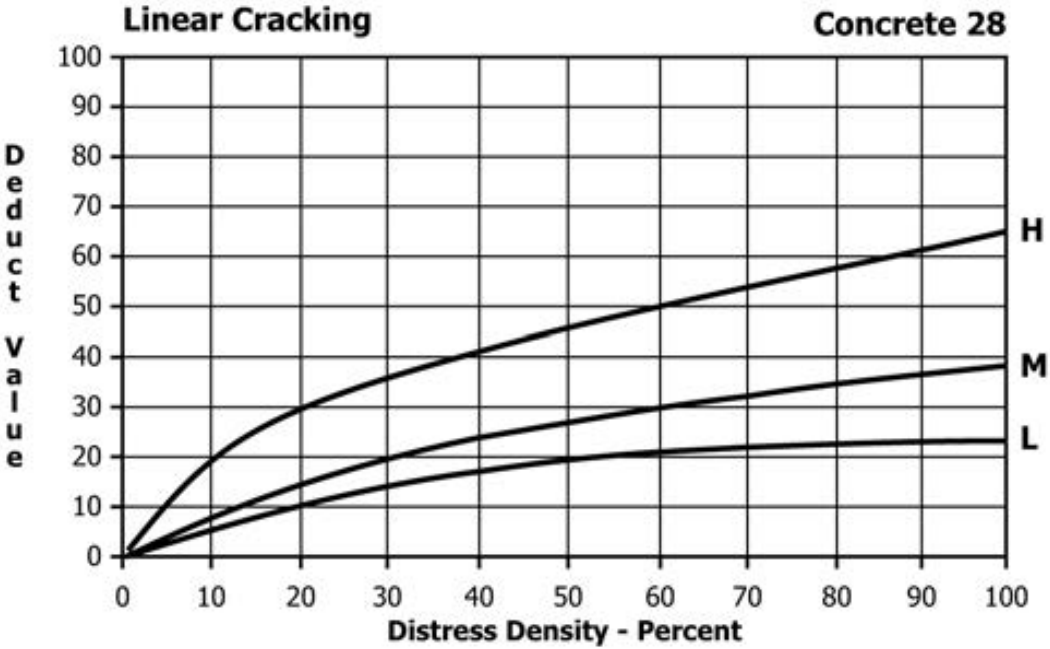
**Figure A-107 Medium-Severity Linear Cracking**



Figure A-108 High-Severity Linear Cracking



Figure A-109 Linear Cracking Deduct Curve



### **A-3.9 Large Patches and Utility Cuts (29).**

The large patches and utility cuts distress includes patches more than 5.5 square feet (0.5 square meter). A patch is an area where the original pavement has been removed and replaced by filler material. A utility cut is a patch that has replaced the original pavement to allow the installation or maintenance of underground utilities. The severity levels of a utility cut are assessed according to the same criteria as large patching.

#### **A-3.9.1 Severity Levels.**

**L** Patch is functioning well, with little or no deterioration.

**M** Patch is moderately deteriorated and/or moderate spalling can be seen around the edges. Patch material can be dislodged with considerable effort.

**H** Patch is badly deteriorated. The extent of the deterioration warrants replacement.

#### **A-3.9.2 How to Count.**

If a single slab has one or more patches with the same severity level, it is counted as one slab containing that distress. If a single slab has more than one severity level, it is counted as one slab with the higher severity level.

**Figure A-110 Low-Severity Large Patch and Utility Cut**



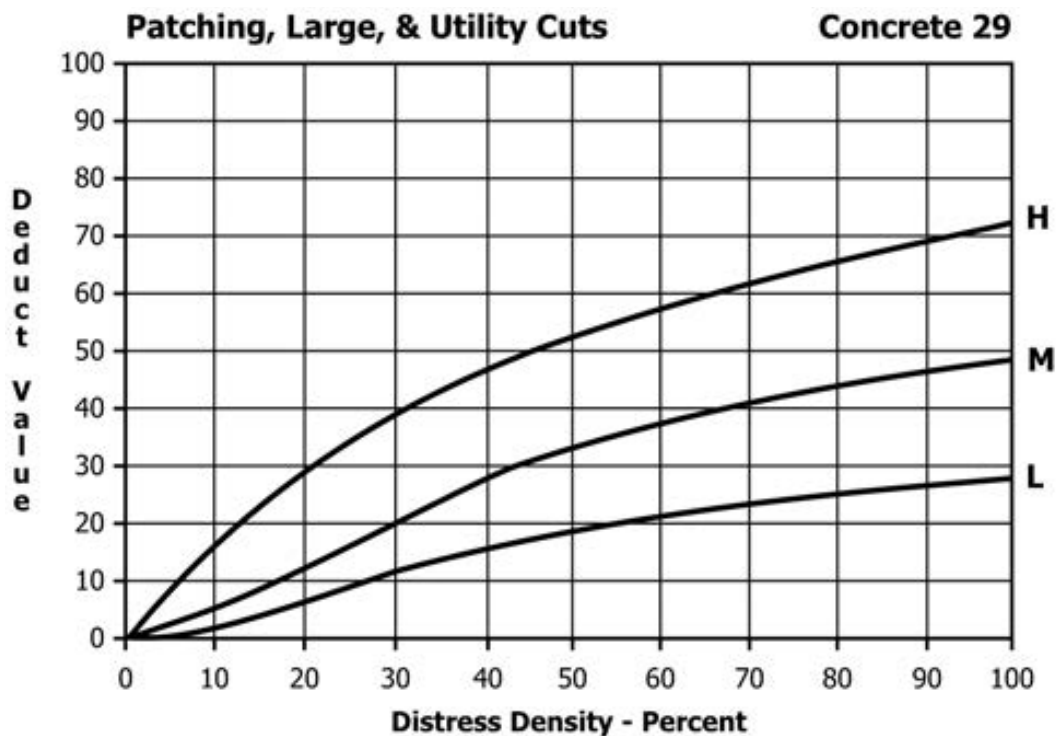
**Figure A-111 Medium-Severity Large Patch and Utility Cut**



**Figure A-112 High-Severity Large Patch and Utility Cut**



Figure A-113 Large Patch and Utility Cut Deduct Curve



**A-3.10 Small Patch (30).**

A patch is an area where the original pavement has been removed and replaced by a filler material.

**A-3.10.1 Severity Levels.**

**L** Patch is functioning well with little or no deterioration.

**M** Patch is moderately deteriorated. Patch material can be dislodged with considerable effort.

**H** Patch is badly deteriorated. The extent of deterioration warrants replacement.

**A-3.10.2 How to Count.**

If a single slab has one or more patches with the same severity level, it is counted as one slab containing that distress. If a single slab has more than one severity level, it is counted as one slab with the higher severity level.

Figure A-114 Low-Severity Small Patch



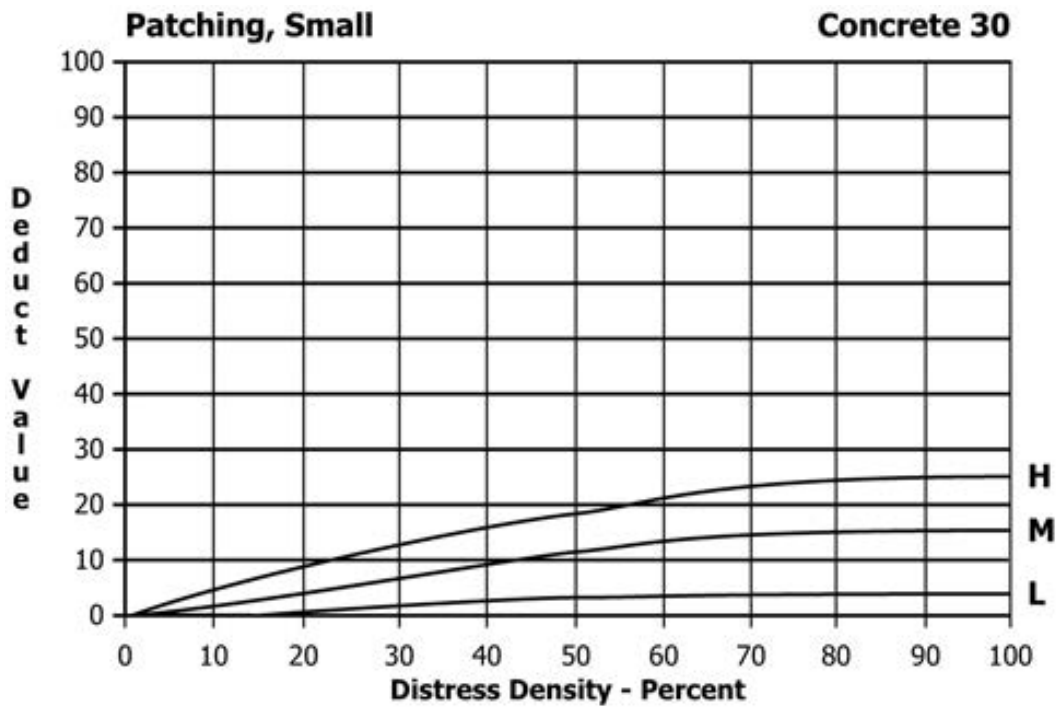
Figure A-115 Medium-Severity Small Patch



Figure A-116 High-Severity Small Patch



Figure A-117 Small Patch Deduct Curve



**A-3.11 Polished Aggregate (31).**

This distress is caused by repeated traffic applications. Polished aggregate is present when close examination of a pavement reveals that the portion of aggregate extending above the asphalt is either very small or there are no rough or angular aggregate particles to provide good skid resistance.

**A-3.11.1 Severity Levels.**

No degrees of severity are defined. However, the degree of polishing should be significant before it is included in the condition survey and rated as a defect.

**A-3.11.2 How to Count.**

A slab with polished aggregate is counted as one slab.

**Figure A-118 Polished Aggregate**

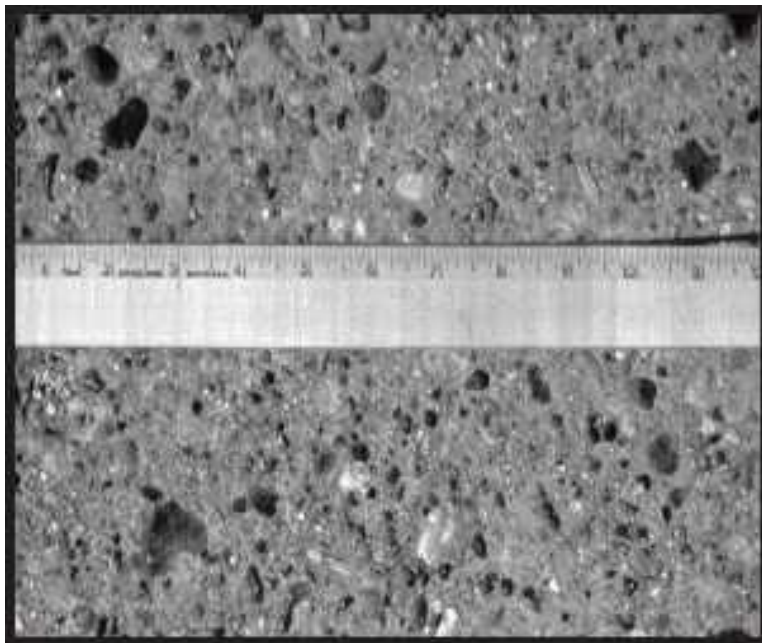
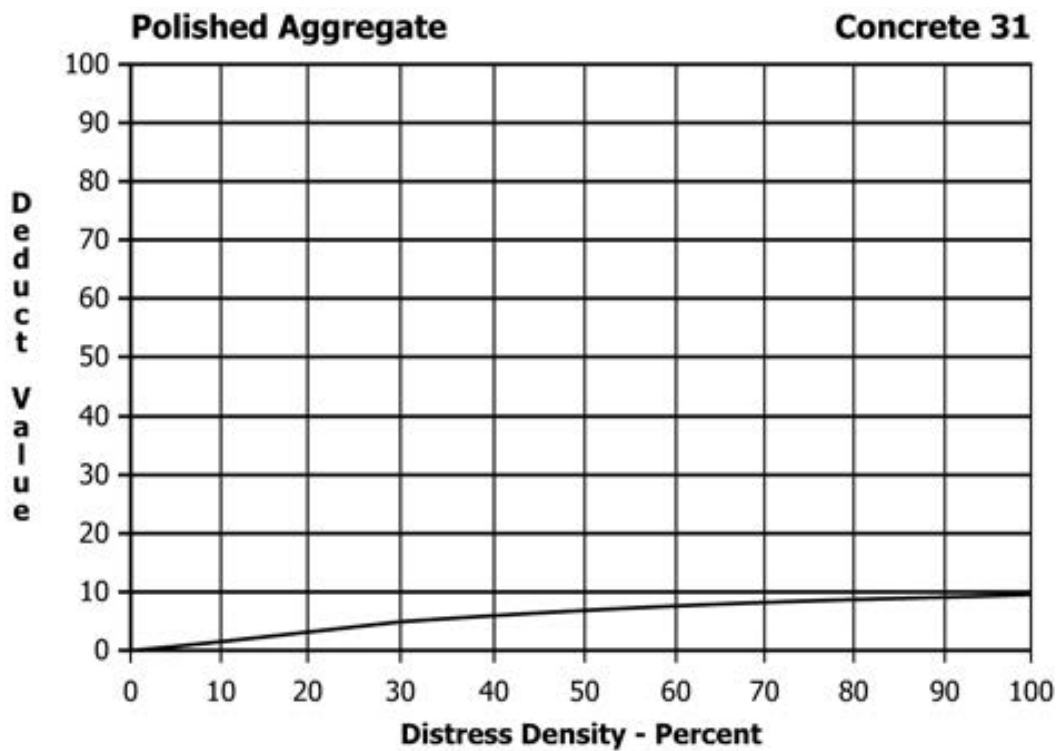


Figure A-119 Polished Aggregate Deduct Curve



**A-3.12 Popouts (32).**

A popout is a small piece of pavement that breaks loose from the surface due to freeze-thaw action, combined with expansive aggregates. Popouts usually range in diameter from approximately 1 to 4 inches (25 to 100 millimeters) and in depth from 0.5 to 2 inches (13 to 50 millimeters).

**A-3.12.1 Severity Levels.**

No degrees of severity are defined for popouts. However, popouts must be extensive before they are counted as a distress. Average popout density must exceed approximately three popouts per square yard (square meter) over the entire slab area.

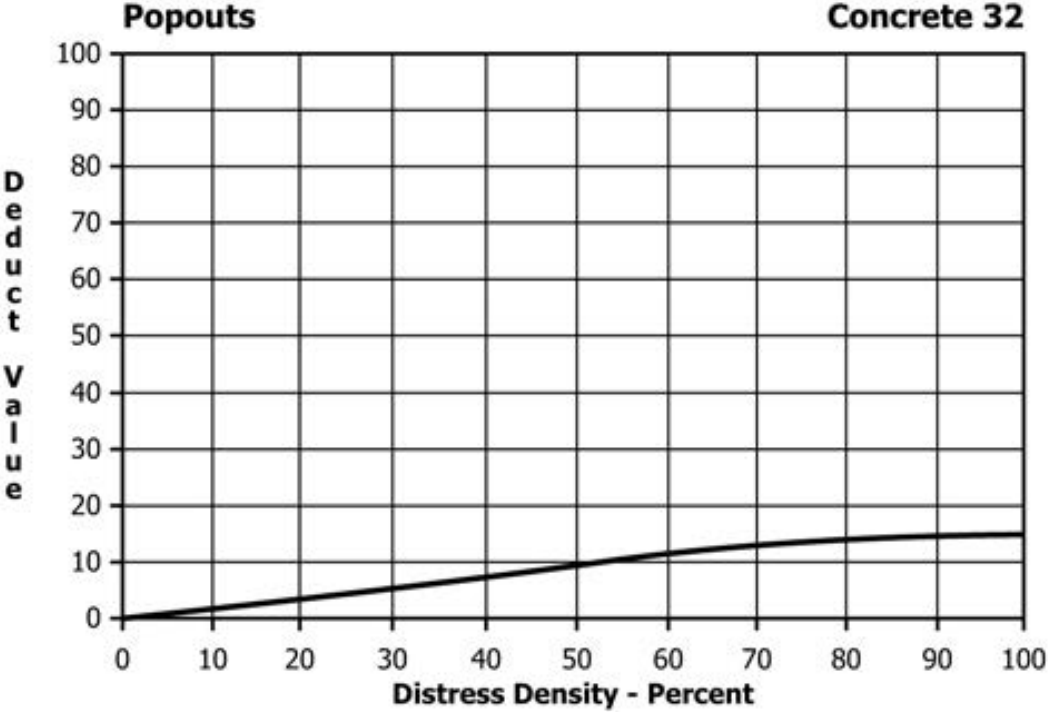
**A-3.12.2 How to Count.**

The density of the distress must be measured. If there is any doubt that the average is greater than three popouts per square yard (square meter), at least three random 11 square feet (1 square meter) areas should be checked. When the average is greater than this density, the slab should be counted.

Figure A-120 Popouts



Figure A-121 Popouts Deduct Curve



### **A-3.13 Pumping (33).**

Pumping is the ejection of material from the slab foundation through joints or cracks. This is caused by deflection of the slab with passing loads. As a load moves across the joint between the slabs, water is first forced under the leading slab and then forced back under the trailing slab. This action erodes and eventually removes soil particles, resulting in progressive loss of pavement support. Pumping can be identified by surface stains and evidence of base or subgrade material on the pavement close to joints or cracks. Pumping near joints is caused by poor joint sealer and indicates loss of support; repeated loading will eventually produce cracks. Pumping can also occur along the slab edge, causing loss of support.

#### **A-1.1.1 Severity Levels.**

No degrees of severity are defined. It is enough to indicate that pumping exists.

#### **A-3.13.1 How to Count.**

One pumping joint between two slabs is counted as two slabs. However, if the remaining joints around the slab are also pumping, one slab is added per additional pumping joint.

**Figure A-122 Pumping**



Figure A-123 Pumping

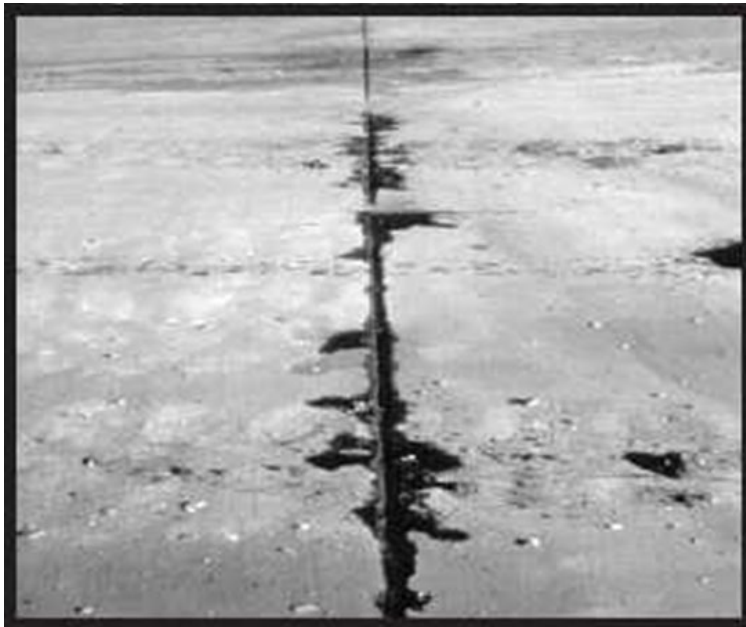
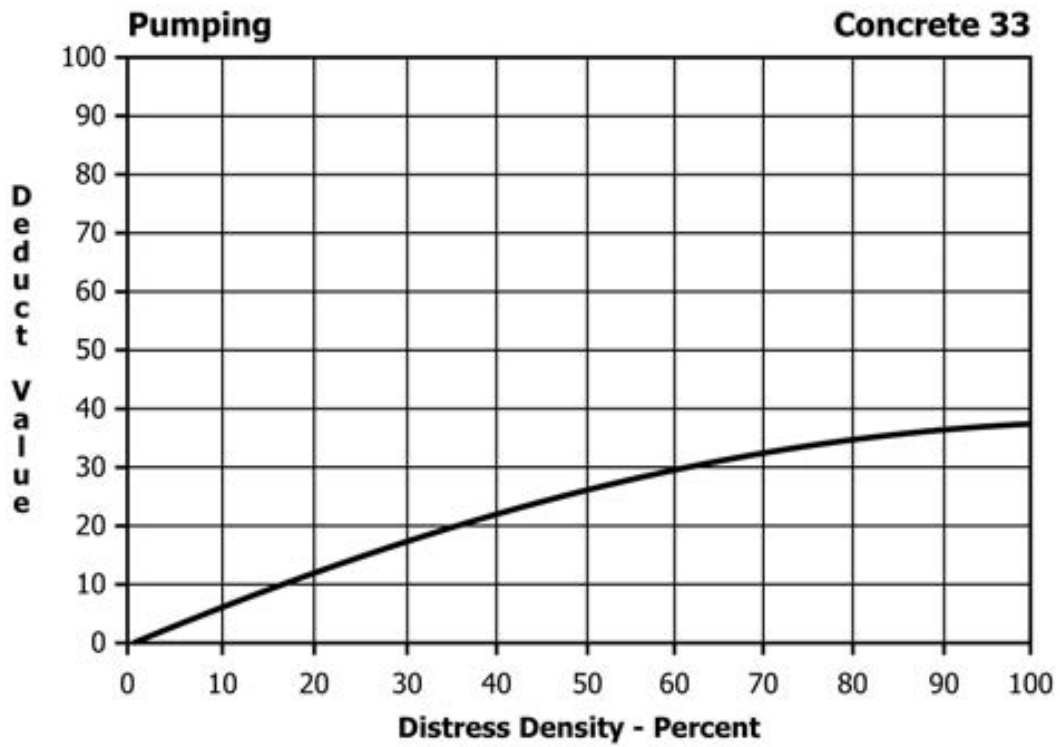


Figure A-124 Pumping Deduct Curve



**A-3.14 Punchout (34).**

This distress is a localized area of the slab that is broken into pieces. The punchout can take many different shapes and forms, but it is usually defined by a crack and a joint. The distance between the joint and the crack or two closely spaced cracks is < 5 feet (1.5 meters) wide. This distress is caused by heavy repeated loads, inadequate slab thickness, loss of foundation support, and/or a localized concrete construction deficiency (e.g., honeycombing).

**A-3.14.1 Severity Levels.**

Table A-7 lists the severity levels for punchouts.

**Table A-7 Punchout Severity Levels**

| Severity Of Majority Of Cracks | Number Of Pieces |        |             |
|--------------------------------|------------------|--------|-------------|
|                                | 2 to 3           | 4 to 5 | More than 5 |
| L                              | L                | L      | M           |
| M                              | L                | M      | H           |
| H                              | M                | H      | H           |

**A-3.14.2 How to Count.**

If a slab contains more than one punchout or a punchout and a crack, it is counted as shattered.

Figure A-125 Low-Severity Punchout



Figure A-126 Medium-Severity Punchout



Figure A-127 High-Severity Punchout

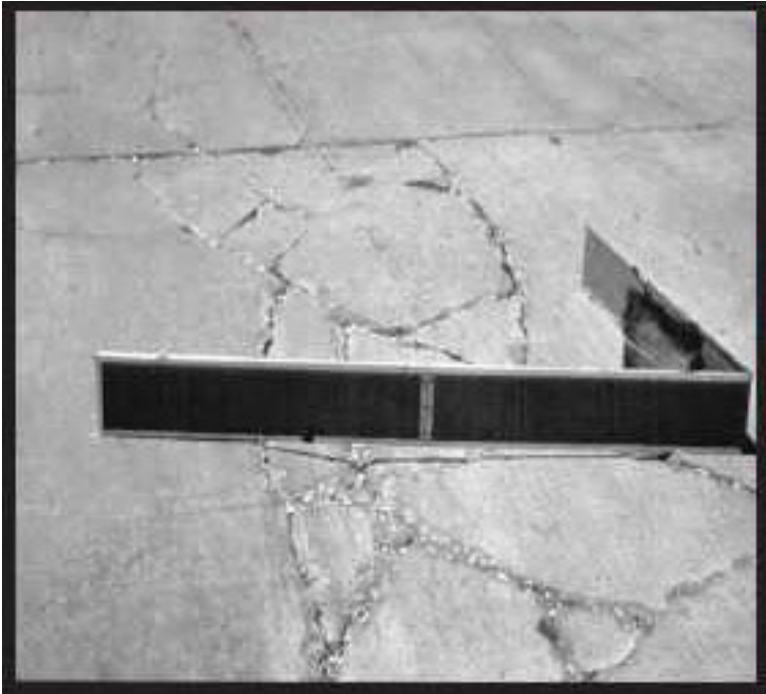
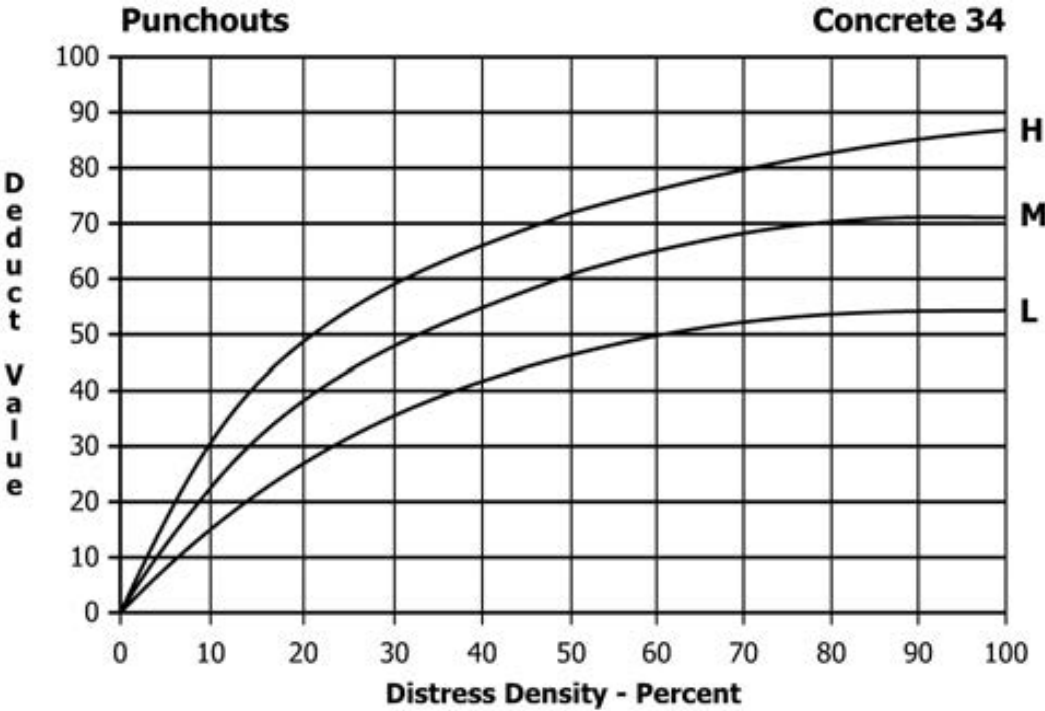


Figure A-128 Punchout Deduct Curve



**A-3.15 Railroad Crossing (35).**

Railroad crossing distress is characterized by depressions or bumps around the tracks.

**A-3.15.1 Severity Levels.**

**L** Railroad crossing causes low-severity ride quality.\*

**M** Railroad crossing causes medium-severity ride quality.\*

**H** Railroad crossing causes high-severity ride quality.\*

\* See Table A-5 for ride quality definition.

**A-3.15.2 How to Count.**

The number of slabs crossed by the railroad tracks are counted. Any large bump created by the tracks should be counted as part of the crossing.

**Figure A-129 Low-Severity Railroad Crossing**



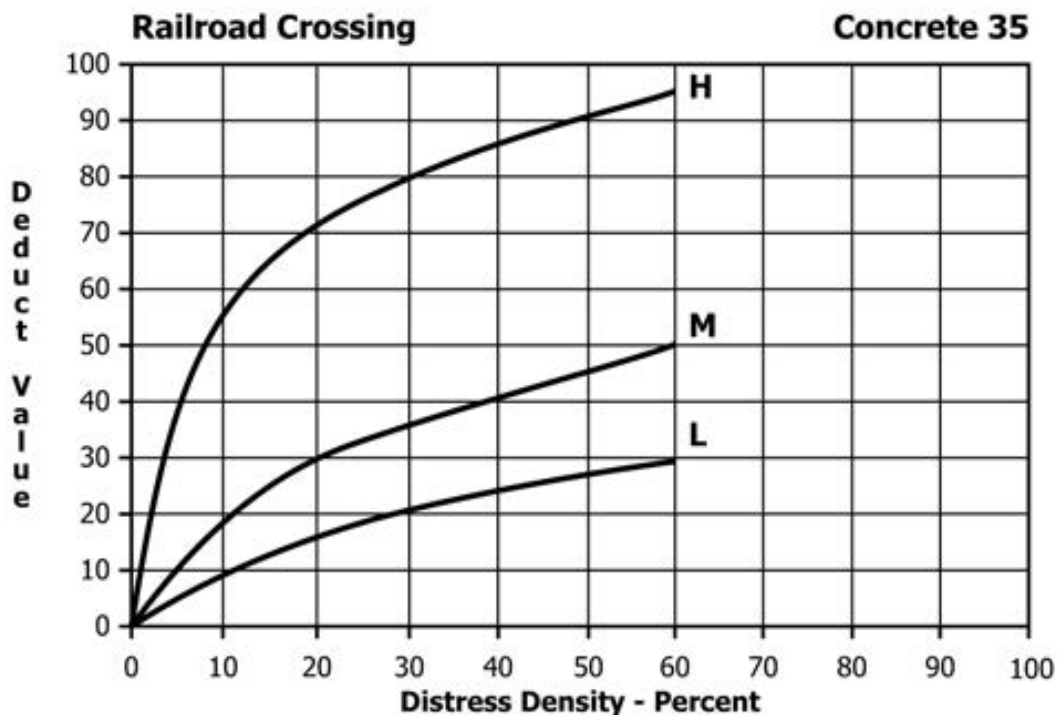
**Figure A-130 Medium-Severity Railroad Crossing**



**Figure A-131 High-Severity Railroad Crossing**



Figure A-132 Railroad Crossing Deduct Curve



### A-3.16 Scaling, Map Cracking, and Crazeing (36).

Map cracking or crazing refers to a network of shallow, fine, or hairline cracks that extend only through the upper surface of the concrete. The cracks tend to intersect at angles of 120 degrees. Map cracking or crazing is usually caused by concrete over-finishing, and may lead to surface scaling, which is the breakdown of the slab surface to a depth of approximately 0.25 to 0.5 inch (6 to 13 millimeters). Scaling may also be caused by deicing salts, improper construction, freeze-thaw cycles, and poor aggregate. The type of scaling defined here is not caused by "D" cracking. If scaling is caused by "D" cracking, it should be counted under that distress only.

#### A-3.16.1 Severity Levels.

**L** Crazeing or map cracking exists over most of the slab area; the surface is in good condition, with only minor scaling present.

**M** Slab is scaled, but less than 15 percent of the slab is affected.

**H** Slab is scaled over more than 15 percent of its area.

#### A-3.16.2 How to Count.

A scaled slab is counted as one slab. Low-severity crazing should only be counted if the potential for scaling appears to be imminent or a few small pieces come out.

**Figure A-133 Low-Severity Scaling**



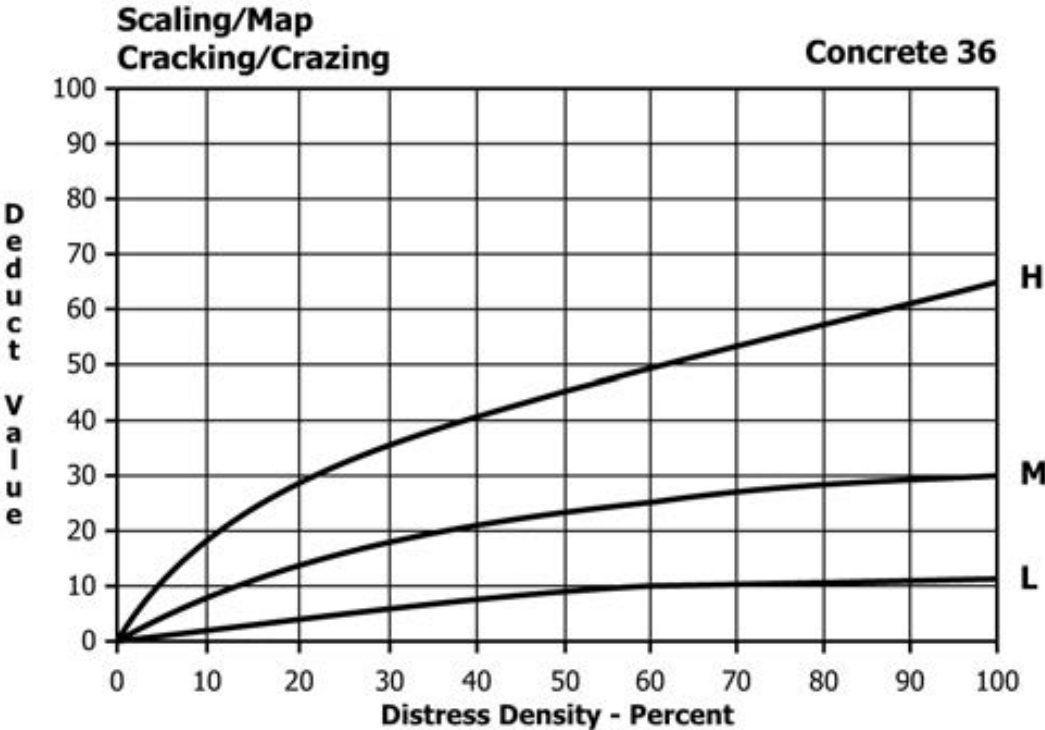
**Figure A-134 Medium-Severity Scaling**



Figure A-135 High-Severity Scaling



Figure A-136 Scaling, Map Cracking, and Crazeing Deduct Curve



**A-3.17 Shrinkage Cracks (37).**

Shrinkage cracks are hairline cracks that are usually less than 6.5 feet (2 meters) long and do not extend across the entire slab. They are formed during the setting and curing of the concrete and usually do not extend through the depth of the slab.

**A-3.17.1 Severity Levels.**

No degrees of severity are defined. It is enough to indicate that shrinkage cracks are present.

**A-3.17.2 How to Count.**

If any shrinkage cracks exist on a particular slab, the slab is counted as one slab with shrinkage cracks.

**Figure A-137 Shrinkage Cracks**

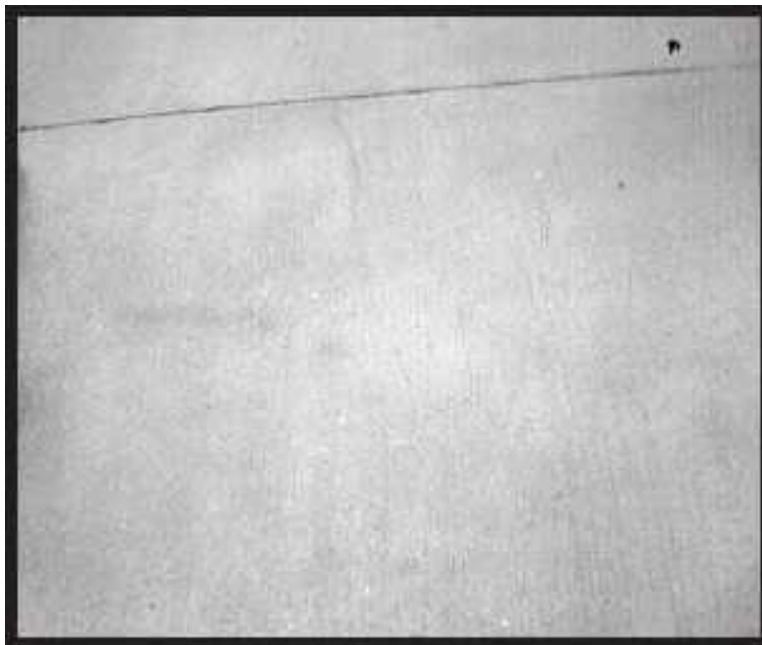
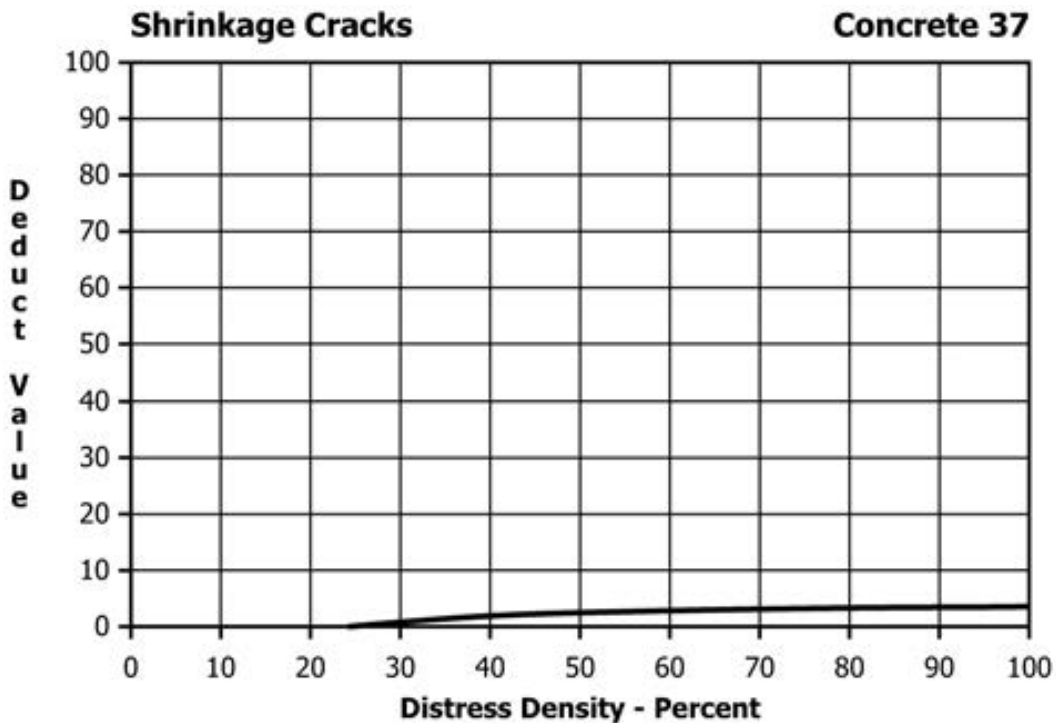


Figure A-138 Shrinkage Crack Deduct Curve



**A-3.18 Corner Spalling (38).**

Corner spalling is the breakdown of the slab within approximately 1.5 feet (0.5 meter) of the corner. A corner spall differs from a corner break in that the spall usually angles downward to intersect the joint, whereas a break extends vertically through the slab corner. Spalls less than 5 inches (130 millimeters) from the crack to the corner on both sides should not be counted.

**A-3.18.1 Severity Levels.**

Table A-8 lists the levels of severity for corner spalling. Corner spalling with an area of less than 10 square inches (64.5 square centimeters) from the crack to the corner on both sides should not be counted.

Table A-8 Corner Spall Severity Levels

| Depth Of Spall               | Dimensions Of Sides Of Spall                            |                              |
|------------------------------|---|------------------------------|
|                              | 5 x 5 in. to 12 x 12 in. (130 x 130 mm to 300 x 300 mm) | > 12 x 12 in. (300 x 300 mm) |
| ≤ 1 in. (25 mm)              | L   | L                            |
| > 1 to ≤ 2 in. (25 to 50 mm) | L   | M                            |
| > 2 in. (50 mm)              | M   | H                            |

**A-3.18.2 How to Count.**

If one or more corner spalls with the same severity level are in a slab, the slab is counted as one slab with corner spalling. If more than one severity level occurs, it is counted as one slab with the higher severity level.

Figure A-139 Low-Severity Corner Spall



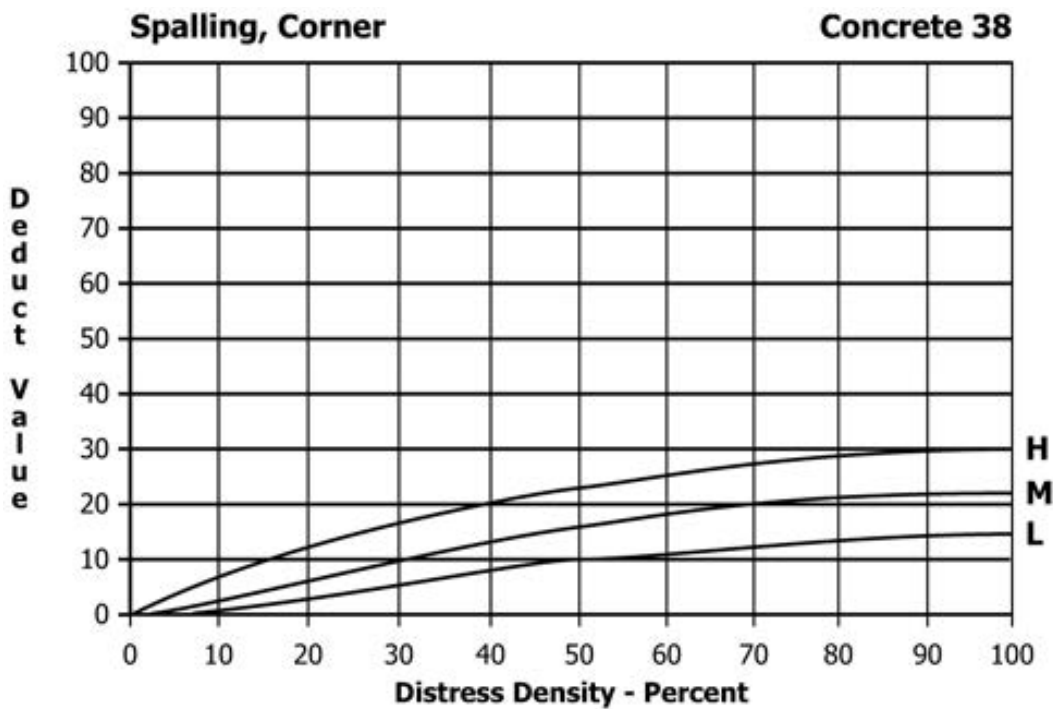
Figure A-140 Medium-Severity Corner Spall



Figure A-141 High-Severity Corner Spall



Figure A-142 Corner Spall Deduct Curve



**A-3.19 Joint Spalling (39).**

Joint spalling is the breakdown of the slab edges within 1.5 feet (0.5 meter) of the joint. A joint spall usually does not extend vertically through the slab but intersects the joint at an angle. Spalling results from:

- Excessive stresses at the joint caused by traffic loading or by infiltration of incompressible materials.
- Weak concrete at the joint caused by overworking.
- Water accumulation in the joint and freeze-thaw action.

**A-3.19.1 Severity Levels.**

Table A-9 shows the severity levels of joint spalling. A frayed joint where the concrete has been worn away along the entire joint is rated as low severity.

**Table A-9 Joint Spall Severity Levels**

| Spall Pieces  | Width of Spall      | Length of Spall   |                   |
|---|---------------------|-------------------|-------------------|
|   |                     | ≤ 2 ft<br>(0.6 m) | > 2 ft<br>(0.6 m) |
| Tight: Cannot be easily removed (maybe a few pieces missing)  | ≤ 4 in.<br>(102 mm) | L                 | L                 |
|   | > 4 in.             | L                 | L                 |
| Loose: Can be removed and some pieces are missing; if most or all pieces are missing, spall is shallow, less than 25 mm (1 in.) | ≤ 4 in.             | L                 | M                 |
|   | > 4 in.             | L                 | M                 |
| Missing: Most or all pieces have been removed   | ≤ 4 in.             | L                 | M                 |
|   | > 4 in.             | M                 | H                 |

**A-3.19.2 How to Count.**

If spall is along the edge of one slab, it is counted as one slab with joint spalling. If spalling is on more than one edge of the same slab, the edge having the highest severity is counted and recorded as one slab. Joint spalling can also occur along the edges of two adjacent slabs. If this is the case, each slab is counted as having joint spalling.

Figure A-143 Low-Severity Joint Spall



Figure A-144 Medium-Severity Joint Spall



Figure A-145 High-Severity Joint Spall



Figure A-146 Joint Spall Deduct Curve

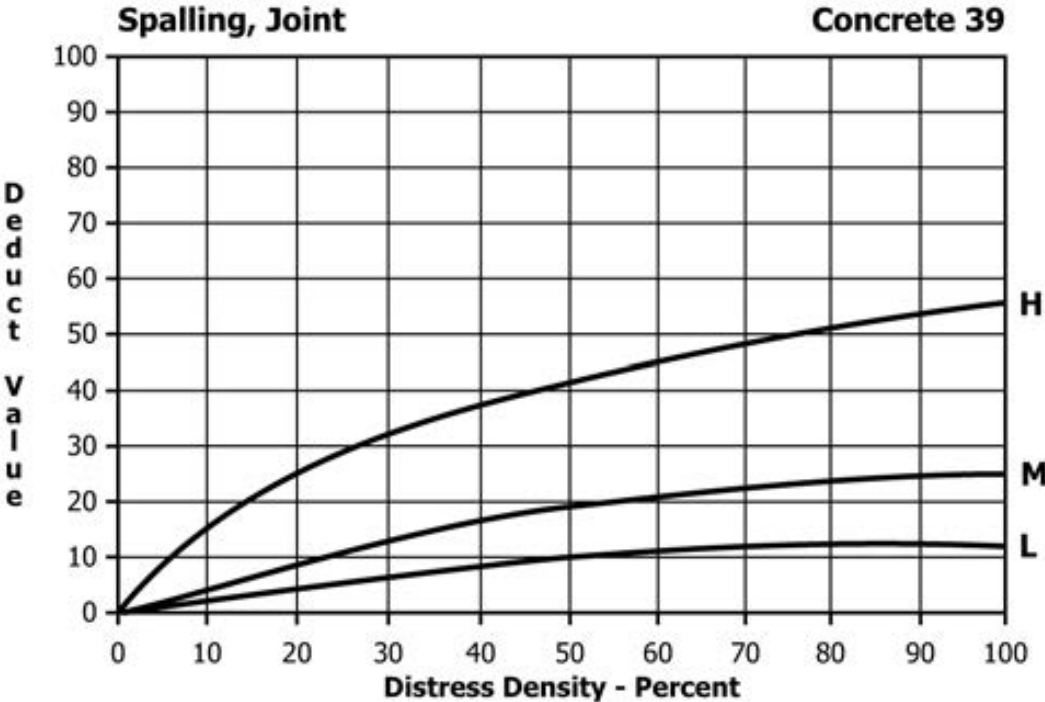
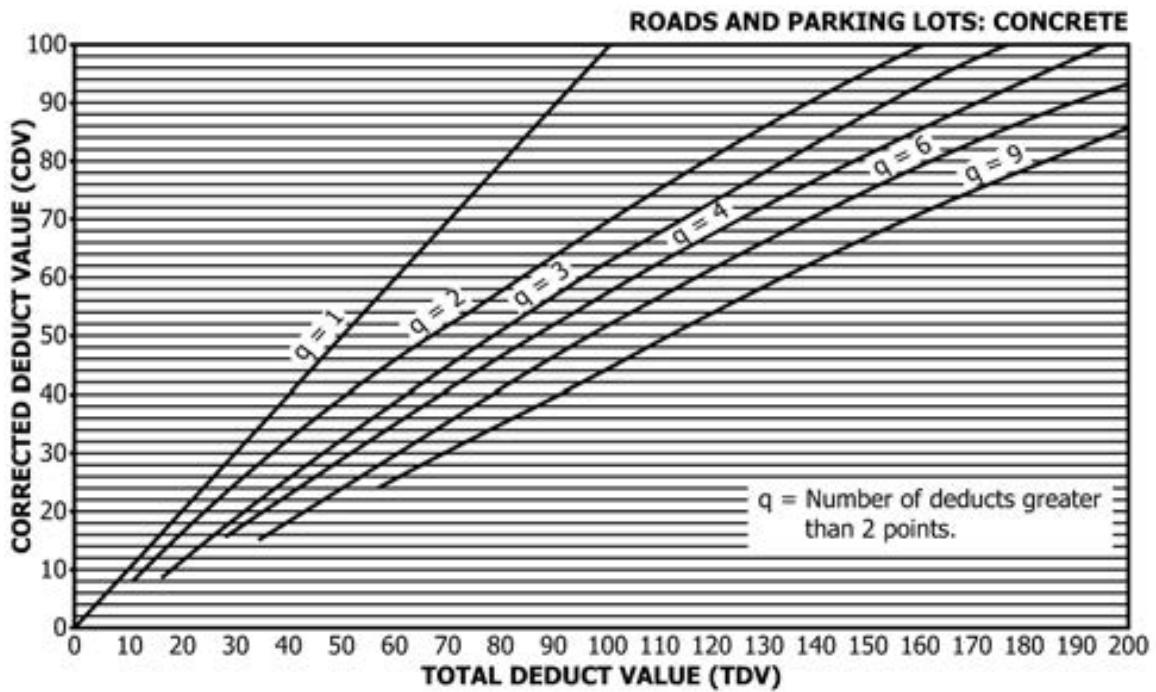


Figure A-147 Corrected Deduct Value Curve PCC Road and Parking Pavement



Corrected deduct values for jointed concrete pavement.

#### A-4 ASPHALT-SURFACED AIRFIELD DISTRESSES.

During the field condition surveys and validation of the PCI, several questions are commonly asked about the identification and measurement of some of the distresses. The answers to these questions for each distress are included under the heading "How to Measure." For convenience, however, the most frequently raised issues are addressed in Table A-10.

**Table A-10 Frequent Problems in Asphalt Pavement Distress Identification**

| <b>Situation</b>   | <b>Action</b>  | <b>Remarks</b>  |
|--|--|---|
| Spalling   | Used to define severity level  | Breaking of asphalt or loss of materials around cracks or joints  |
| Crack severity   | If a crack varies in severity along its entire length, record individual severity levels                                     | If severity levels cannot be divided easily into distinct portions, rate at the highest severity level                |
| Alligator cracking and rutting in same area  | Record each separately at respective severity level  |   |
| Bleeding counted in area   | Polished aggregate is not counted in same area   |   |
| Polished aggregate in very small amount  | Do not count   | Polished aggregate is only counted when there is a significant amount   |
| Any distress (including cracking) in a patched area  | Do not record  | Effect of distress is considered in patch severity level  |
| Block cracking is recorded   | If block cracking is recorded for asphalt pavements (not including AC over PCC), do not record L&T cracking in the same area |   |
| Asphalt overlay over concrete  | Block cracking and joint reflection cracking are recorded separately   | AC over PCC could have, for example, 100 percent block cracking and 100 feet (30 meters) of joint reflection cracking |
| Weathering (surface wear) and raveling in the same sample area                               | Weathering (surface wear) is not recorded if medium- or high-severity raveling is recorded                                   | Raveling is always recorded   |
| Surface treatment coming off   | Count as raveling  |   |
| Pavement is broken into pieces smaller than 1 ft by 1 ft (0.3 m by 0.3 m) throughout an area | If thin surface seal or painted area, count as raveling. If asphalt layer, count as high severity block cracking             | Type of surface material and depth of the cracks determine the distress type  |
| Broken or loose surficial material   | Increases FOD potential  | Increased possibility of material ingestion into an engine  |

#### **A-4.1 Alligator (Fatigue) Cracking (41).**

Alligator (or fatigue) cracking is a series of interconnecting cracks caused by fatigue failure of the asphalt surface under repeated traffic loading. The cracking initiates at the bottom of the asphalt surface (or stabilized base) where tensile stress and strain is highest under a wheel load. The cracks propagate to the surface initially as a series of parallel cracks. After repeated traffic loading, the cracks connect and form multi-sided, sharp-angled pieces that develop a pattern resembling chicken wire or the skin of an alligator. The pieces are less than 2 feet (0.6 meter) on the longest side. Alligator cracking occurs only in areas subjected to repeated traffic loadings, such as wheel paths; therefore, it would not occur over an entire area unless the entire area was subjected to traffic loading. (Pattern-type cracking that occurs over an entire area that is not subject to loading is rated as block cracking, which is not a load-associated distress.) Alligator cracking is considered a major structural distress.

##### **A-4.1.1 Severity Levels.**

**L** Fine, longitudinal hairline cracks running parallel to each other with no or only a few interconnecting cracks. The cracks are not spalled.

**M** Further development of light alligator cracking into a pattern or network of cracks that may be lightly spalled. Medium-severity alligator cracking is defined by a well-defined pattern of interconnecting cracks, where all pieces are securely held in place (i.e., good aggregate interlock between pieces).

**H** Network or pattern cracking progresses so pieces are well-defined and spalled at the edges; some of the pieces rock under traffic and may cause foreign object damage (FOD) potential.

##### **A-4.1.2 How to Measure.**

Alligator cracking is measured in square feet (square meters) of surface area. The major difficulty in measuring this type of distress is that often two or three levels of severity exist within one distressed area. If these portions can be easily distinguished from each other, measure and record separately; however, if the different levels of severity cannot be easily divided, rate the entire area at the highest severity level present. If alligator cracking and rutting occur in the same area, each is recorded separately at its respective severity level.

Figure A-148 Low-Severity Alligator Cracking



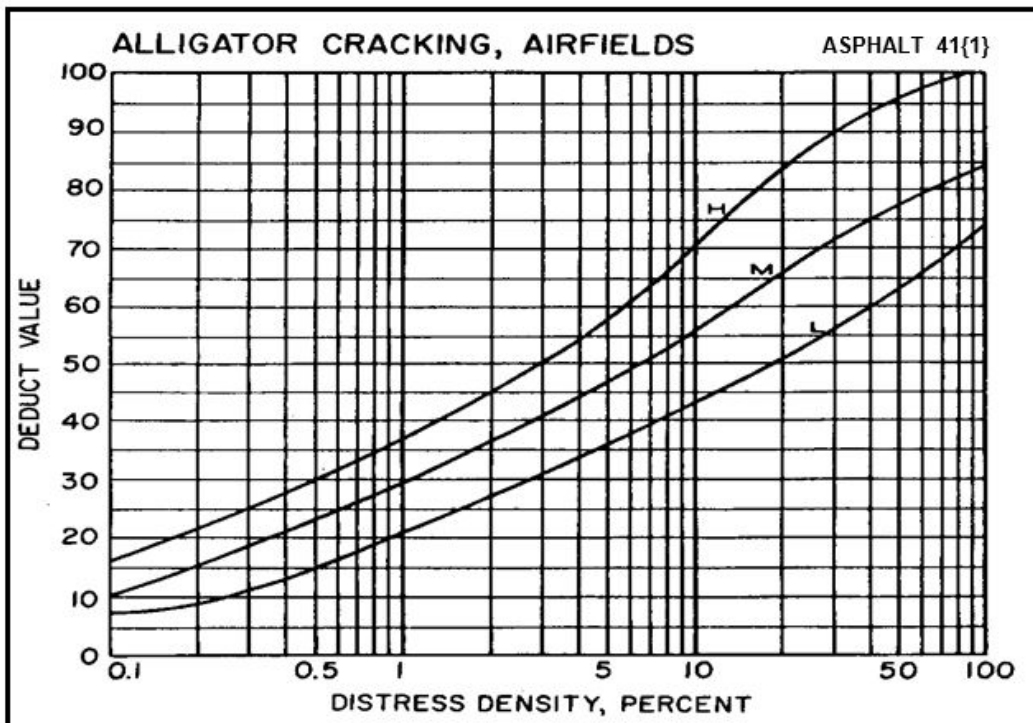
Figure A-149 Medium-Severity Alligator Cracking



Figure A-150 High-Severity Alligator Cracking



Figure A-151 Alligator Cracking Deduct Curve



## **A-4.2 Bleeding (42).**

Bleeding is a film of bituminous material on the pavement surface that creates a shiny, glass-like, reflecting surface that usually becomes quite sticky. Bleeding is caused by excessive amounts of asphalt cement or tars in the mix and/or low air-void content. Bleeding occurs when asphalt fills the voids of the mix during hot weather and then expands onto the surface of the pavement. Since the bleeding process is not reversible during cold weather, asphalt or tar will accumulate on the surface.

### **A-4.2.1 Severity Levels.**

No degrees of severity are defined. Note bleeding when it is extensive enough to cause a reduction in skid resistance.

### **A-4.2.2 How to Measure.**

Bleeding is measured in square feet (square meters) of surface area. If bleeding is counted, polished aggregate is not counted in the same area.

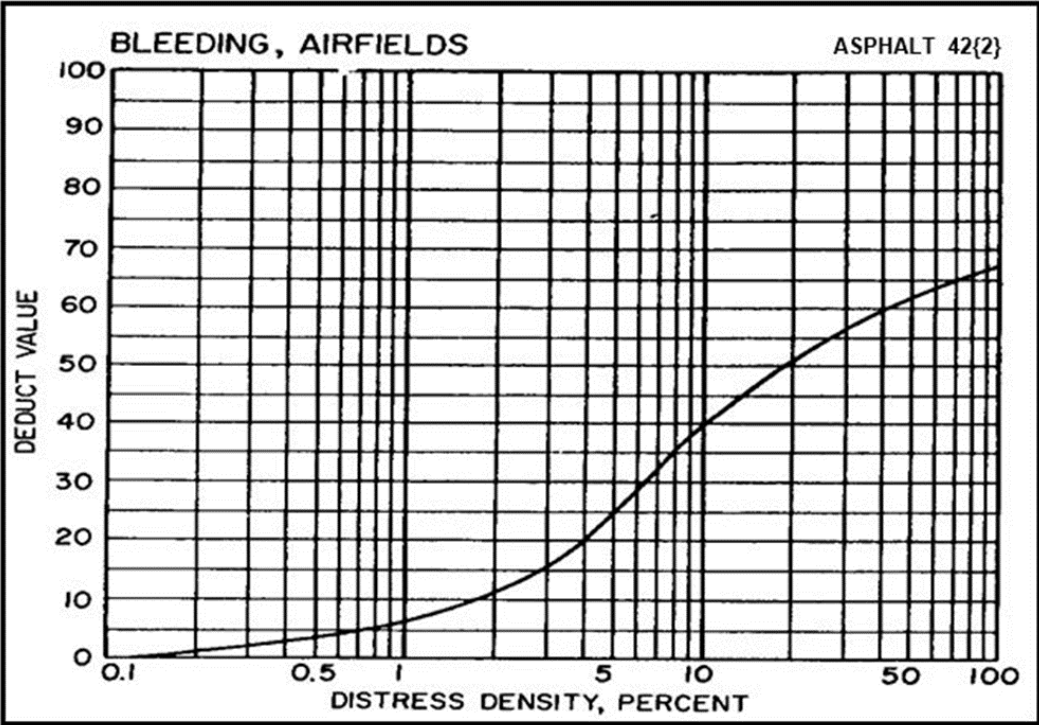
**Figure A-152 Bleeding**



Figure A-153 Bleeding



Figure A-154 Bleeding Deduct Curve



### **A-4.3 Block Cracking (43).**

Block cracks are interconnected cracks that divide the pavement into roughly rectangular pieces. The blocks may range in size from approximately 1 foot by 1 foot to 10 feet by 10 feet (0.3 meter by 0.3 meter to 3 meters by 3 meters). Block cracking is caused mainly by shrinkage of the AC and daily temperature cycling (which results in daily stress/strain cycling); it is not load-associated. The occurrence of block cracking usually indicates that the asphalt has significantly hardened. Block cracking typically occurs over a large proportion of pavement area but sometimes occurs in non-traffic areas. This type of distress differs from alligator cracking in that alligator cracks form smaller, multi-sided pieces with sharp angles. Also, unlike block cracks, alligator cracks are caused by repeated traffic loadings and therefore are located only in traffic areas (i.e., wheel paths).

#### **A-4.3.1 Severity Levels.**

**L** Blocks are defined by cracks that are non-spalled (sides of the crack are vertical) or only lightly spalled, causing no FOD potential. Non-filled cracks have 0.25 inch (6 millimeters) or less mean width and filled cracks have filler in satisfactory condition.

**M** Blocks are defined by either (1) filled or non-filled cracks that are moderately spalled (some FOD potential); (2) non-filled cracks that are not spalled or have only minor spalling (some FOD potential) but have a mean width greater than approximately 0.25 inch (6 millimeters); or (3) filled cracks that are not spalled or have only minor spalling (some FOD potential) but have filler in unsatisfactory condition.

**H** Blocks are well defined by cracks that are severely spalled, causing a definite FOD potential.

#### **A-4.3.2 How to Measure.**

Block cracking is measured in square feet (square meters) of surface area. It usually occurs at one severity level in a given pavement section; however, measure and record separately any areas of the pavement section having distinctly different levels of severity. For asphalt pavements, not including AC over PCC, if block cracking is recorded, do not record longitudinal and transverse (L&T) cracking in the same area. For asphalt overlay over concrete, separately record block cracking, joint reflection cracking, and L&T cracking reflected from old concrete.

**Figure A-155 Low-Severity Block Cracking**



**Figure A-156 Low-Severity Block Cracking**



**Figure A-157 Medium-Severity Block Cracking**



**Figure A-158 Medium-Severity Block Cracking**



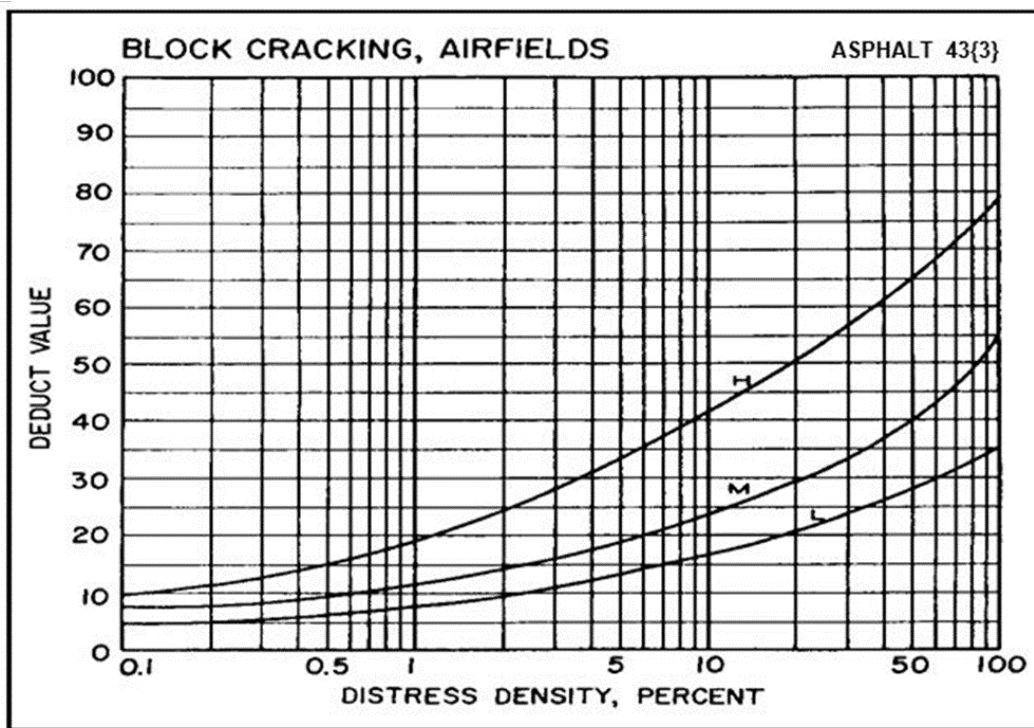
**Figure A-159 High-Severity Block Cracking**



**Figure A-160 High-Severity Block Cracking**



Figure A-161 Block Cracking Deduct Curve



#### A-4.4 Corrugation (44).

Corrugation is a series of closely spaced ridges and valleys (ripples) occurring at fairly regular intervals, usually less than 5 feet (1.5 meters) along the pavement. The ridges are perpendicular to the traffic direction. Traffic action combined with an unstable pavement surface or base usually causes this type of distress.

##### A-4.4.1 Severity Levels.

**L** Corrugations are minor and do not significantly affect ride quality (see measurement criteria in Table A-11).

**M** Corrugations are noticeable and significantly affect ride quality (see measurement criteria in Table A-11).

**H** Corrugations are easily noticed and severely affect ride quality (see measurement criteria in Table A-11).

##### A-4.4.2 How to Measure.

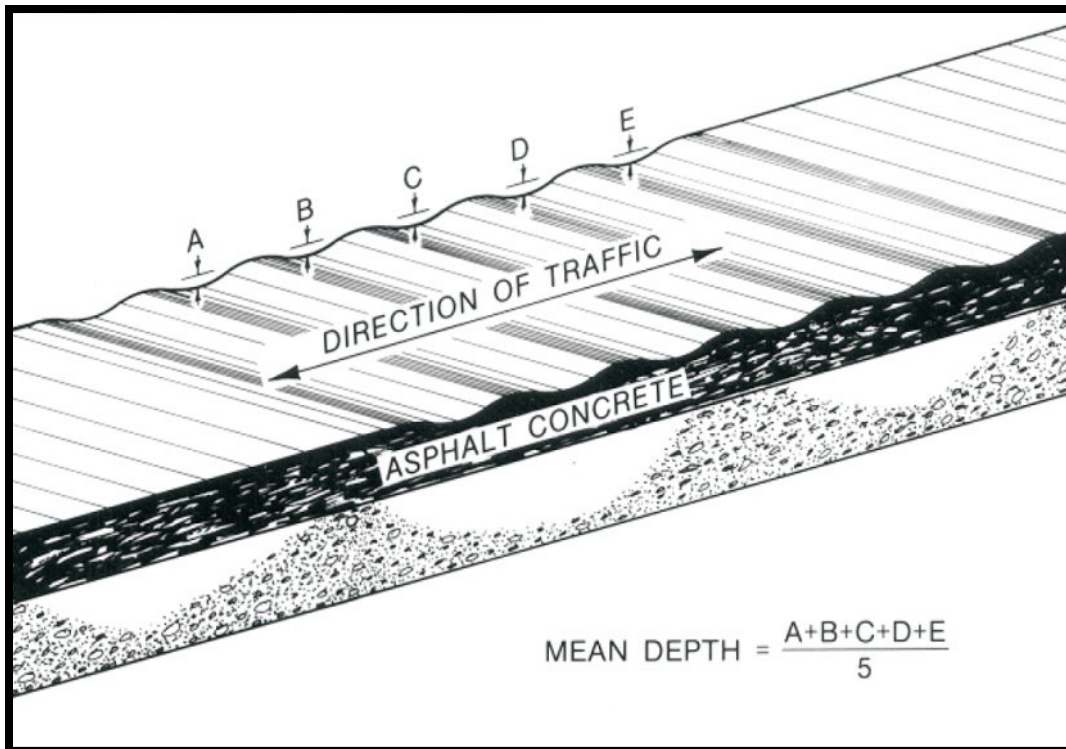
Corrugation is measured in square feet (square meters) of surface area. The mean elevation difference between the ridges and valleys of the corrugations indicates the level of severity. To determine the mean elevation difference, place a 10-foot (3-meter) straightedge perpendicular to the corrugations so the depth of the valleys is measured

in inches (millimeters). The mean depth is calculated from five such measurements. See Table A-11 and Figure A-162.

**Table A-11 Corrugation Measurement Criteria**

| Measurement Criteria Severity | Runways and High-Speed Taxiways  | Taxiways and Aprons            |
|-------------------------------|----------------------------------|--------------------------------|
| L                             | < 0.25 inch<br>(< 6 mm)          | < 0.5 inch<br>(< 13 mm)        |
| M                             | 0.25 to 0.5 inch<br>(6 to 13 mm) | 0.5 to 1 inch<br>(13 to 25 mm) |
| H                             | > 0.5 inch<br>(> 13 mm)          | > 1 inch<br>(> 25 mm)          |

**Figure A-162 Corrugation**



**Figure A-163 Low-Severity Corrugation**



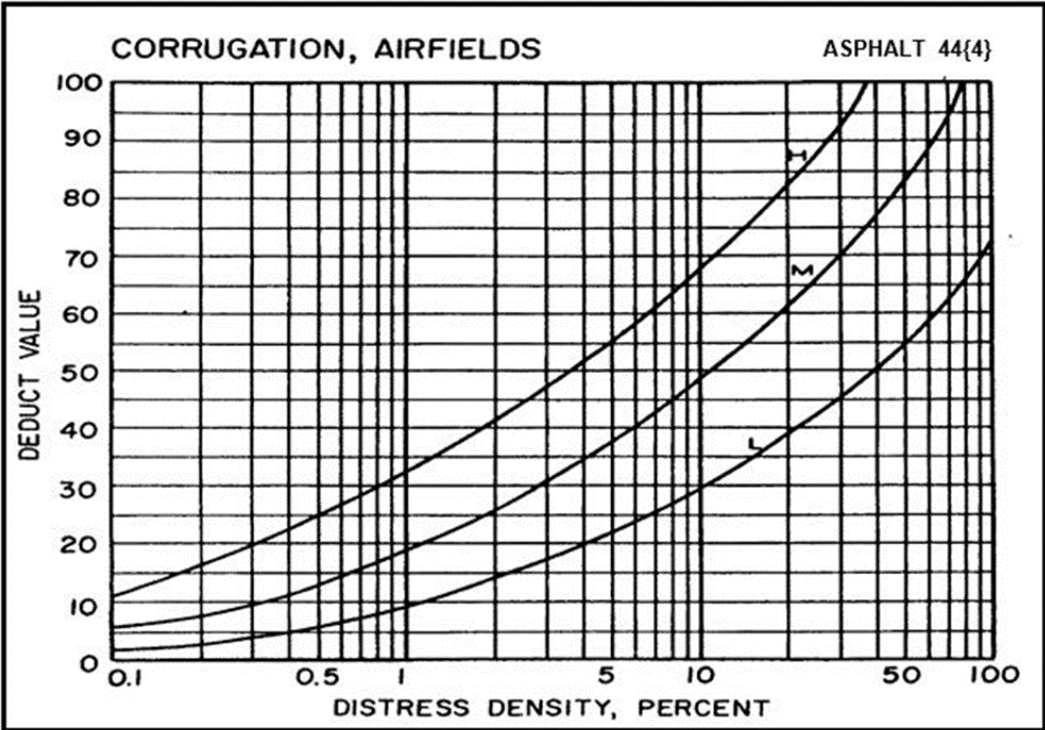
**Figure A-164 Medium-Severity Corrugation**



Figure A-165 High-Severity Corrugation



Figure A-166 Corrugation Deduct Curve



**A-4.5 Depression (45).**

Depressions are localized pavement surface areas having elevations slightly lower than those of the surrounding pavement. In many instances, light depressions are not noticeable until after a rain, when ponding water creates “birdbath” areas, but the depressions can also be located without rain because of stains created by ponding water. Depressions can be caused by settlement of the foundation soil or can be built up during construction. Depressions cause roughness and, when filled with water of sufficient depth, can cause hydroplaning of aircraft.

**A-4.5.1 Severity Levels.**

**L** Depression can be observed or located by stained areas, only slightly affects pavement riding quality, and may cause hydroplaning potential on runways (see measurement criteria in Table A-12).

**M** Depression can be observed, moderately affects pavement riding quality, and causes hydroplaning potential on runways (see measurement criteria in Table A-12).

**H** Depression can be readily observed, severely affects pavement riding quality, and causes definite hydroplaning potential (see measurement criteria in Table A-12).

**A-4.5.2 How to Measure.**

Depressions are measured in square feet (square meters) of surface area. The maximum depth of the depression determines the level of severity. This depth can be measured by placing a 10-foot (3-meter) straightedge across the depressed area and measuring the maximum depth in inches (millimeters). Depressions larger than 10 feet (3 meters) across must be measured by either visual estimation or direct measurement when filled with water.

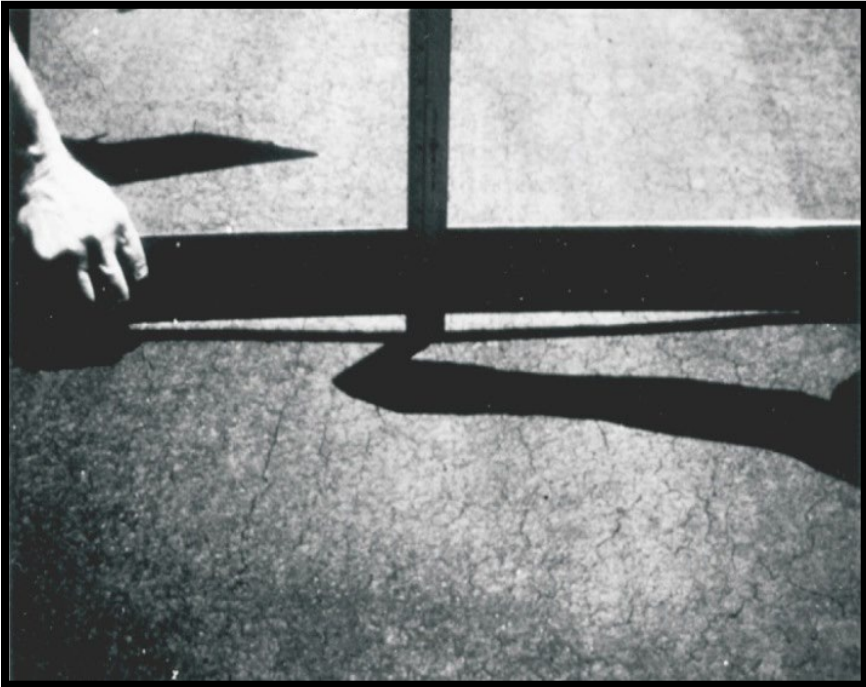
**Table A-12 Maximum Depth of Depression**

| Severity | Runways & High-Speed Taxiways     | Taxiways & Aprons              |
|----------|-----------------------------------|--------------------------------|
| L        | 0.125 to 0.5 inch<br>(3 to 13 mm) | 0.5 to 1 inch<br>(13 to 25 mm) |
| M        | 0.5 to 1 inch<br>(13 to 25 mm)    | 1 to 2 inches<br>(25 to 51 mm) |
| H        | > 1 inch<br>(> 25 mm)             | > 2 inches<br>(> 51 mm)        |

Figure A-167 Low-Severity Depression



Figure A-168 Medium-Severity Depression



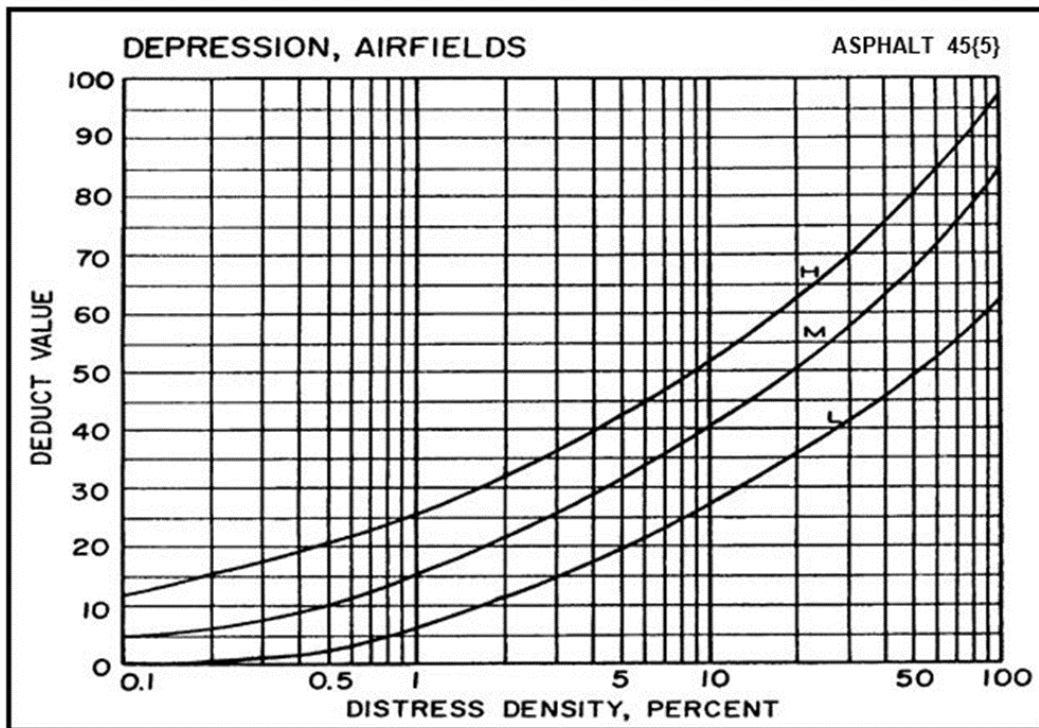
**Figure A-169 High-Severity Depression**



**Figure A-170 High-Severity Depression**



Figure A-171 Depression Deduct Curve



**A-4.6 Jet Blast Erosion (46).**

Jet blast erosion causes darkened areas on the pavement surface when bituminous binder has been burned or carbonized; localized burned areas may vary in depth up to approximately 0.5 inch (13 millimeters).

**A-4.6.1 Severity Levels.**

No degrees of severity are defined. It is sufficient to indicate that jet blast erosion exists.

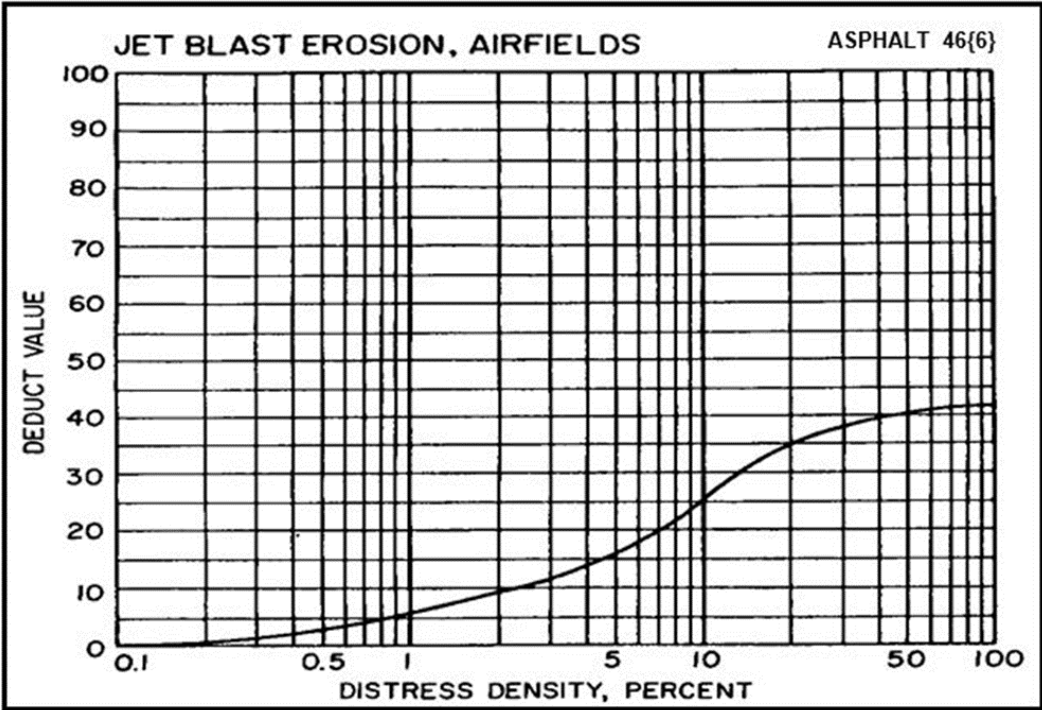
**A-4.6.2 How to Measure.**

Jet blast erosion is measured in square feet (square meters) of surface area.

Figure A-172 Jet Blast Erosion



Figure A-173 Jet Blast Erosion Deduct Curve



#### **A-4.7 Joint Reflection Cracking from PCC (47).**

This distress occurs only on pavements having an asphalt or tar surface over a PCC slab. This category does not include reflection cracking from any other type of base (i.e., cement stabilized, lime stabilized); such cracks are listed as L&T cracks. Joint reflection cracking is caused mainly by movement of the PCC slab beneath the AC surface because of thermal and moisture changes; it is not load-related. However, traffic loading may cause a breakdown of the AC near the crack, resulting in spalling and FOD potential. If the pavement is fragmented along a crack, the crack is said to be spalled. Knowledge of the slab dimensions beneath the AC surface will help identify these cracks.

##### **A-4.7.1 Severity Levels.**

**L** Cracks have only light spalling (little or no FOD potential) or no spalling and can be filled or non-filled. If non-filled, the cracks have a mean width of 0.25 inch (6 millimeters) or less. Filled cracks are of any width but their filler material is in satisfactory condition.

**M** One of these conditions exists: (1) cracks are moderately spalled (some FOD potential) and can be either filled or non-filled of any width; (2) filled cracks are not spalled or are only lightly spalled but the filler is in unsatisfactory condition; (3) non-filled cracks are not spalled or are only lightly spalled but the mean crack width is greater than 0.25 inch (6 millimeters); or (4) light random cracking exists near the crack or at the corner of intersecting cracks.

**H** Cracks are severely spalled (definite FOD potential) and can be either filled or non-filled of any width.

##### **A-4.7.2 How to Measure.**

Joint reflection cracking is measured in linear feet (linear meters). Identify and record the length and severity level of each crack. If the crack does not have the same severity level along its entire length, separately record each portion. For example, a crack that is 50 feet (15 meters) long may have 10 feet (3 meters) of high-severity cracking, 20 feet (6 meters) of medium-severity cracking, and 20 feet (6 meters) of low-severity cracking; these are recorded separately. If the different levels of severity in a portion of a crack cannot be easily divided, rate that portion at the highest severity present.

**Figure A-174 Low-Severity Joint Reflection Cracking**



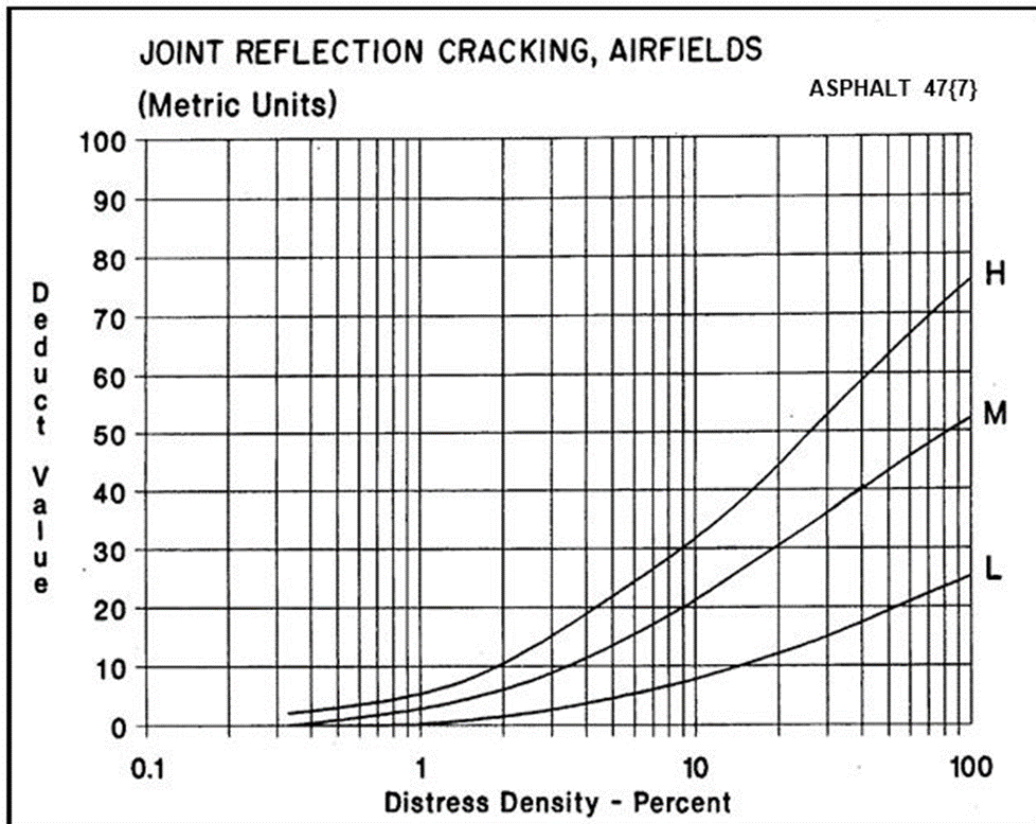
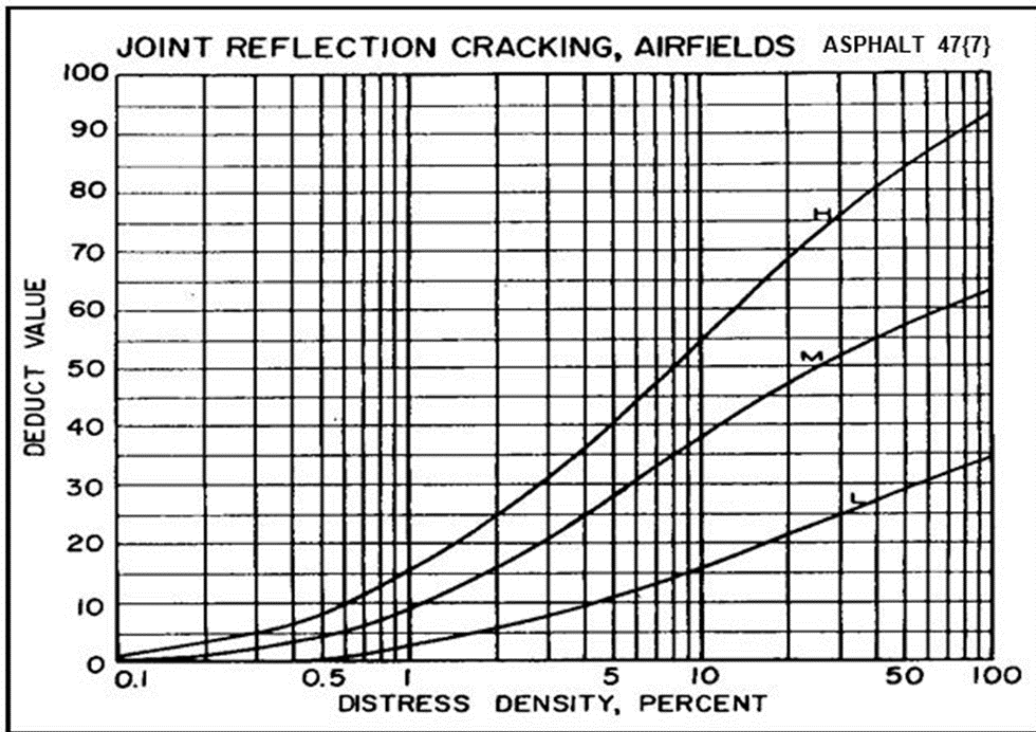
**Figure A-175 Medium-Severity Joint Reflection Cracking**



Figure A-176 High-Severity Joint Reflection Cracking



Figure A-177 Joint Reflection Cracking Deduct Curve



**A-4.8 Longitudinal and Transverse (L&T) Cracking (48) (Non-PCC Joint Reflective).**

Longitudinal cracks are parallel to the pavement's centerline or laydown direction. They may be caused by (1) a poorly constructed paving lane joint; (2) shrinkage of the AC surface due to low temperatures or hardening of the asphalt; or (3) a reflective crack caused by cracks beneath the surface course, including cracks in PCC slabs (but not at PCC joints). Transverse cracks extend across the pavement at approximately right angles to the pavement centerline or direction of laydown. They may be caused by items 2 or 3 above. These types of cracks are not usually load-associated. If the pavement is fragmented along a crack, the crack is said to be spalled.

**A-4.8.1 Severity Levels.**

**L** Cracks have either minor spalling (little or no FOD potential) or no spalling. The cracks can be filled or non-filled. Non-filled cracks have a mean width of 0.25 inch (6 millimeters) or less; filled cracks are of any width but their filler material is in satisfactory condition.

**M** One of these conditions exists: (1) cracks are moderately spalled (some FOD potential) and can be either filled or non-filled of any width; (2) filled cracks are not spalled or are only lightly spalled but the filler is in unsatisfactory condition; (3) non-filled cracks are not spalled or are only lightly spalled but the mean crack width is greater than 0.25 inch (6 millimeters); or (4) light random cracking exists near the crack or at the corners of intersecting cracks.

**H** Cracks are severely spalled, causing definite FOD potential. They can be either filled or non-filled of any width.

**A-4.8.2 How to Measure.**

L&T cracks are measured in linear feet (linear meters). Identify and record the length and severity of each crack. If the crack does not have the same severity level along its entire length, separately record each portion of the crack with a different severity level. For example, see the explanation of how to measure joint reflection cracking in paragraph A-4.7.2. If block cracking is recorded, L&T cracking are not recorded in the same area.

Figure A-178 Low-Severity L&T Cracking



Figure A-179 Medium-Severity L&T Cracking



Figure A-180 High-Severity L&T Cracking



**A-4.8.3 Longitudinal and Transverse Cracking (Non-PCC Joint Reflective) in Porous Friction Courses (PFC): Severity Levels.**

**Note:** These severity levels are in addition to the existing definitions in paragraph 4-8.1.

**L** Cracks have either minor spalling (little or no FOD potential) or no spalling. The cracks can be filled or non-filled. Non-filled cracks have a mean width of 0.25 inch (6 millimeters) or less; filled cracks are of any width but their filler material is in satisfactory condition. Furthermore, the average raveled area (area with dislodged or missing coarse aggregate larger than 0.19 inch [4.75 millimeters]) around the crack is less than 0.25 inch (6 millimeters) wide.

**M** The average raveled area (area with dislodged or missing coarse aggregate larger than 0.19 inch [4.75 millimeters]) around the crack is 0.25 to 1 inch (6 to 25 millimeters) wide or one of these conditions exists: (1) cracks are moderately spalled (some FOD potential) and can be either filled or non-filled of any width; (2) filled cracks are not spalled or are only lightly spalled, but the filler is in unsatisfactory condition; (3) non-filled cracks are not spalled or are only lightly spalled but the mean crack width is greater than 0.25 inch (6 millimeters); or (4) light random cracking exists near the crack or at the corners of intersecting cracks.

**H** The average raveled area (area with dislodged or missing coarse aggregate larger than 0.19 inch [4.75 millimeters]) around the crack is greater than 1 inch (25 millimeters) wide or cracks are severely spalled, causing definite FOD potential. They can be either filled or non-filled of any width.

**A-4.8.4 How to Measure.**

L&T cracks are measured in linear feet (linear meters). Identify and record the length and severity of each crack. If the crack does not have the same severity level along its entire length, separately record each portion of the crack with a different severity level. For an example, see the explanation of how to measure joint reflection cracking in paragraph A-4.7.2. If block cracking is recorded, L&T cracking are not recorded in the same area.

**Figure A-181 Low-Severity PFC L&T Cracking**

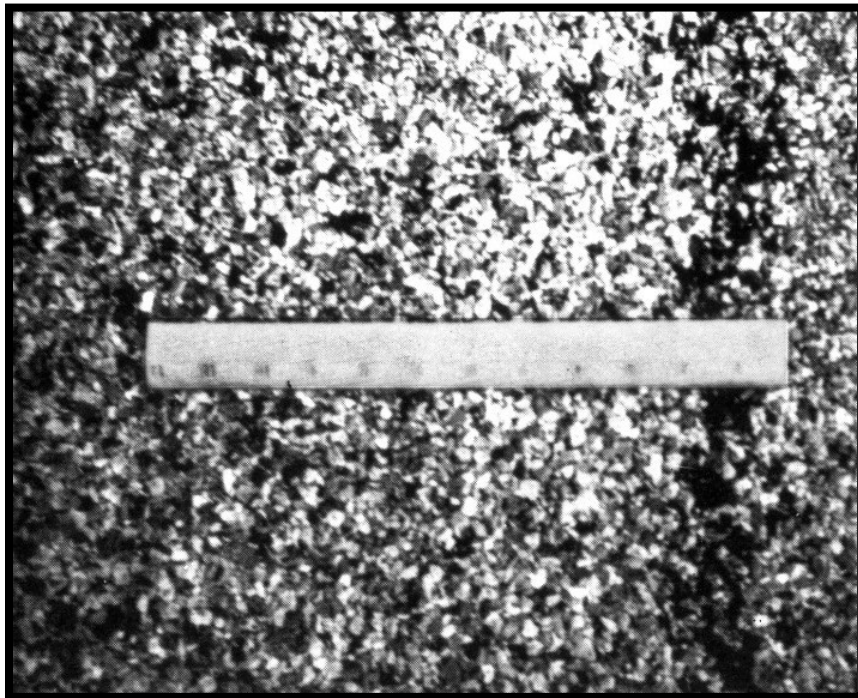


Figure A-182 Medium-Severity PFC L&T Cracking

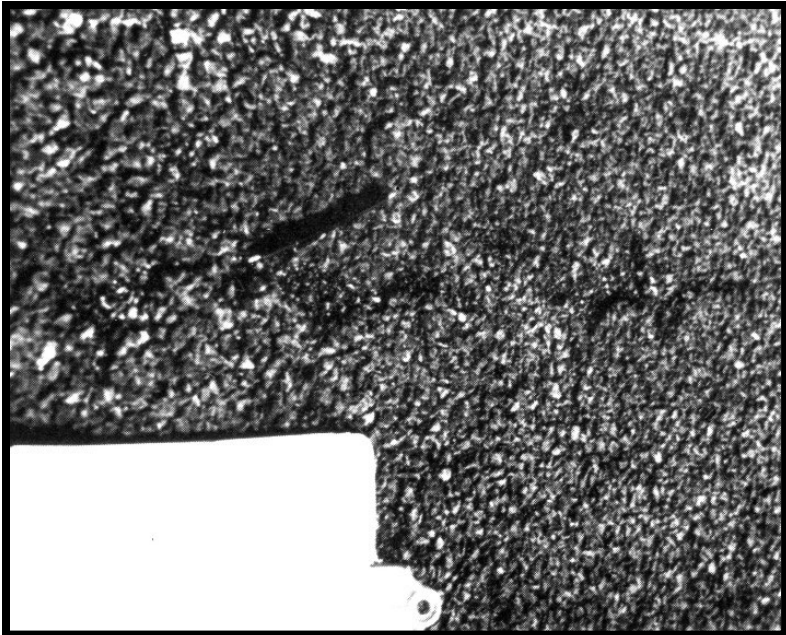


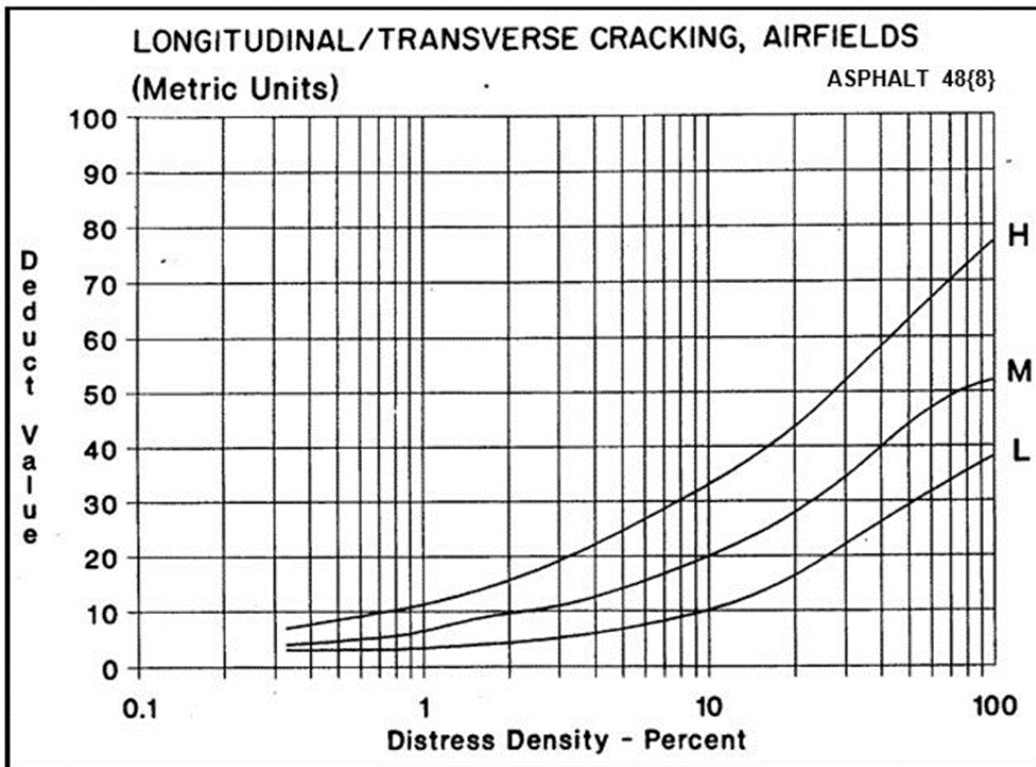
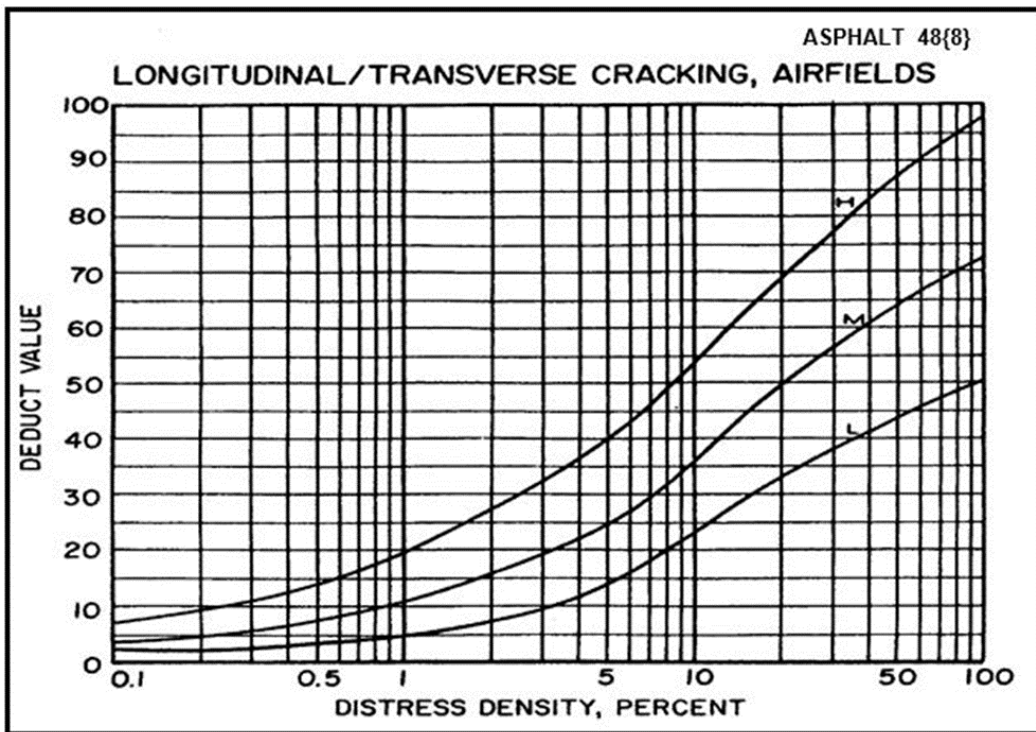
Figure A-183 Medium-Severity PFC L&T Cracking



Figure A-184 High-Severity PFC L&T Cracking



Figure A-185 L&T Cracking Deduct Curve



**A-4.9 Oil Spillage (49).**

Oil spillage is the deterioration or softening of the pavement surface caused by the spilling of oil, fuel, or other solvents.

**A-4.9.1 Severity Levels.**

No degrees of severity are defined. It is sufficient to indicate that oil spillage exists.

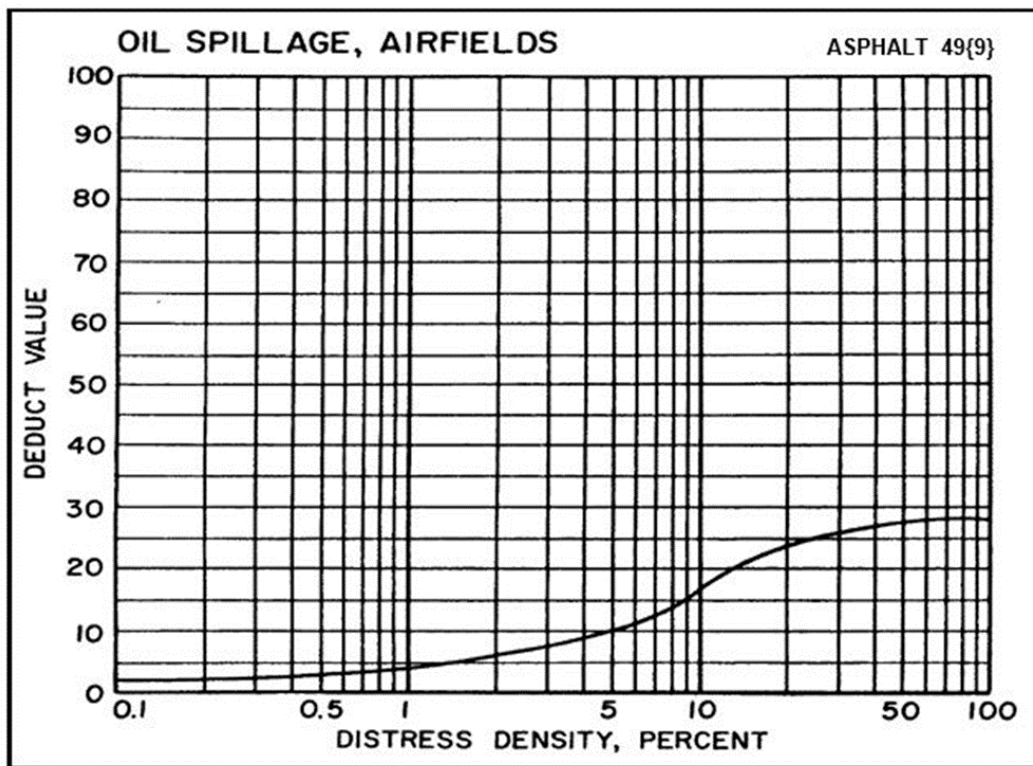
**A-4.9.2 How to Measure.**

Oil spillage is measured in square feet (square meters) of surface area. A stain is not a distress unless material has been lost or the binder has been softened. If hardness is approximately the same as on surrounding pavement and if no material has been lost, do not record as a distress.

**Figure A-186 Oil Spillage**



Figure A-187 Oil Spillage



#### A-4.10 Patching and Utility Cut Patch (50).

A patch is considered a defect, regardless of how well it is performing.

##### A-4.10.1 Severity Levels.

**L** Patch is in good condition and performing satisfactorily; little or no FOD potential.

**M** Patch is somewhat deteriorated and affects riding quality to some extent; some FOD potential.

**H** Patch is badly deteriorated and affects riding quality significantly or has high FOD potential. Patch needs replacement.

The use of dense-graded AC patches on PCC surfaces causes a water-damming effect at the patch that contributes to differential skid resistance of the surface. Rate low-severity, dense-graded patches as medium-severity patches because of the differential friction problem. Medium- and high-severity patches are rated the same as above.

##### A-4.10.2 How to Measure.

Patching is measured in square feet (square meters) of surface area; however, if a single patch has areas of differing severity levels, measure and record these areas separately. For example, a 25-square-foot (2.5-square-meter) patch may have

10 square feet (1 square meter) of medium severity and 15 square feet (1.5 square meters) of low severity. Record these areas separately. Any distress found in a patched area is not recorded; however, its effects on the patch will be considered when determining the patch's severity level.

A very large patch (area > 2,500 square feet [230 square meters]) or feathered-edge pavement may qualify as an additional sample unit or a separate section.

**Figure A-188 Low-Severity Patching**



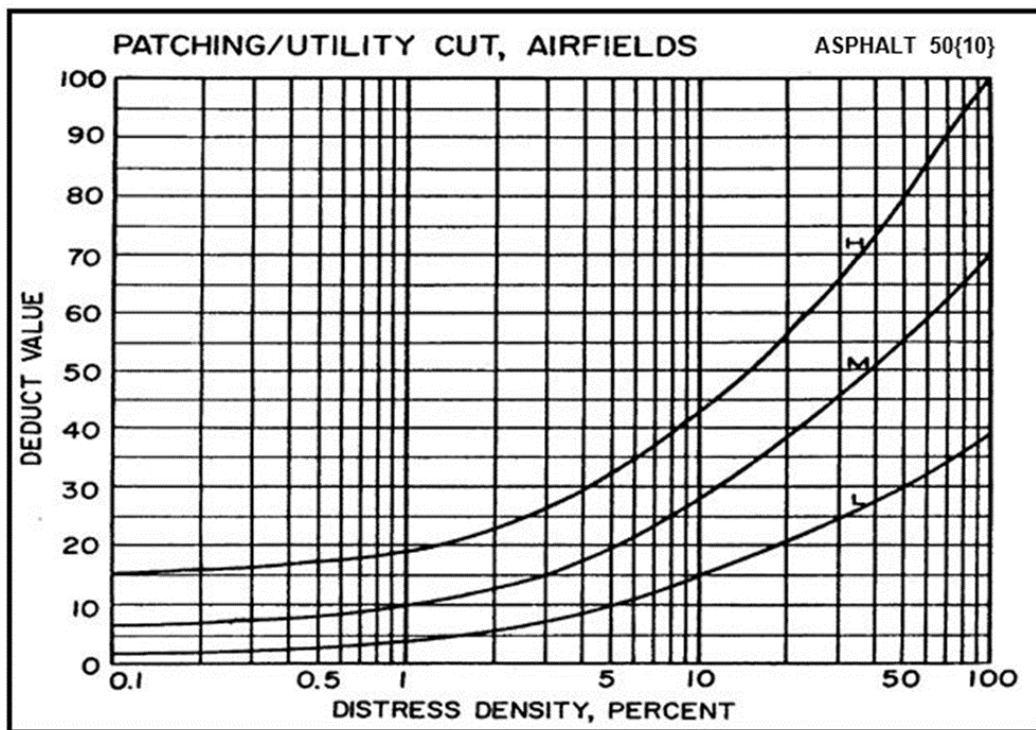
Figure A-189 Medium-Severity Patching



Figure A-190 High-Severity Patching



Figure A-191 Patching/Utility Cut



**A-4.11 Polished Aggregate (51).**

Aggregate polishing is caused by repeated traffic applications. Polished aggregate is present when close examination of a pavement reveals that the portion of aggregate extending above the asphalt is either very small or there are no rough or angular aggregate particles to provide good skid resistance. Existence of this type of distress is also indicated when the number on a skid resistance rating test is low or has dropped significantly from previous ratings.

**A-4.11.1 Severity Levels.**

No degrees of severity are defined; however, when the degree of polishing is significant, polishing is included in the condition survey and rated as a defect.

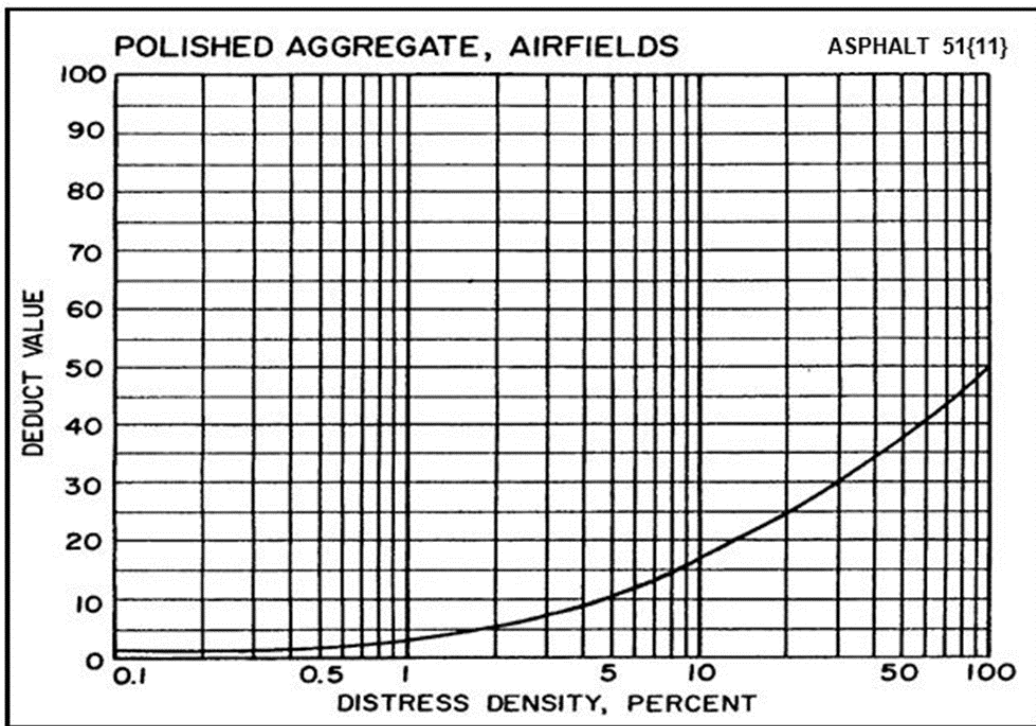
**A-4.11.2 How to Measure.**

Polished aggregate is measured in square feet (square meters) of surface area. If bleeding is counted, polished aggregate is not counted in the same area.

Figure A-192 Polished Aggregate



Figure A-193 Polished Aggregate Deduct Curve



## **A-4.12 Raveling (52).**

Raveling is the dislodging or loss of coarse aggregate particles (stone or rocks larger than 0.19 inch [4.75 millimeters]) from the pavement surface. This is characterized by aggregates larger than 0.19 inch (4.75 millimeters) missing or no longer bound to the surface.

### **A-4.12.1 Dense Mix Severity Levels.**

As used herein, “coarse aggregate” refers to predominant coarse aggregate sizes of the asphalt mix. The term “aggregate clusters” refers to when more than one adjoining coarse aggregate piece is missing. If in doubt about a severity level, examine three representative areas of 1 square yard (1 square meter) each and count the number of missing coarse aggregate particles.

**L** One of these conditions exists: (1) in a 1-square-yard (1-square-meter) representative area, the number of coarse aggregate particles missing is between five and twenty; or (2) missing aggregate clusters are less than 2 percent of the examined 1-square-yard (1-square-meter) area. In low-severity raveling, there is little or no FOD potential.

**M** One of these conditions exists: (1) in a 1-square-yard (1-square-meter) representative area, the number of coarse aggregate particles missing is between 21 and 40; or (2) missing aggregate clusters are between 2 and 10 percent of the examined 1-square-yard (1-square-meter) area. In medium-severity raveling, there is some FOD potential.

**H** One of these conditions exists: (1) in a 1-square-yard (1-square-meter) representative area, the number of coarse aggregate particles missing is over 40; or (2) missing aggregate clusters are more than 10 percent of the examined 1-square-yard (1-square-meter) area. In high-severity raveling, there is significant FOD potential.

### **A-4.12.2 How to Measure.**

Raveling is measured in square feet (square meters) of surface area. Mechanical damage caused by hook drags, tire rims, or snowplows is counted as areas of high-severity raveling.

Figure A-194 Low-Severity Raveling (Dense Mix)



Figure A-195 Medium-Severity Raveling (Dense Mix)



**Figure A-196 High-Severity Raveling (Dense Mix)**



**A-4.12.3 Slurry Seal/Coal Tar Over Dense Mix Severity Levels.**

**L** (1) The scaled area is less than 1 percent. (2) In the case of coal tar where pattern cracking has developed, the surface cracks are less than 0.25 inch (6 millimeters) wide.

**M** (1) The scaled area is between 1 and 10 percent. (2) In the case of coal tar where pattern cracking has developed, the cracks are 0.25 inch (6 millimeters) wide or greater.

**H** (1) The scaled area is over 10 percent. (2) In the case of coal tar, the surface is peeling off.

**A-4.12.4 How to Measure.**

Raveling is measured in square feet (square meters) of surface area. Mechanical damage caused by hook drags, tire rims, or snowplows is counted as areas of high-severity raveling.

Figure A-197 Low-Severity Raveling (Slurry Seal/Coal Tar Over Dense Mix)



Figure A-198 Medium-Severity Raveling (Slurry Seal/Coal Tar Over Dense Mix)



**Figure A-199 High-Severity Raveling (Slurry Seal/Coal Tar Over Dense Mix)**



**A-4.12.5 Porous Friction Course (PFC) Severity Levels.**

**L** In a 1-square-foot (0.1-square-meter) representative sample, the number of aggregate pieces missing is between five and twenty and/or the number of missing aggregate clusters does not exceed one.

**M** In a 1-square-foot (0.1-square-meter) representative sample, the number of aggregate pieces missing is between 21 and 40 and/or the number of missing aggregate clusters is greater than one but does not exceed 25 percent of the area.

**H** In a 1-square-foot (0.1-square-meter) representative sample, the number of aggregate pieces missing is over 40 and/or the number of missing aggregate clusters is greater than 25 percent of the area.

**A-4.12.6 How to Measure.**

Raveling is measured in square feet (square meters) of surface area. Mechanical damage caused by hook drags, tire rims, or snowplows is counted as areas of high-severity raveling.

Figure A-200 Low-Severity Raveling (PFC)



Figure A-201 Medium-Severity Raveling (PFC)



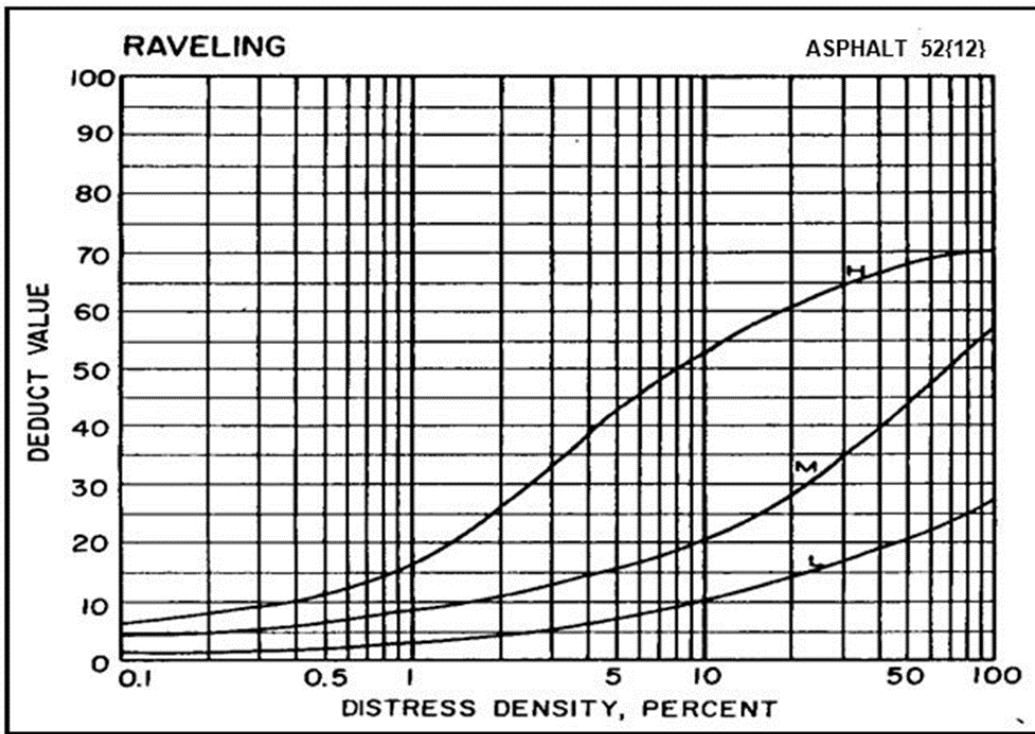
Figure A-202 High-Severity Raveling (PFC)



Figure A-203 High-Severity Raveling (PFC)



Figure A-204 Raveling Deduct Curve



**A-4.13 Rutting (53).**

A rut is a surface depression in the wheel path. Pavement uplift may occur along the sides of the rut; however, in many instances, ruts are noticeable only after a rainfall, when the wheel paths are filled with water. Rutting stems from a permanent deformation in any of the pavement layers or subgrade. It is usually caused by consolidation or lateral movement of the materials due to traffic loads. Significant rutting can lead to major structural failure of the pavement.

**A-4.13.1 Severity Levels.**

**Table A-13 Mean Rut Depth Criteria**

| Severity | All Pavement Sections            |
|----------|----------------------------------|
| L        | 0.25 to 0.5 inch<br>(6 to 13 mm) |
| M        | 0.5 to 1 inch<br>(13 to 25 mm)   |
| H        | > 1 inch<br>(> 25 mm)            |

**A-4.13.2 How to Measure.**

Rutting is measured in square feet (square meters) of surface area and the severity is determined by the mean depth of the rut. The mean rut depth is calculated in inches (millimeters) by laying a straightedge across the rut, measuring the depth, then using measurements taken along the length of the rut to compute the mean.

**Figure A-205 Low-Severity Rutting**



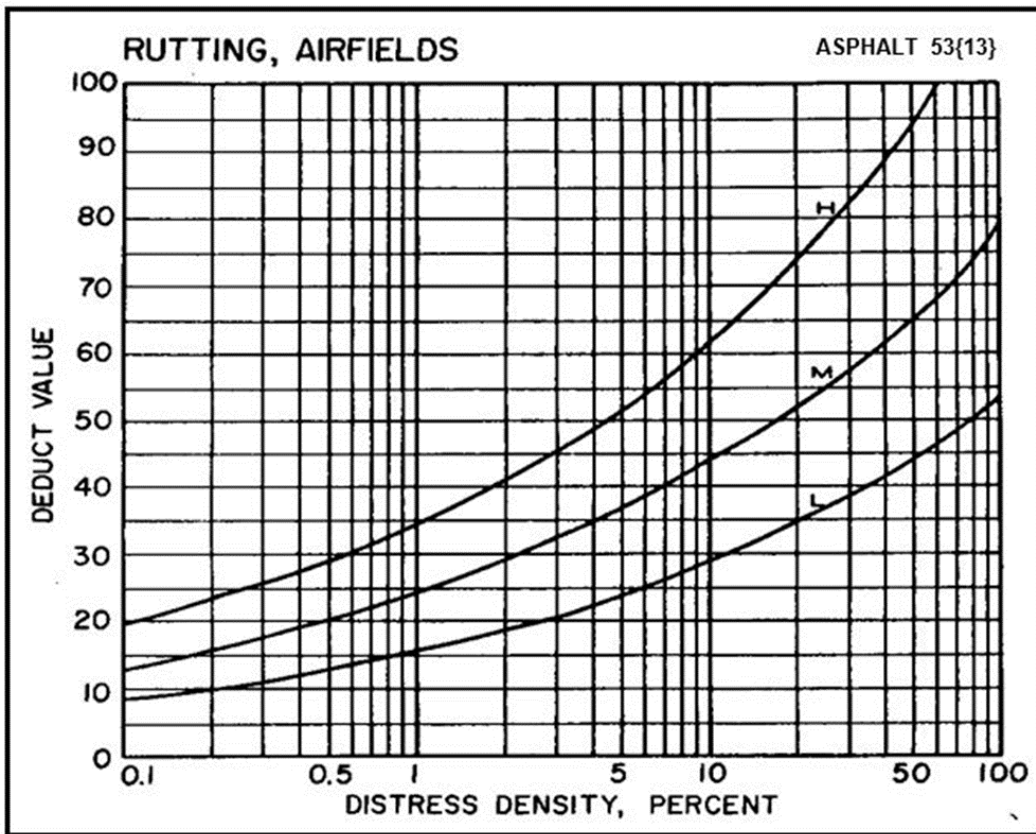
**Figure A-206 Medium-Severity Rutting**



**Figure A-207 High-Severity Rutting**



Figure A-208 Rutting Deduct Curve



**A-4.14 Shoving of Asphalt Pavement by PCC Slabs (54).**

PCC pavements occasionally increase in length at ends where they adjoin flexible pavements (commonly referred to as "pavement growth"). This "growth" shoves the asphalt- or tar-surfaced pavements, causing them to swell and crack. The PCC slab growth is caused by a gradual opening of the joints as they are filled with incompressible materials that prevent them from reclosing.

**A-4.14.1 Severity Levels.**

Table A-14 is used to determine the severity levels of shoving. At present, no significant research has been conducted to quantify levels of severity of shoving.

**Table A-14 Shoving Criteria**

| <b>Severity</b> | <b>Height Differential</b>           |
|-----------------|--------------------------------------|
| L               | < 0.75 inch<br>( < 19 mm)            |
| M               | 0.75 to 1.5 inch<br>(19 mm to 38 mm) |
| H               | > 1.5 inch<br>( > 38 mm)             |

**L** A slight amount of shoving has occurred, with little effect on ride quality and no breakup of the asphalt pavement.

**M** A significant amount of shoving has occurred, causing moderate roughness or breakup of the asphalt pavement.

**H** A large amount of shoving has occurred, causing severe roughness or breakup of the asphalt pavement.

**A-4.14.2 How to Measure.**

Shoving is measured by determining the area in square feet (square meters) of the swell caused by shoving.

Figure A-209 Low-Severity Shoving



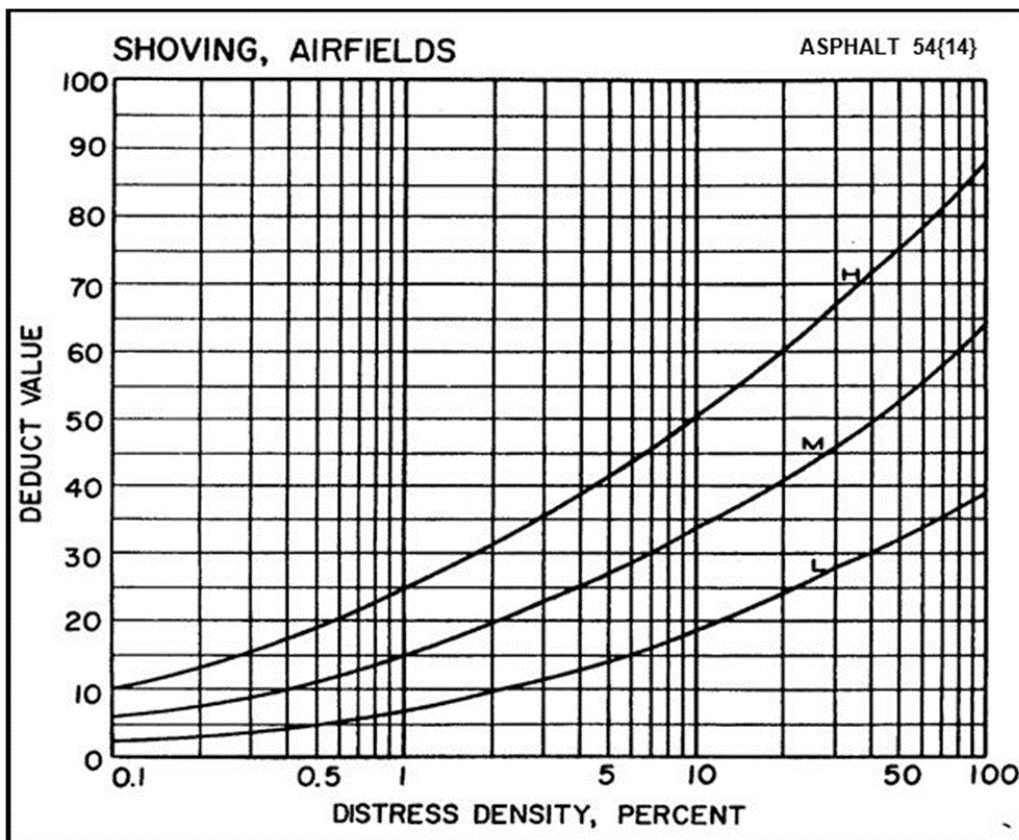
Figure A-210 Medium-Severity Shoving



Figure A-211 High-Severity Shoving



Figure A-212 Shoving Deduct Curve



#### **A-4.15 Slippage Cracking (55).**

Slippage cracks are crescent- or half-moon-shaped cracks having two ends pointed in the direction of traffic. They are produced when braking or turning wheels cause the pavement surface to slide and deform. This usually occurs when there is a low-strength surface mix or poor bond between the surface and next layer of pavement structure.

##### **A-4.15.1 Severity Levels.**

No degrees of severity are defined. It is sufficient to indicate that a slippage crack exists.

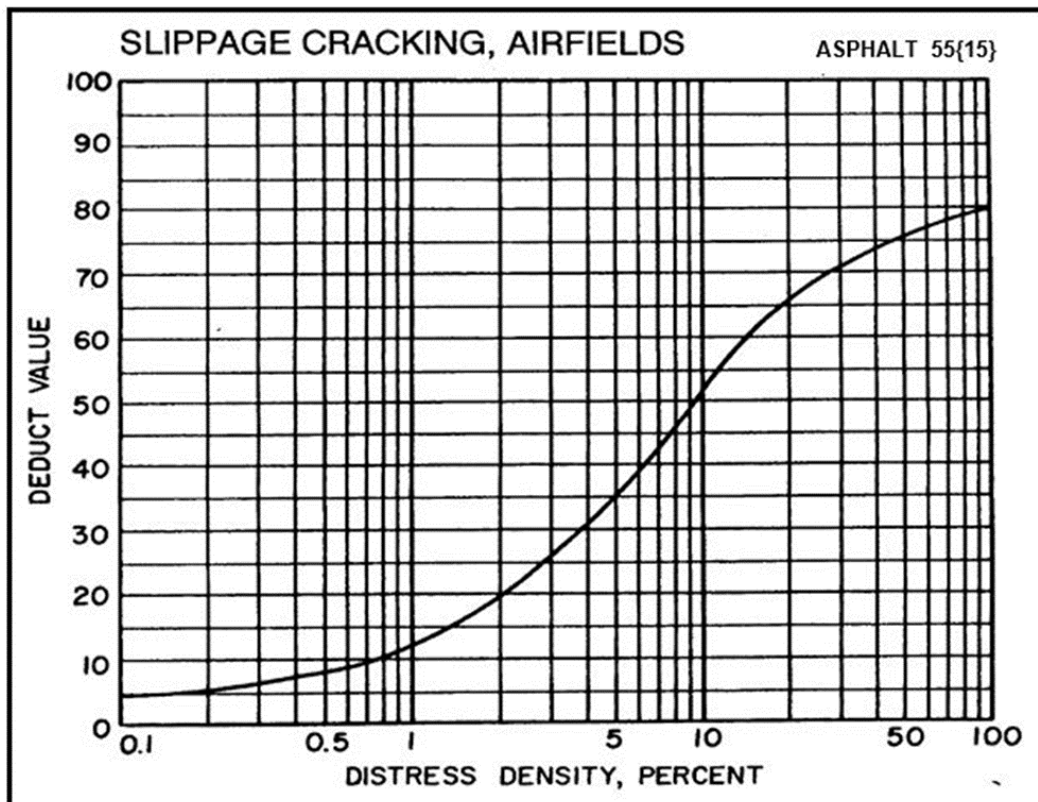
##### **A-4.15.2 How to Measure.**

Slippage cracking is measured in square feet (square meters) of surface area.

**Figure A-213 Slippage Cracking**



Figure A-214 Slippage Cracking Deduct Curve



**A-4.16 Swell (56).**

A swell is characterized by an upward bulge in the pavement's surface. A swell may occur sharply over a small area or as a longer, gradual wave. Either type of swell can be accompanied by surface cracking. A swell is usually caused by frost action in the subgrade or by swelling soil but a small swell can also occur on the surface of an asphalt overlay (over PCC) as a result of a blowup in the PCC slab.

**A-4.16.1 Severity Levels.**

**L** Swell is barely visible and has a minor effect on the pavement's ride quality as determined at the normal aircraft speed for the pavement section under consideration. (Low-severity swells are not always observable but their existence can be confirmed by driving a vehicle over the section at the normal aircraft speed. An upward acceleration will occur if the swell is present.)

**M** Swell can be observed without difficulty and has a significant effect on the pavement's ride quality as determined at the normal aircraft speed for the pavement section under consideration.

**H** Swell can be readily observed and severely affects the pavement's ride quality at the normal aircraft speed for the pavement section under consideration.

**A-4.16.2 How to Measure.**

The surface area of the swell is measured in square feet (square meters). Consider the type of pavement section (i.e., runway, taxiway, or apron) when determining the severity rating. For example, a swell of sufficient magnitude to cause considerable roughness on a runway at high speeds would be rated as more severe than the same swell located on the apron or taxiway where the normal aircraft operating speeds are much lower. The guidance in Table A-15 is provided for runways:

**Table A-15 Swell Criteria**

| Severity | Height Differential               |
|----------|-----------------------------------|
| L        | < 0.75 inch<br>( < 19 mm)         |
| M        | 0.75 to 1.5 inch<br>(19 to 38 mm) |
| H        | > 1.5 inch<br>( > 38 mm)          |

**Figure A-215 Low-Severity Swell**



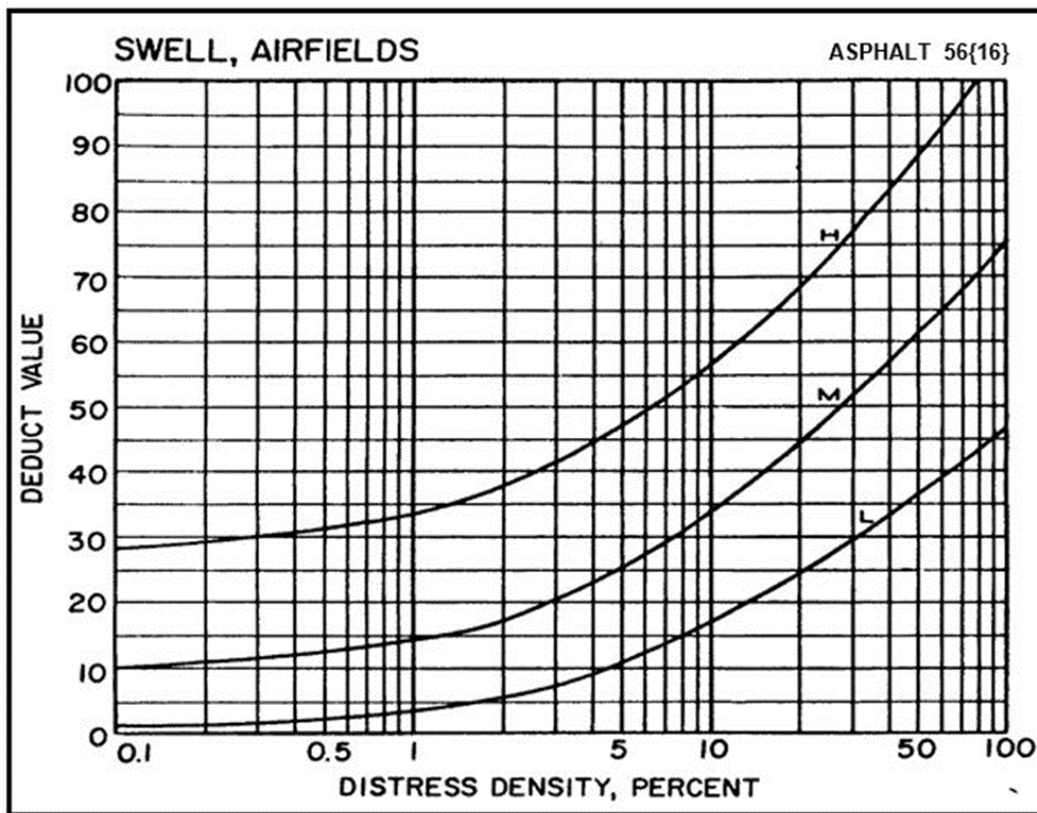
**Figure A-216 Medium-Severity Swell**



**Figure A-217 High-Severity Swell**



Figure A-218 Swell Deduct Curve



**A-4.17 Weathering (Surface Wear) – Dense Mix Asphalt (57).**

Weathering is the wearing away of the asphalt binder and fine aggregate matrix from the pavement surface.

**A-4.17.1 Severity Levels.**

**L** Asphalt surface is beginning to show signs of aging that may be accelerated by climatic conditions. Loss of the fine aggregate matrix is noticeable and may be accompanied by fading of the asphalt color. Edges of the coarse aggregates are beginning to be exposed (less than 0.04 inch [1 millimeter]). Pavement may be relatively new (as new as six months old).

**M** Loss of fine aggregate matrix is noticeable and edges of coarse aggregate have been exposed up to one-fourth of the width (of the longest side) of the coarse aggregate due to the loss of fine aggregate matrix.

**H** Edges of coarse aggregate have been exposed greater than one-fourth of the width (of the longest side) of the coarse aggregate. There is considerable loss of fine aggregate matrix, leading to potential or some loss of coarse aggregate.

**A-4.17.2 How to Measure.**

Weathering (surface wear) is measured in square feet (square meters). Weathering (surface wear) is not recorded if medium- or high-severity raveling is recorded.

**Figure A-219 Low-Severity Weathering**



Figure A-220 Medium-Severity Weathering



Figure A-221 High-Severity Weathering



Figure A-222 Weathering Deduct Curve

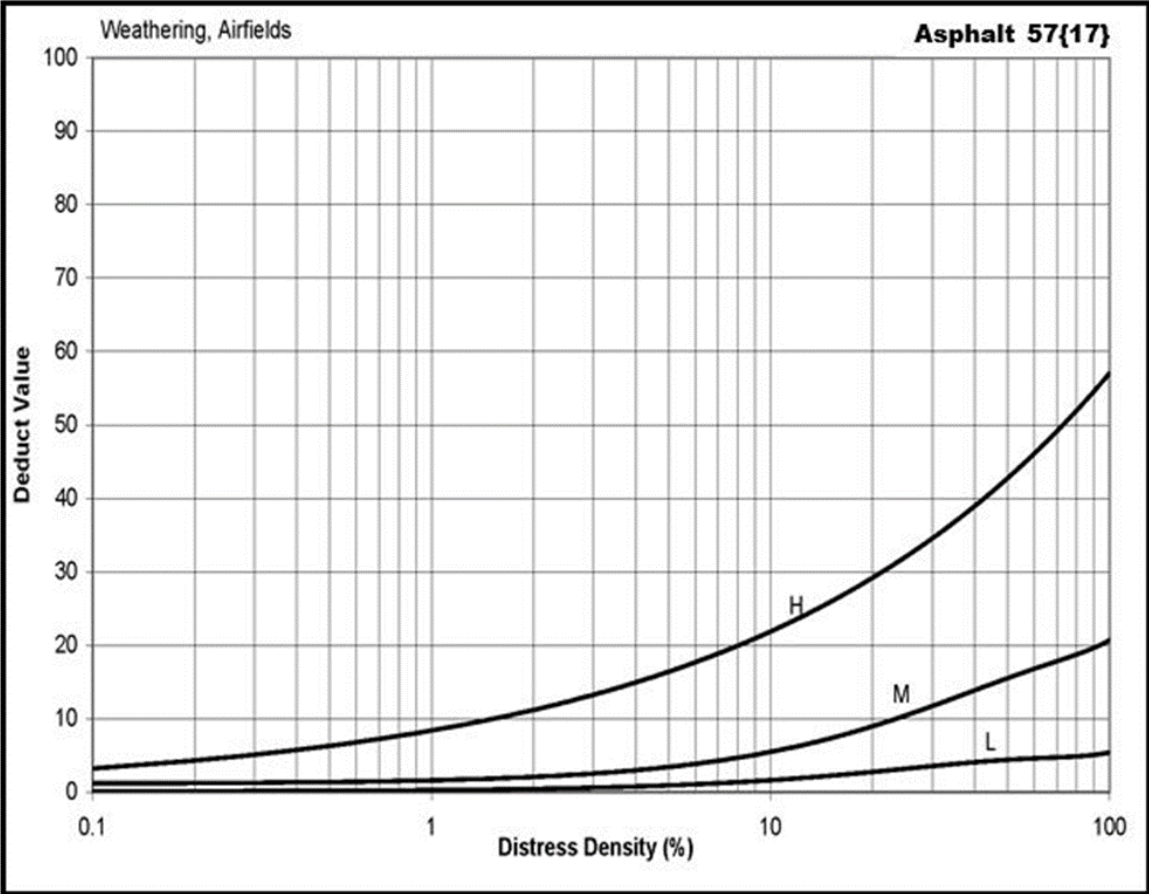
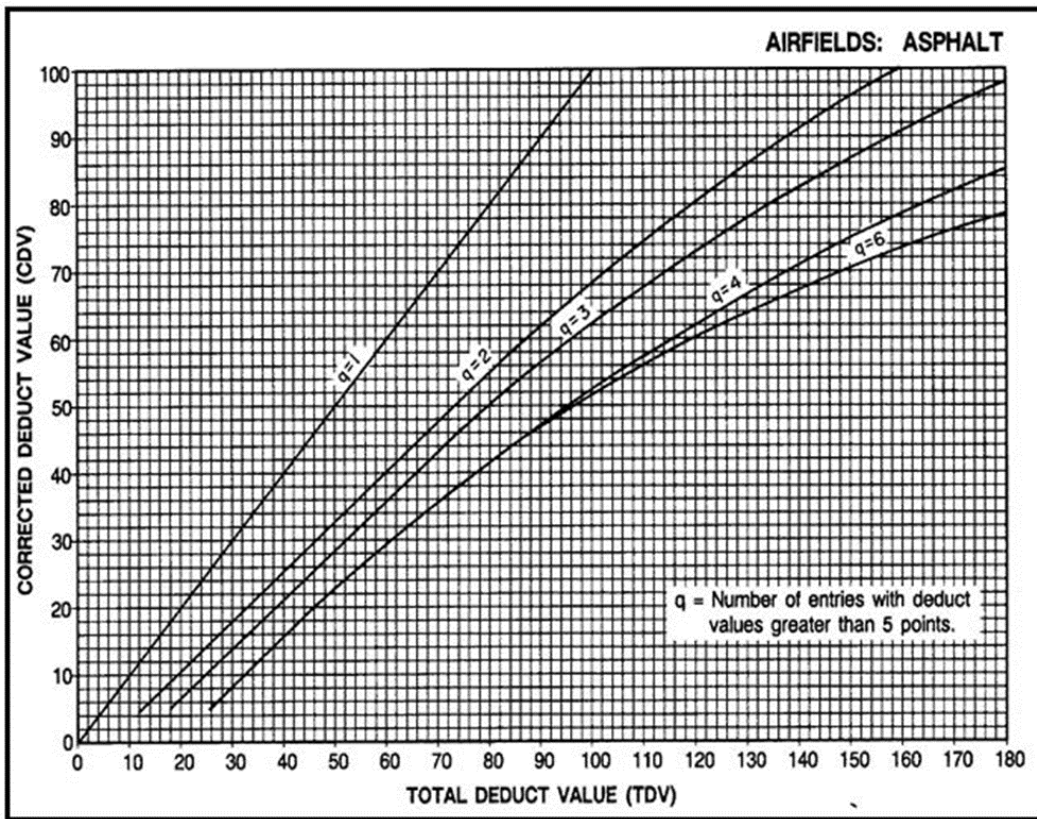


Figure A-223 Corrected Deduct Value Curves for Asphalt Airfields



**A-5 CONCRETE-SURFACED AIRFIELD DISTRESSES.**

During the field condition surveys and validation of the PCI, several questions are commonly asked about the identification and measurement of some of the distresses. The answers to these questions for each distress are included under the heading "How to Measure." For convenience, however, the most frequently raised issues are addressed in Table A-16.

**Table A-16 Frequent Problems in Pavement Distress Identification**

| Situation   | Action   | Remarks  |
|---|--|--|
| Low-severity scaling (i.e., crazing)  | Count only if possible future scaling will occur within two to three years |  |
| Joint seal damage   | This is not counted on a slab-by-slab basis                                | A severity level based on the overall condition of the joint seal in the sample unit is assigned |
| Joint spall small enough to be filled during a joint seal repair                                | Do not record  |  |
| Medium- or high-severity intersecting crack (shattered slab)                                    | Do not count any other distress  |  |
| Corner or joint spalling caused by "D" cracking   | Record only "D" cracking   | If spalls are caused by factors other than "D" cracking, record each factor separately           |
| Crack repaired by a narrow patch (e.g., 4 to 10 in. [100 to 250 mm] wide)                       | Record only crack and not patch at appropriate severity level              |  |
| Original distress of patch more severe than patch itself  | Record original distress type  | If, for example, patch material is present on scaled area of slab, only the scaling is counted   |
| Hairline cracks that are only a few feet (meters) long and do not extend across the entire slab | Rate as shrinkage cracks   |  |

**A-5.1 Blowup (61).**

Blowups occur in hot weather, usually at a transverse crack or joint that is not wide enough to permit expansion by the concrete slabs. The insufficient width is usually caused by infiltration of incompressible materials into the joint space. When expansion cannot relieve enough pressure, a localized upward movement of the slab edges (buckling) or shattering will occur in the vicinity of the joint. Blowups can also occur at utility cuts and drainage inlets. This type of distress is almost always repaired

immediately because of the severe damage potential to aircraft. Blowups are included for reference when closed sections are being evaluated for reopening.

#### **A-5.1.1 Severity Levels.**

**L** Buckling or shattering has not rendered the pavement inoperative and only a slight amount of roughness exists.

**M** Buckling or shattering has not rendered the pavement inoperative but a significant amount of roughness exists.

**H** Buckling or shattering has rendered the pavement inoperative.

**Note:** For pavements to be considered operational, all foreign material from blowups must be removed.

#### **A-5.1.2 How to Count.**

A blowup usually occurs at a transverse crack or joint. At a crack, a blowup is counted as being in one slab, but at a joint, two slabs are affected and the distress is recorded as occurring in two slabs.

Figure A-224 Low-Severity Blowup



Figure A-225 Low-Severity Blowup



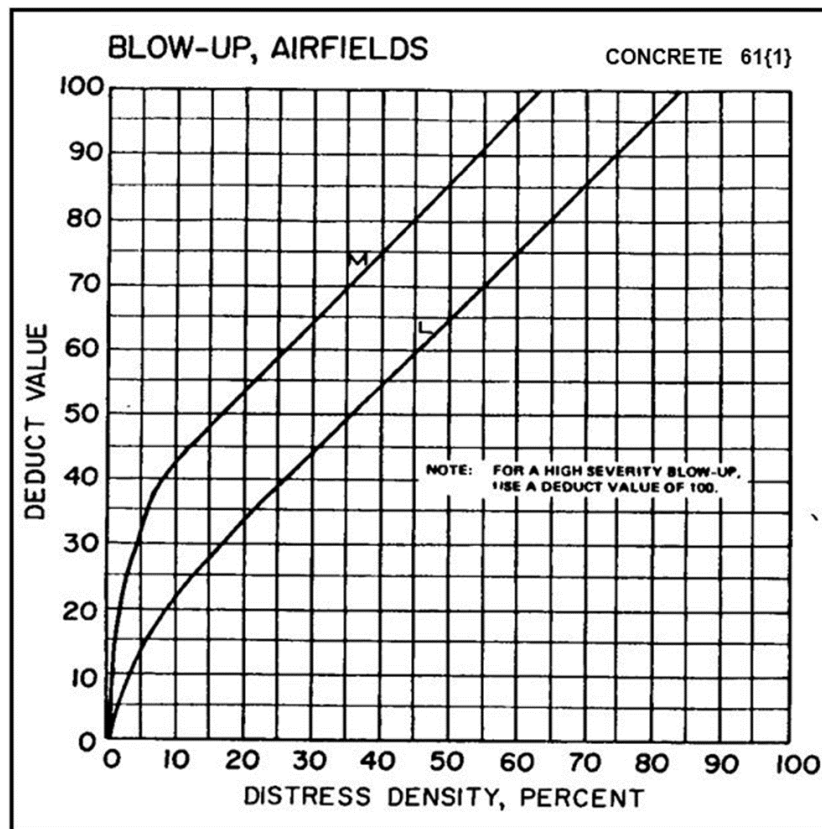
**Figure A-226 Medium-Severity Blowup**



**Figure A-227 High-Severity Blowup**



Figure A-228 Blowup Deduct Curve



### A-5.2 Corner Break (62).

A corner break is a crack that intersects the joints at a distance less than or equal to one-half the slab length on both sides, measured from the corner of the slab. For example, a slab that is 25 by 25 feet (7.5 by 7.5 meters) and has a crack intersecting the joint 5 feet (1.5 meters) from the corner on one side and 17 feet (5 meters) on the other side is not considered a corner break—it is a diagonal crack. However, a crack that intersects 7 feet (2 meters) on one side and 10 feet (3 meters) on the other is considered a corner break. A corner break differs from a corner spall in that the crack extends vertically through the entire slab thickness while a corner spall intersects the joint at an angle. Load repetition combined with loss of support and curling stresses causes corner breaks.

#### A-5.2.1 Severity Levels.

**L** Crack has either no spalling or minor spalling (no FOD potential). If non-filled, it has a mean width less than approximately 0.125 inch (3 millimeters); a filled crack can be of any width, but the filler material must be in satisfactory condition. The area between the corner break and the joints is not cracked.

**M** One of these conditions exists: (1) a filled or non-filled crack is moderately spalled (some FOD potential); (2) a non-filled crack has a mean width between

0.125 inch (3 millimeters) and 1 inch (25 millimeters); (3) a filled crack is not spalled or only lightly spalled but the filler is in unsatisfactory condition; or (4) the area between the corner break and the joints is lightly cracked. "Lightly cracked" means one low-severity crack dividing the corner into two pieces.

**H** One of these conditions exists: (1) a filled or non-filled crack is severely spalled, causing definite FOD potential; (2) a non-filled crack has a mean width greater than approximately 1 inch (25 millimeters), creating tire damage potential; or (3) the area between the corner break and the joints is severely cracked.

#### **A-5.2.2 How to Count.**

A distressed slab is recorded as one slab if it (1) contains a single corner break; (2) contains more than one break of a particular severity; or (3) contains two or more breaks of different severities. For two or more breaks, record the highest level of severity. For example, count as one slab with a medium-severity corner break a slab containing both low- and medium-severity corner breaks. Measure crack widths between vertical walls, not in spalled areas of the crack. If the corner break is faulted 0.125 inch (3 millimeters) or more, increase severity to the next higher level. If the corner is faulted more than 0.5 inch (13 millimeters), rate the corner break at high severity. If faulting in the corner is incidental to faulting in the slab, rate faulting separately. The angle of crack into the slab is usually not evident at low severity. Unless the crack angle can be determined, to differentiate between a corner break and corner spall, use these criteria: If the crack intersects both joints more than 2 feet (600 millimeters) from the corner, it is a corner break. If less than 2 feet (600 millimeters), unless you can verify the crack is vertical, it is a spall.

**Figure A-229 Low-Severity Corner Break**



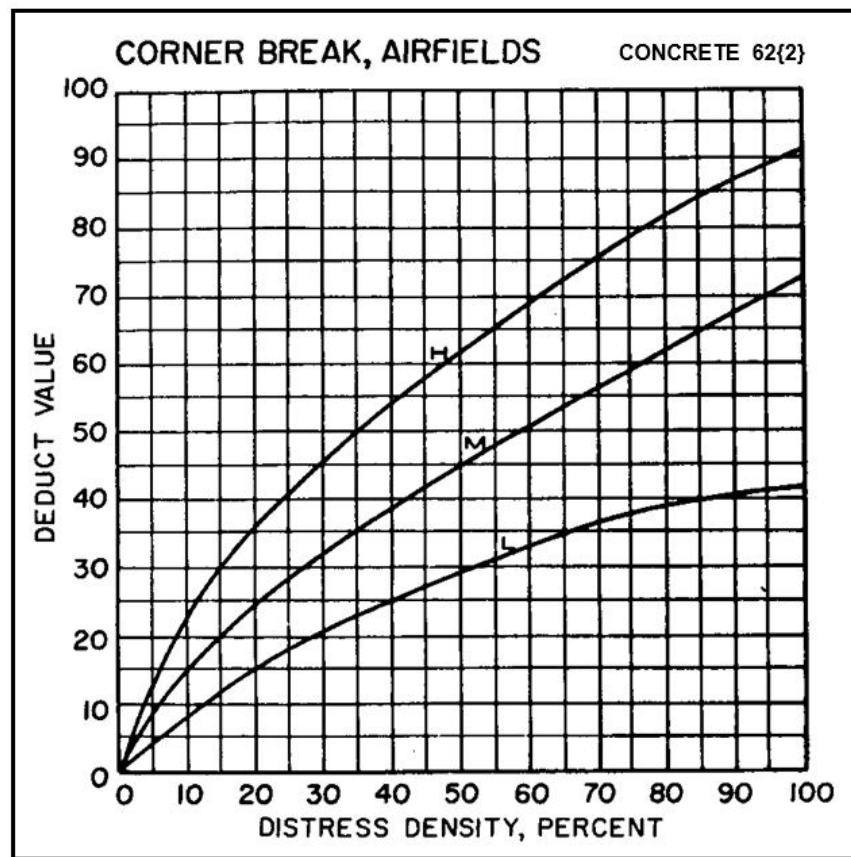
**Figure A-230 Medium-Severity Corner Break**



**Figure A-231 High-Severity Corner Break**



Figure A-232 Corner Break Deduct Curve



### A-5.3 Linear Cracking (Longitudinal, Transverse, and Diagonal) (63).

These cracks, which divide the slab into two or three pieces, are usually caused by a combination of load repetition, curling stresses, and shrinkage stresses. (For slabs divided into four or more pieces, see shattered slab/intersecting cracks, paragraph A-5.12.) Low-severity cracks are usually warping- or friction-related and are not considered major structural distresses. Medium- or high-severity cracks are usually working cracks and are considered major structural distresses.

Hairline cracks that are only a few feet (meters) long and do not extend across the entire slab are rated as shrinkage cracks.

#### A-5.3.1 Non-reinforced PCC Severity Levels.

**L** Crack has no spalling or minor spalling (no FOD potential). If non-filled, it is less than 0.125 inch (3 millimeters) wide. A filled crack can be of any width but its filler material must be in satisfactory condition or the slab is divided into three pieces by low-severity cracks.

**M** One of these conditions exists: (1) a filled or non-filled crack is moderately spalled (some FOD potential); (2) a non-filled crack has a mean width between

0.125 inch (3 millimeters) and 1 inch (25 millimeters); (3) a filled crack has no spalling or minor spalling but the filler is in unsatisfactory condition; or (4) the slab is divided into three pieces by two or more cracks, one of which is at least medium severity.

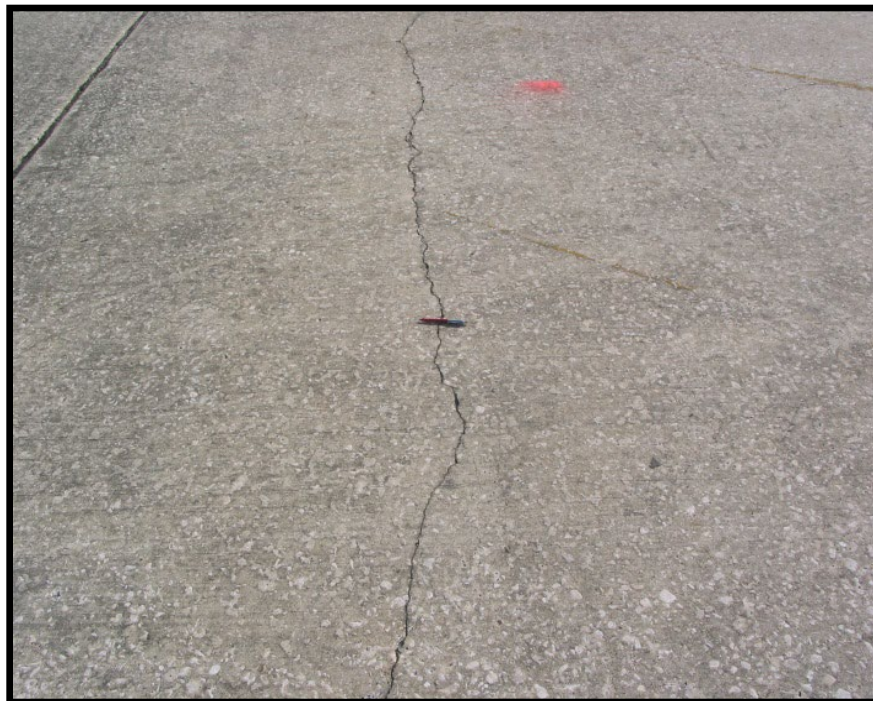
**H** One of the following conditions exists: (1) a filled or non-filled crack is severely spalled (definite FOD potential); (2) a non-filled crack has a mean width approximately greater than 1 inch (25 millimeters), creating tire damage potential; or (3) the slab is divided into three pieces by two or more cracks, one of which is at least high severity.

#### **A-5.3.2 How to Count.**

Once the severity has been identified, the distress is recorded as one slab. If a crack is repaired by a narrow patch (e.g., 4 to 10 inches wide [100 to 250 millimeters]), record only the crack and not the patch at the appropriate severity level.

Cracks used to define and rate corner breaks, "D" cracks, patches, shrinkage cracks, and spalls are not recorded as longitudinal/transverse/diagonal cracks.

**Figure A-233 Low-Severity Linear Cracking**



**Figure A-234 Medium-Severity Linear Cracking**



**Figure A-235 High-Severity Linear Cracking**



### A-5.3.3 Reinforced Concrete Severity Levels.

**L** (1) Non-filled crack, 0.125 inch (3 millimeters) to 0.5 inch (13 millimeters) wide, with no faulting or spalling; (2) filled or non-filled cracks of any width < 0.5 inch (13 millimeters), with low-severity spalling; or (3) filled cracks of any width (filler satisfactory) with no faulting or spalling. **Note:** A crack less than 0.125 inch (3 millimeters) wide with no spalling or faulting is counted as shrinkage cracking.

**M** (1) Non-filled cracks, 0.5 inch (13 millimeters) to 1 inch (25 millimeters) wide, with no faulting or spalling; (2) filled cracks of any width with faulting < 0.375 inch (10 millimeters) or medium-severity spalling; or (3) non-filled cracks of width < 1 inch (25 millimeters) with faulting < 0.375 inch (10 millimeters) or medium-severity spalling.

**H** (1) Non-filled cracks of width > 1 inch (25 millimeters); (2) non-filled cracks of any width with faulting > 0.375 inch (10 millimeters) or medium-severity spalling; or (3) filled cracks of any width with faulting > 0.375 inch (10 millimeters) or high-severity spalling.

#### A-5.3.3.1 How to Count.

Once the severity has been identified, the distress is recorded as one slab. If a crack is repaired by a narrow patch (e.g., 4 to 10 inches wide [100 to 250 millimeters]), only the crack and not the patch are recorded at the appropriate severity level. Slabs longer than 30 feet (9 meters) are divided into approximately equal length "slabs" having imaginary joints assumed to be in perfect condition.

Figure A-236 Linear Cracking (Reinforced PCC)

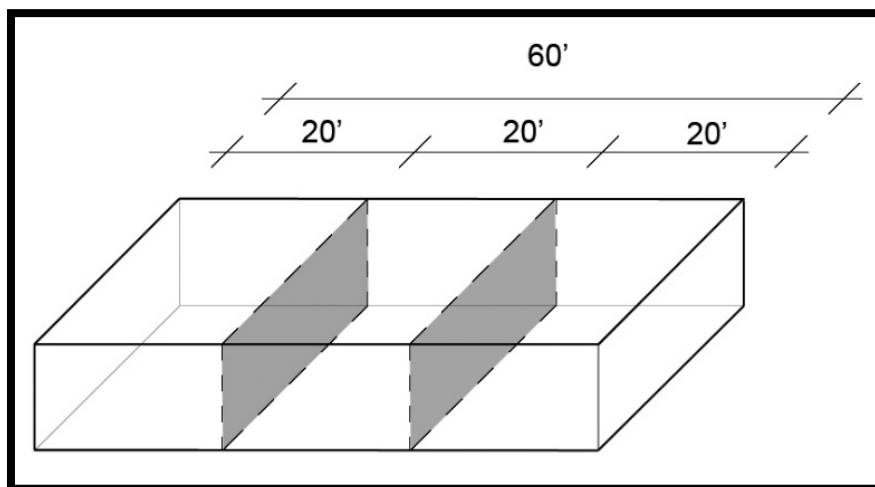
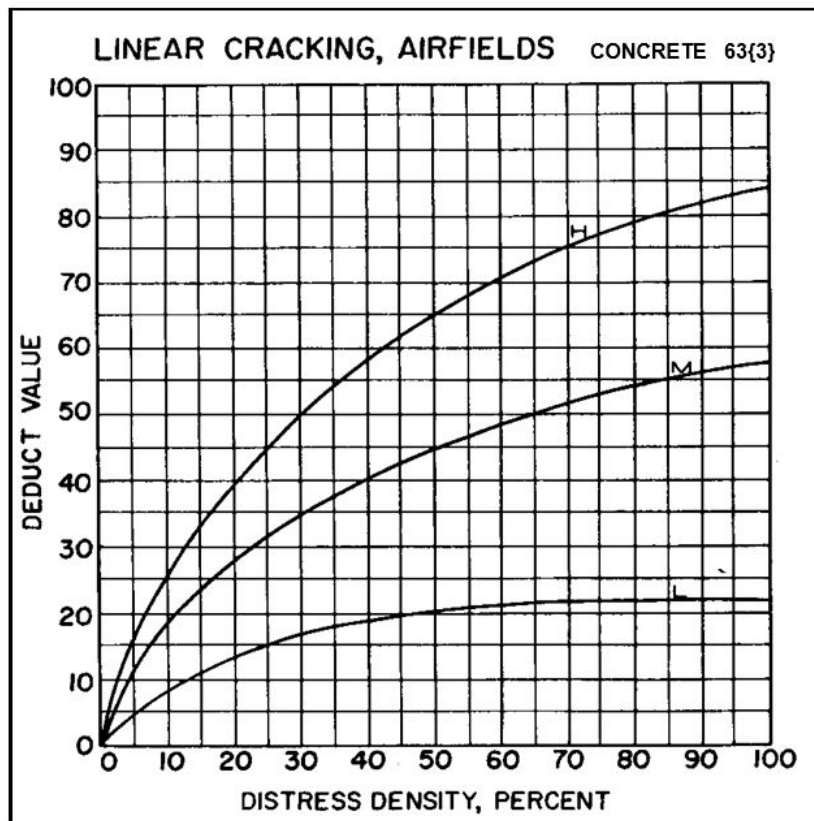


Figure A-237 Linear Cracking Deduct Curve



#### A-5.4 Durability (“D”) Cracking (64).

Durability cracking is caused by the inability of the concrete to withstand environmental factors such as freeze-thaw cycles. It usually appears as a pattern of cracks running parallel to a joint or linear crack. A dark coloring is usually seen around the fine durability cracks. This type of cracking may eventually lead to disintegration of the concrete within 1 to 2 feet (0.3 to 0.6 meter) of the joint or crack.

##### A-5.4.1 Severity Levels.

**L** “D” cracking is defined by hairline cracks occurring in a limited area of the slab, such as one or two corners along one joint. Little or no disintegration has occurred. No FOD potential.

**M** (1) “D” cracking has developed over a considerable amount of slab area with little or no disintegration or FOD potential; or (2) “D” cracking has occurred in a limited area of the slab, such as in one or two corners or along one joint but pieces are missing and disintegration has occurred. Some FOD potential.

**H** “D” cracking has developed over a considerable amount of slab area with disintegration or FOD potential.

**A-5.4.2 How to Count.**

When the distress is located and rated at one severity, it is counted as one slab. If more than one severity level is found, the slab is counted as having the higher severity distress. If “D” cracking is counted, do not record scaling on the same slab.

**Figure A-238 Low-Severity “D” Cracking**



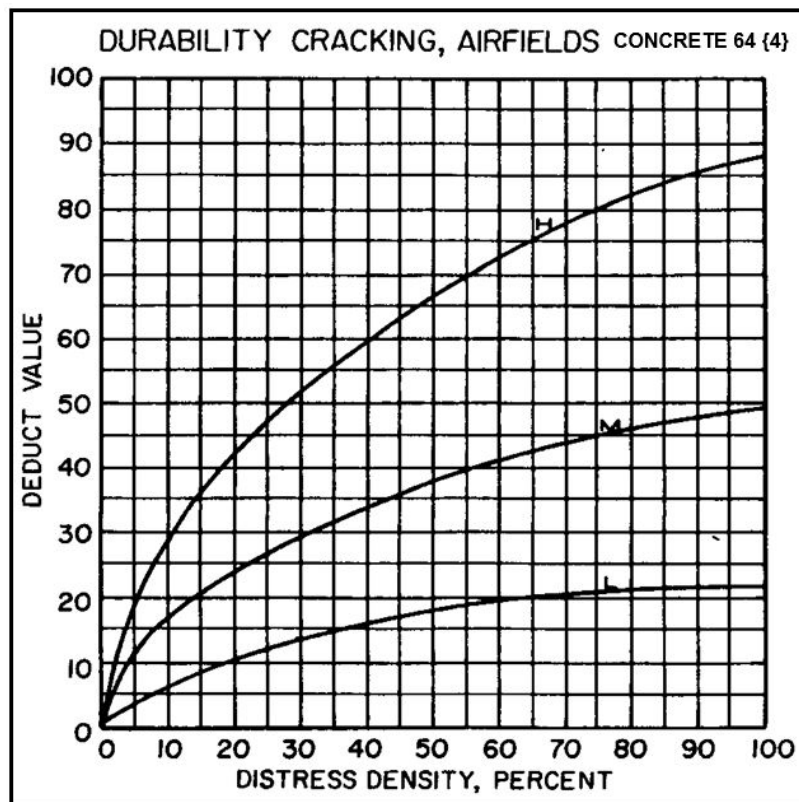
Figure A-239 Medium-Severity "D" Cracking



Figure A-240 High-Severity "D" Cracking



Figure A-241 Durability Cracking Deduct Curve



### A-5.5 Joint Seal Damage (65).

Joint seal damage is any condition that enables soil or rocks to accumulate in the joints or allows significant infiltration of water. Accumulation of incompressible materials prevents the slabs from expanding and may result in buckling, shattering, or spalling. Pliable joint filler bonded to the edges of the slabs protects the joints from accumulating materials and prevents water from seeping down and softening the foundation supporting the slab. Typical types of joint seal damage are (a) stripping of joint sealant, (b) extrusion of joint sealant, (c) weed growth, (d) hardening of the filler (oxidation), (e) loss of bond to the slab edges, and (f) lack or absence of sealant in the joint.

#### A-5.5.1 Severity Levels.

**L** Joint sealer is in generally good condition throughout the sample. Sealant is performing well, with only a minor amount of any of the above types of damage present. Joint seal damage is at low severity if a few of the joints have sealer that has debonded from, but is still in contact with, the joint edge. This condition exists if a knife blade can be inserted between the sealer and joint face without resistance.

**M** Joint sealer is in generally fair condition over the entire surveyed section, with one or more of the above types of damage occurring to a moderate degree. Sealant needs replacement within two years. Joint seal damage is at medium severity if a few of

the joints have any of these conditions: (1) joint sealer is in place but water access is possible through visible openings no more than 0.125 inch (3 millimeters) wide; if a knife blade cannot be inserted easily between sealer and joint face, this condition does not exist; (2) pumping debris is evident at the joint; (3) joint sealer is oxidized and “lifeless” but pliable (like a rope) and generally fills the joint opening; or (4) vegetation in the joint is obvious but does not obscure the joint opening.

**H** Joint sealer is in generally poor condition over the entire surveyed section, with one or more of the above types of damage occurring to a severe degree. Sealant needs immediate replacement. Joint seal damage is at high severity if 10 percent or more of the joint sealer exceeds the limiting criteria listed above or if 10 percent or more of the sealer is missing.

#### **A-5.5.2 How to Count.**

Joint seal damage is not counted on a slab-by-slab basis but is rated based on the overall condition of the sealant in the sample unit. Joint sealer is in satisfactory condition if it prevents entry of water into the joint, has some elasticity, and if no vegetation is growing between the sealer and joint face. Premolded sealer is rated using the same criteria as above except as follows: (1) premolded sealer is elastic and is firmly pressed against the joint walls and (2) premolded sealer is below the joint edge. If the sealer extends above the surface, it can be caught by moving equipment such as snow plows or brooms and pulled out of the joint. Premolded sealer is recorded at low severity if any part is visible above the joint edge. It is at medium severity if 10 percent or more of the length is above the joint edge or if any part is more than 0.5 inch (13 millimeters) above the joint edge. It is at high severity if 20 percent or more is above the joint edge, if any part is more than 1 inch (25 millimeters) above the joint edge, or if 10 percent or more is missing. Rate joint sealer by joint segment. Sample unit rating is the same as the most severe rating held by at least 20 percent of the segments rated. In rating oxidation, do not rate on appearance, rate on resilience. Some joint sealer will have a very dull surface and may even show surface cracks in the oxidized layer. If the sealer is performing satisfactorily and has good characteristics beneath the surface, it is satisfactory.

Figure A-242 Low-Severity Joint Seal Damage



Figure A-243 Medium-Severity Joint Seal Damage

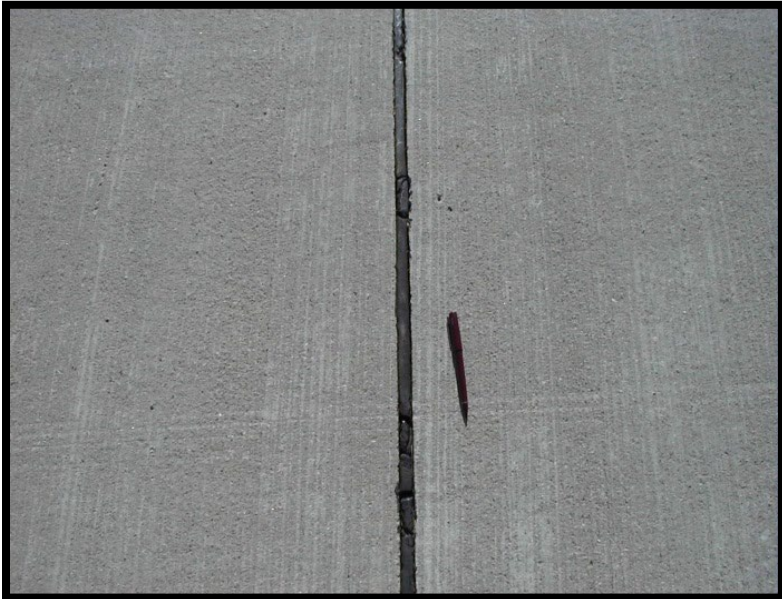


Figure A-244 High-Severity Joint Seal Damage



Figure A-245 Joint Seal Deduct Values

**JOINT SEAL DAMAGE**

Concrete 65 {5}

Joint seal damage is not rated by density. The severity of the distress is determined by the sealant's overall condition for a particular section.

The deduct values for the three levels of severity are as follows:

1. High Severity - 12 Points
2. Medium Severity - 7 Points
3. Low Severity - 2 Points

**A-5.6 Patching, Small (Less Than 5.5 ft<sup>2</sup> [0.5 m<sup>2</sup>]) (66).**

A patch is an area where the original pavement has been removed and replaced by a filler material. For condition evaluation, patching is divided into two types: small (less than 5.5 square feet [0.5 square meter]) and large (over 5.5 square feet [0.5 square meter]). Large patches are described in paragraph A-5.7.

**A-5.6.1 Severity Levels.**

**L** Patch is functioning well, with little or no deterioration.

**M** Patch has deteriorated and/or moderate spalling can be seen around the edges. Patch material can be dislodged with considerable effort (minor FOD potential).

**H** Patch has deteriorated, either by spalling around the patch or cracking within the patch, to a state that warrants replacement.

**A-5.6.2 How to Measure.**

If one or more small patches having the same severity level are located in a slab, it is counted as one slab containing that distress. If more than one severity level occurs, it is counted as one slab, with the higher severity level being recorded. If a crack is repaired by a narrow patch (e.g., 4 to 10 inches [100 to 250 millimeters] wide), only the crack and not the patch is recorded at the appropriate severity level. If the original distress of a patch is more severe than the patch itself, the original distress type is recorded.

**Figure A-246 Low-Severity Small Patch**

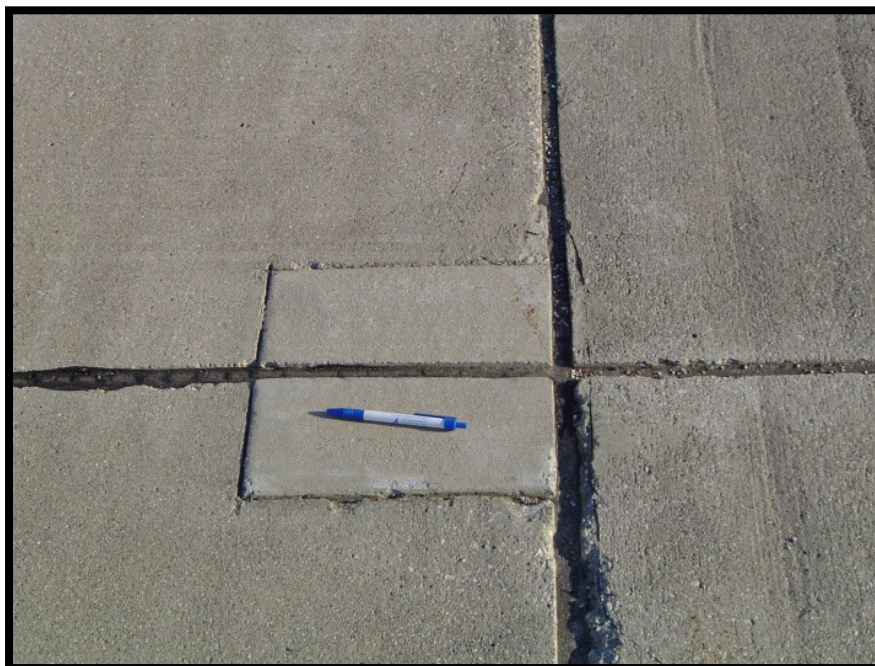


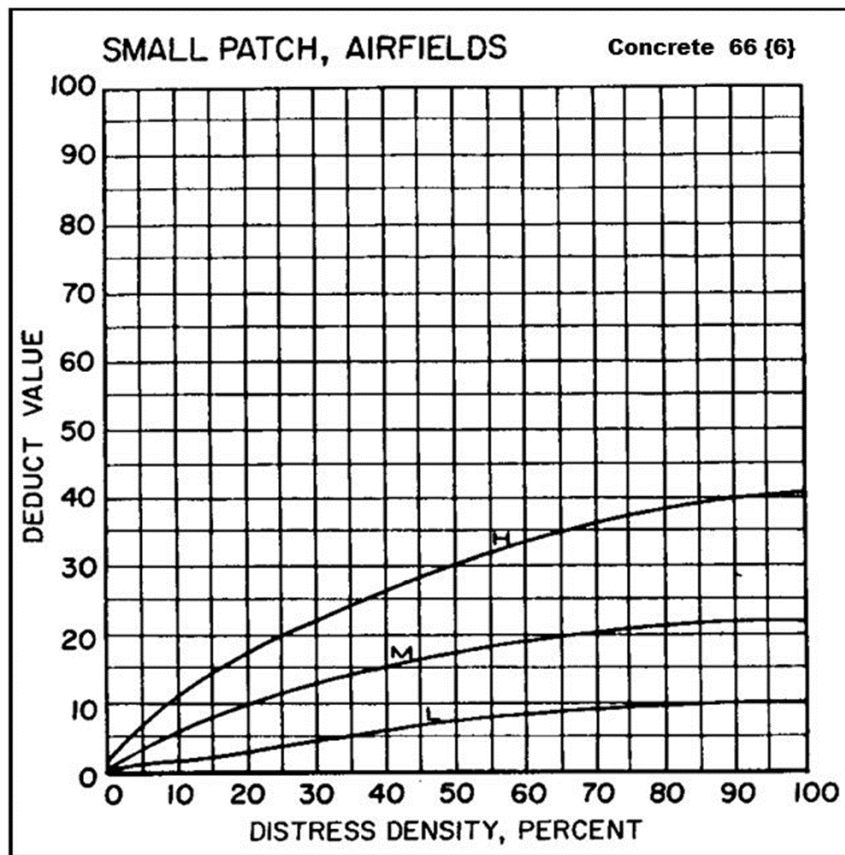
Figure A-247 Medium-Severity Small Patch



Figure A-248 High-Severity Small Patch



Figure A-249 Small Patch Deduct Curve



**A-5.7 Patching, Large (Over 5.5 ft<sup>2</sup> [0.5 m<sup>2</sup>]) And Utility Cut (67).**

Patching is the same as defined in paragraph A-5.6. A utility cut is a patch that has replaced the original pavement because of placement of underground utilities. The severity levels of a utility cut are the same as those for regular patching.

**A-5.7.1 Severity Levels.**

**L** Patch is functioning well, with very little or no deterioration.

**M** Patch has deteriorated and/or moderate spalling is visible around the edges. Patch material can be dislodged with considerable effort, causing some FOD potential.

**H** Patch has deteriorated to a state that causes considerable roughness and/or high FOD potential. The extent of the deterioration warrants replacement of the patch.

**A-5.7.2 How to Count.**

The criteria are the same as for small patches (paragraph A-5.6).

Figure A-250 Low-Severity Large Patch



Figure A-251 Medium-Severity Large Patch



Figure A-252 High Severity Large Patch

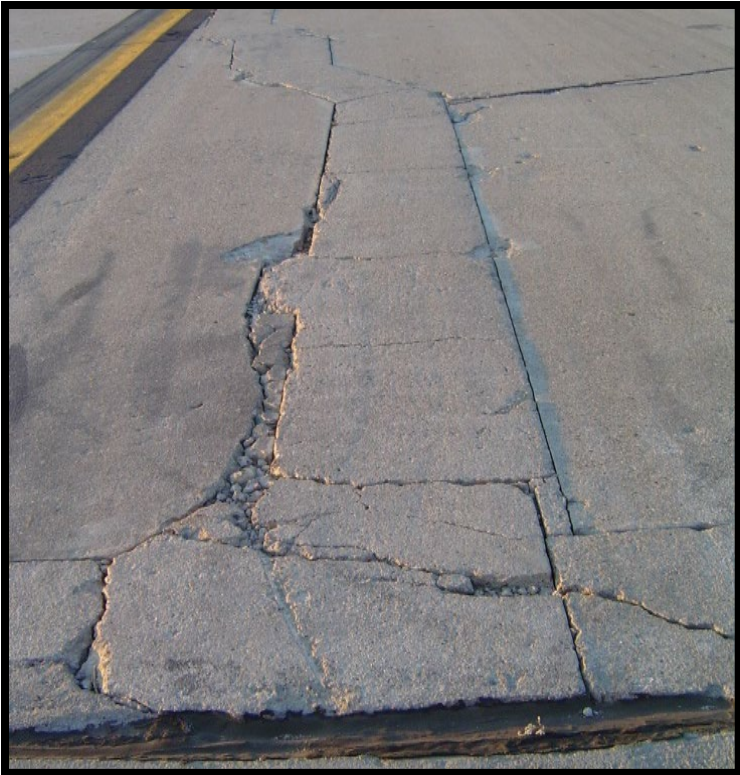
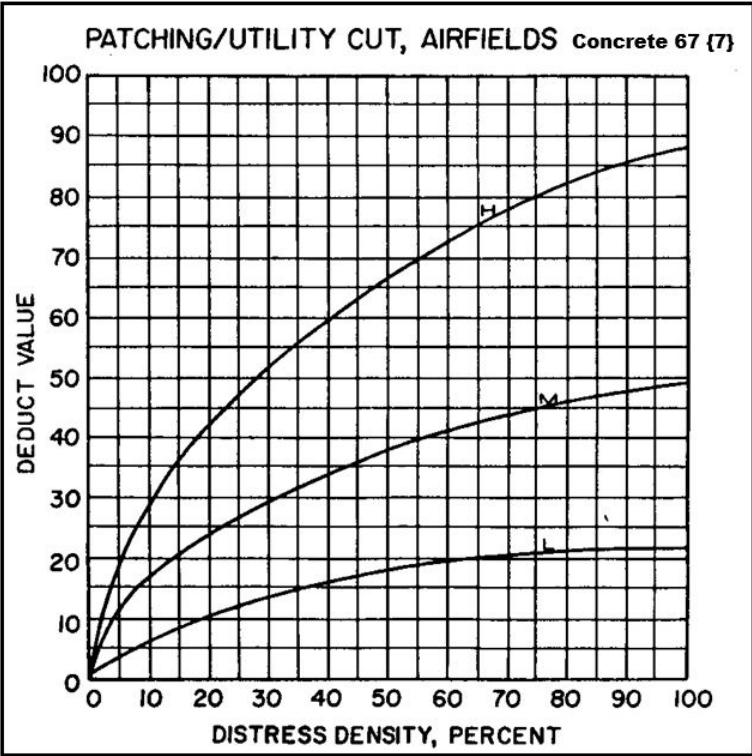


Figure A-253 Large Patch/Utility Cut Deduct Curve



### **A-5.8 Popouts (68).**

A popout is a small piece of pavement that breaks loose from the surface due to freeze-thaw action in combination with expansive aggregates. Popouts usually range from approximately 1 inch (25 millimeters) to 4 inches (100 millimeters) in diameter and from 0.5 inch (13 millimeters) to 2 inches (50 millimeters) deep.

#### **A-5.8.1 Severity Levels.**

No degrees of severity are defined for popouts; however, when popouts are extensive, they are counted as a distress; i.e., average popout density exceeds approximately three popouts per square yard (square meter) over the entire slab area.

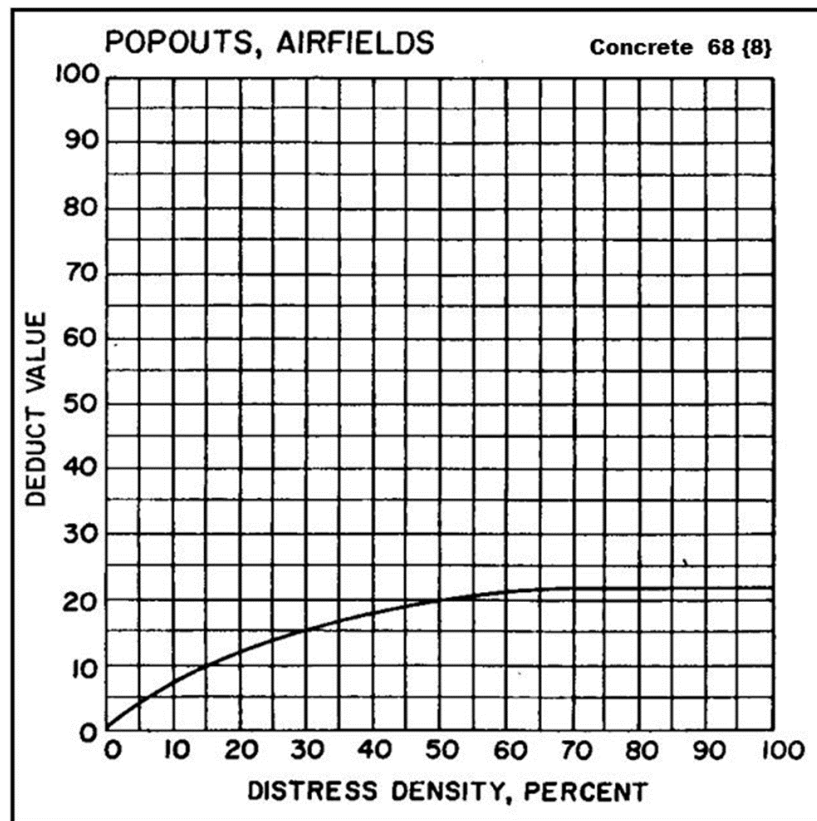
#### **A-5.8.2 How to Count.**

Always measure the density of the distress. If there is any doubt about the average being greater than three popouts per square yard (square meter), at least three random 1-square-yard (1-square-meter) areas are checked. When the average is greater than this density, the slab is counted.

**Figure A-254 Popouts**



Figure A-255 Popouts Deduct Curve



**A-5.9 Pumping (69).**

Pumping is the ejection of material by water through joints or cracks caused by deflection of the slab under passing loads. As the water is ejected, it carries particles of gravel, sand, clay, or silt and results in a progressive loss of pavement support. Surface staining and base or subgrade material on the pavement close to joints or cracks are evidence of pumping. Pumping near joints indicates poor joint sealer and loss of support, which will lead to cracking under repeated loads. Identify the joint sealer as defective before pumping can be said to exist. Pumping can occur at cracks as well as joints.

**A-5.9.1 Severity Levels.**

No degrees of severity are defined. It is sufficient to indicate that pumping exists.

**A-5.9.2 How to Count.**

Slabs are counted as follows: one pumping joint between two slabs is counted as two slabs; however, if the remaining joints around the slab are also pumping, one slab is added per additional pumping joint.

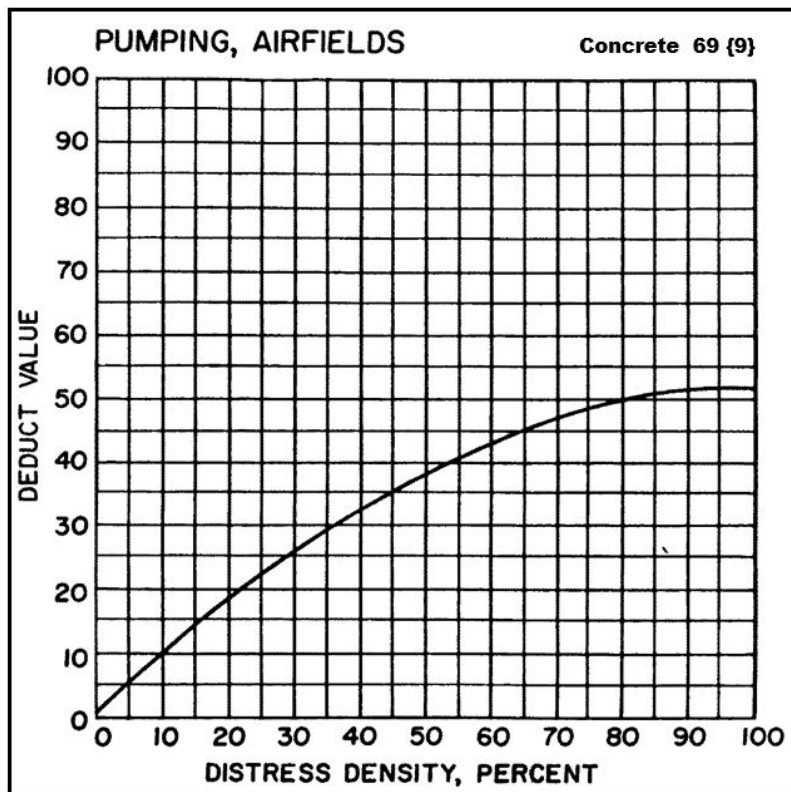
Figure A-256 Pumping



Figure A-257 Pumping Stains



Figure A-258 Pumping Deduct Curve



**A-5.10 Scaling (70).**

Scaling is surface deterioration caused by construction defects, material defects, and environmental factors. Generally, scaling is exhibited by delamination or disintegration of the slab surface to the depth of the defect.

- Construction defects include over-finishing, addition of water to the pavement surface during finishing, lack of curing, and attempted surface repairs of fresh concrete with mortar. Generally, this occurs over a portion of a slab.
- Material defects include inadequate air entrainment for the climate. Generally, this occurs over several slabs that were affected by the concrete batches.
- Environmental factors include freezing of concrete before adequate strength is gained and thermal cycles from certain aircraft. Generally, this occurs over a large area for freezing and in isolated areas for thermal effects.
- Typically, the FOD from scaling is removed by sweeping but the concrete will continue to scale until the affected depth is removed or expended.

### A-5.10.1 Severity Levels.

**L** Minimal loss of surface paste that poses no FOD hazard. No FOD potential.

**M** The loss of surface paste that poses some FOD potential, including isolated fragments of loose mortar, exposure of the sides of coarse aggregate (less than one-fourth of the width of the coarse aggregate), or evidence of coarse aggregate coming loose from the surface.

**H** The high severity is associated with low-durability concrete that will continue to pose a high FOD hazard. Typically, the layer of surface mortar is observable at the perimeter of the scaled area and is likely to continue to scale due to environmental or other factors. Indication of high-severity FOD is that routine sweeping is not sufficient to avoid FOD issues.

### A-5.10.2 How to Count.

If two or more levels of severity exist on a slab, the slab is counted as one slab having the maximum level of severity. If "D" cracking or ASR is counted, scaling is not counted.

**Figure A-259 Low-Severity Scaling**



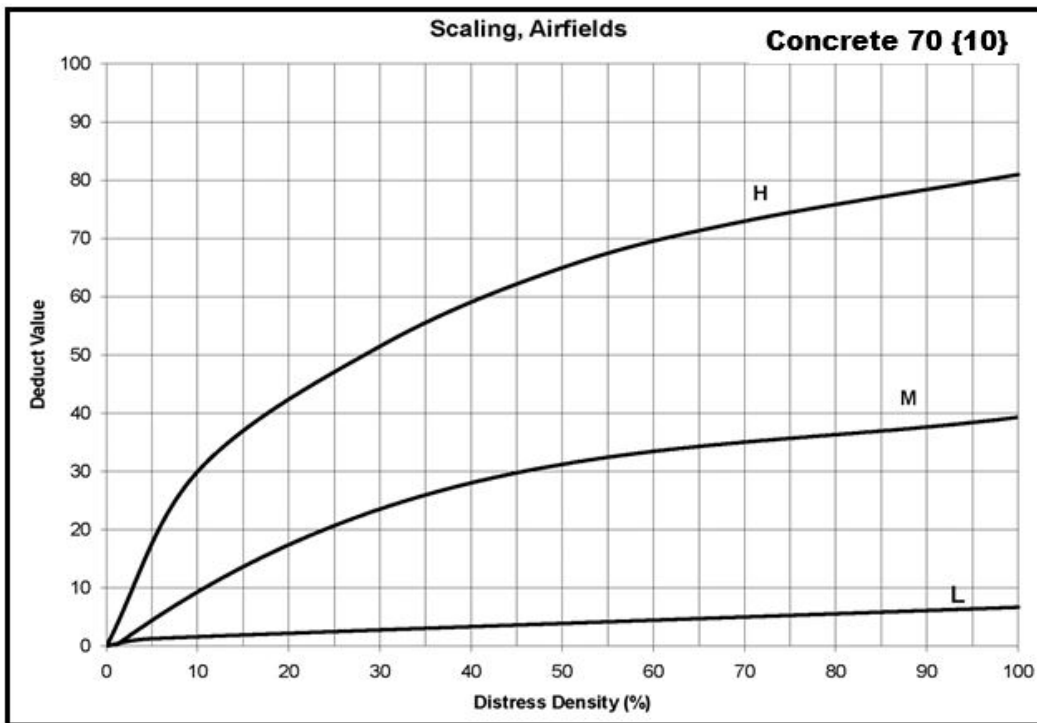
**Figure A-260 Medium-Severity Scaling**



**Figure A-261 High-Severity Scaling**



Figure A-262 Scaling Deduct Curve



**A-5.11 Settlement or Faulting (71).**

Settlement or faulting is a difference of elevation at a joint or crack caused by upheaval or consolidation.

**A-5.11.1 Severity Levels.**

Severity levels are defined by the difference in elevation across the fault and the associated decrease in ride quality and safety as severity increases.

**Table A-17 Difference in Elevation**

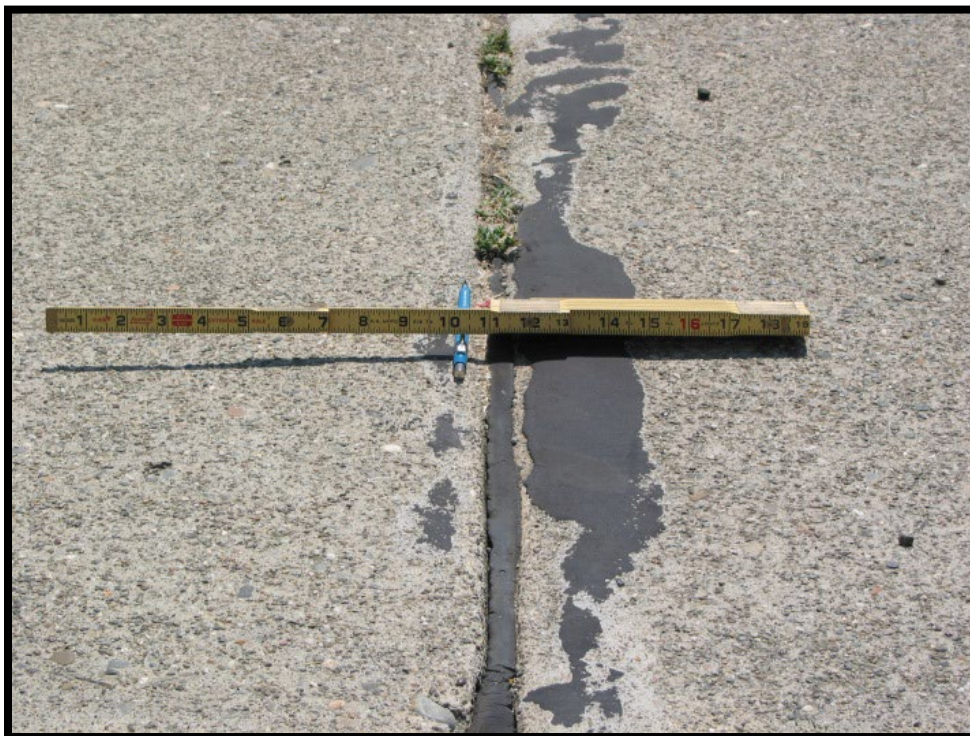
| Severity | Runways/Taxiways           | Aprons                      |
|----------|----------------------------|-----------------------------|
| L        | < 0.25 inch<br>( < 6 mm)   | 0.125–0.5 inch<br>(3–13 mm) |
| M        | 0.25–0.5 inch<br>(6–13 mm) | 0.5–1 inch<br>(13–25 mm)    |
| H        | > 0.5 inch<br>( > 13 mm)   | > 1 inch<br>( > 25 mm)      |

**A-5.11.2 How to Count.**

In counting settlement, a fault between two slabs is counted as one slab. A straightedge or level is used to aid in measuring the difference in elevation between the two slabs.

Construction-induced elevation differential is not rated in PCI procedures. Where construction differential exists, it can often be identified by the way the high side of the joint was rolled down by finishers (usually within 6 inches [150 millimeters] of the joint) to meet the low-slab elevation.

**Figure A-263 Low-Severity Settlement or Faulting**



**Figure A-264 Medium-Severity Settlement or Faulting**



**Figure A-265 High-Severity Settlement or Faulting**

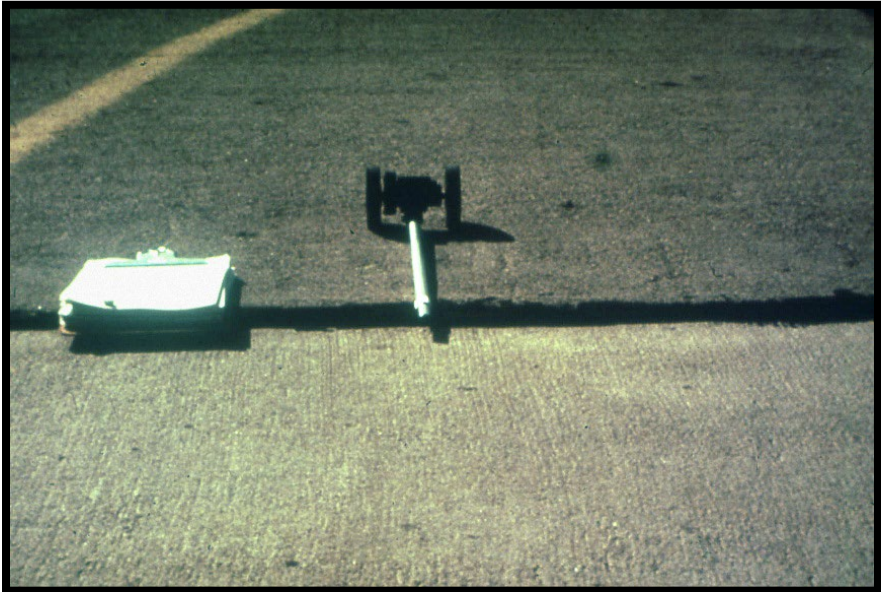
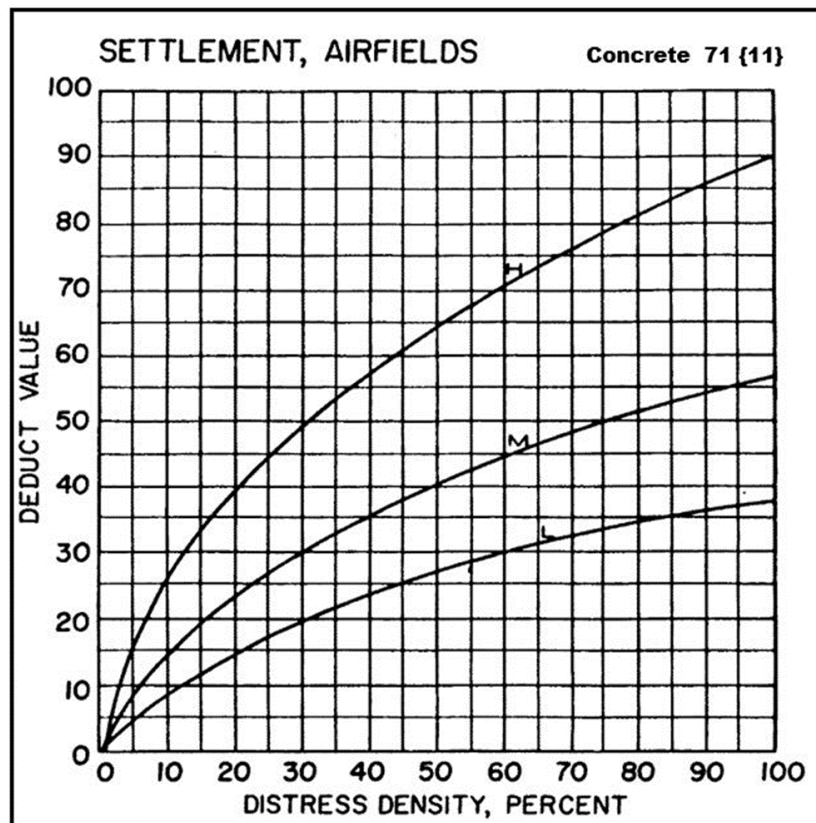


Figure A-266 Settlement or Faulting Deduct Curve



**A-5.12 Shattered Slab/Intersecting Cracks (72).**

Intersecting cracks are cracks that break the slab into four or more pieces because of overloading and/or inadequate support. The high-severity level of this distress type, as defined below, is referred to as a shattered slab. If all pieces or cracks are contained within a corner break, the distress is categorized as a severe corner break.

**A-5.12.1 Severity Levels.**

**L** Slab is broken into four or five pieces predominantly defined by low-severity cracks.

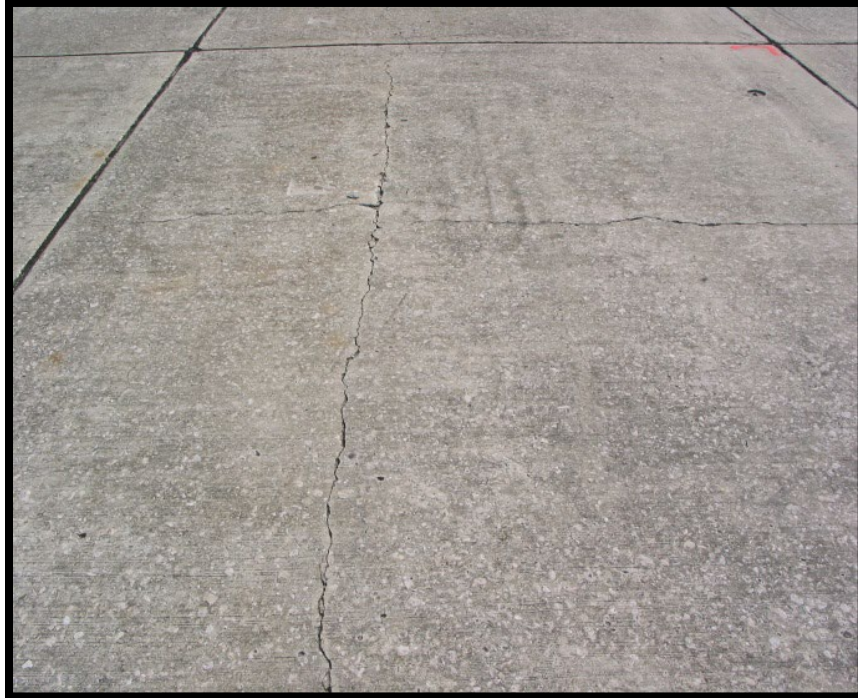
**M** (1) Slab is broken into four or five pieces, with over 15 percent of the cracks of medium severity (no high-severity cracks); or (2) slab is broken into six or more pieces, with over 85 percent of the cracks of low severity.

**H** At this level of severity, the slab is called shattered: (1) slab is broken into four or five pieces, with some or all of the cracks of high severity; (2) slab is broken into six or more pieces, with over 15 percent of the cracks of medium or high severity.

**A-5.12.2 How to Count.**

No other distress such as scaling, spalling, or durability cracking is recorded if the distress is medium- or high-severity level since the severity of this distress substantially affects the slab's rating. Shrinkage cracks are not counted in determining whether or not the slab is broken into four or more pieces.

**Figure A-267 Low-Severity Shattered Slab/Intersecting Cracks**



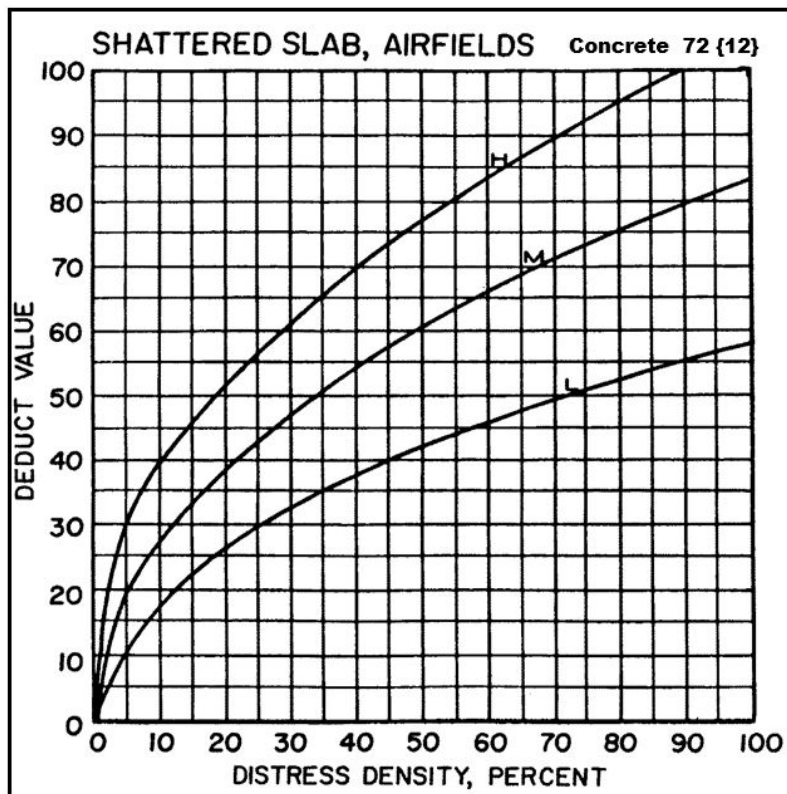
**Figure A-268 Medium-Severity Shattered Slab/Intersecting Cracks**



**Figure A-269 High-Severity Shattered Slab/Intersecting Cracks**



Figure A-270 Shattered Slab Deduct Curve



**A-5.13 Shrinkage Cracks (73).**

Shrinkage cracks are hairline cracks that are usually only a few feet (meters) long and do not extend across the entire slab. They are formed during the setting and curing of the concrete and usually do not extend through the depth of the slab.

**A-5.13.1 Severity Levels.**

No degrees of severity are defined. It is sufficient to indicate that shrinkage cracks exist.

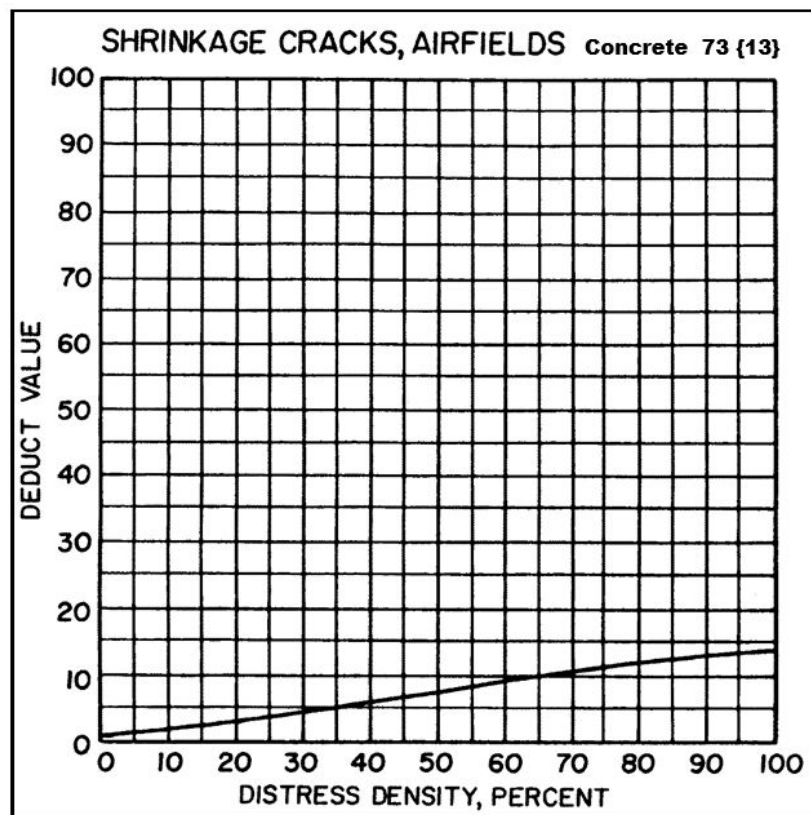
**A-5.13.2 How to Count.**

If one or more shrinkage cracks exist on one particular slab, the slab is counted as one slab with shrinkage cracks.

Figure A-271 Shrinkage Cracks



Figure A-272 Shrinkage Crack Deduct Curve



**A-5.14 Joint Spalling (Transverse and Longitudinal Joints) (74).**

Joint spalling is the breakdown of the slab edges within 2 feet (600 millimeters) of the side of the joint. A joint spall usually does not extend vertically through the slab but intersects the joint at an angle. Spalling results from excessive stresses at the joint or crack caused by infiltration of incompressible materials or traffic loads. Weak concrete at the joint (caused by overworking) combined with traffic loads also causes spalling.

Frayed condition as used in the test method in Table A-18 indicates that material is no longer in place along a joint or crack. Spalling indicates material may or may not be missing along a joint or crack.

**A-5.14.1 Severity Levels.**

**Table A-18 Severity Levels of Spalling**

|   | <b>Spall Length</b>  | <b>Description</b>  |
|---|----------------------|---|
| L | < 2 feet<br>(600 mm) | Spall is broken into pieces or fragmented; little FOD or tire damage potential exists.  |
|   | > 2 feet<br>(600 mm) | (a) Spall is broken into no more than three pieces defined by low- or medium-severity cracks; little or no FOD potential exists; or (b) joint is lightly frayed; little or no FOD potential exists.   |
| M | < 2 feet<br>(600 mm) | Spall is broken into pieces or fragmented, with some of the pieces loose or absent, causing considerable FOD or tire damage potential.  |
|   | > 2 feet<br>(600 mm) | (a) Spall is broken into more than three pieces defined by light or medium cracks; (b) spall is broken into no more than three pieces, with one or more of the cracks being severe, with some FOD potential existing; or (c) joint is moderately frayed, with some FOD potential. |
| H | > 2 feet<br>(600 mm) | (1) Spall is broken into more than three pieces defined by one or more high-severity cracks with high FOD potential; or (2) joint is severely frayed, with high FOD potential.  |

**A-5.14.2 How to Count.**

If the joint spall is located along the edge of one slab, it is counted as one slab with joint spalling. If spalling is located on more than one edge of the same slab, the edge having the highest severity is counted and recorded as one slab. Joint spalling can also occur along the edges of two adjacent slabs. If this is the case, each slab is counted as having

joint spalling. If a joint spall is small enough to be filled during a joint seal repair, it is not recorded.

**Figure A-273 Low-Severity Joint Spall**



**Figure A-274 Medium-Severity Joint Spall**



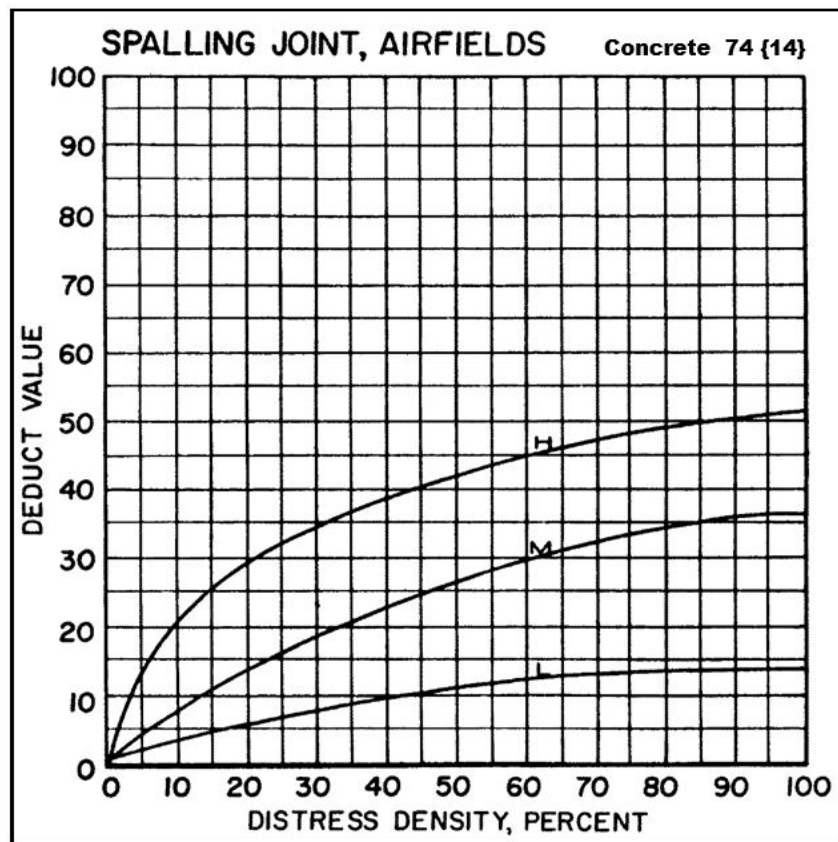
Figure A-275 High-Severity Joint Spall



Figure A-276 High-Severity Joint Spall



Figure A-277 Joint Spall Deduct Curve



**A-5.15 Spalling (Corner) (75).**

Corner spalling is the raveling or breakdown of the slab within approximately 2 feet (600 millimeters) of the corner. A corner spall differs from a corner break in that the spall angles downward to intersect the joint, while a break extends vertically through the slab.

**A-5.15.1 Severity Levels.**

**L** One of these conditions exists: (1) spall is broken into one or two pieces defined by low-severity cracks (little or no FOD potential); or (2) spall is defined by one medium-severity crack (little or no FOD potential).

**M** One of these conditions exists: (1) spall is broken into two or more pieces defined by one or more medium-severity cracks and a few small fragments may be absent or loose; (2) spall is defined by one severe, fragmented crack that may be accompanied by a few hairline cracks; or (3) spall has deteriorated to the extent that loose material is causing some FOD potential.

**H** One of these conditions exists: (1) spall is broken into two or more pieces defined by one or more high-severity fragmented cracks, with loose or absent fragments; (2) pieces of the spall have been displaced to the extent that a tire damage hazard exists;

or (3) spall has deteriorated to the extent that loose material is causing high FOD potential.

**A-5.15.2 How to Count.**

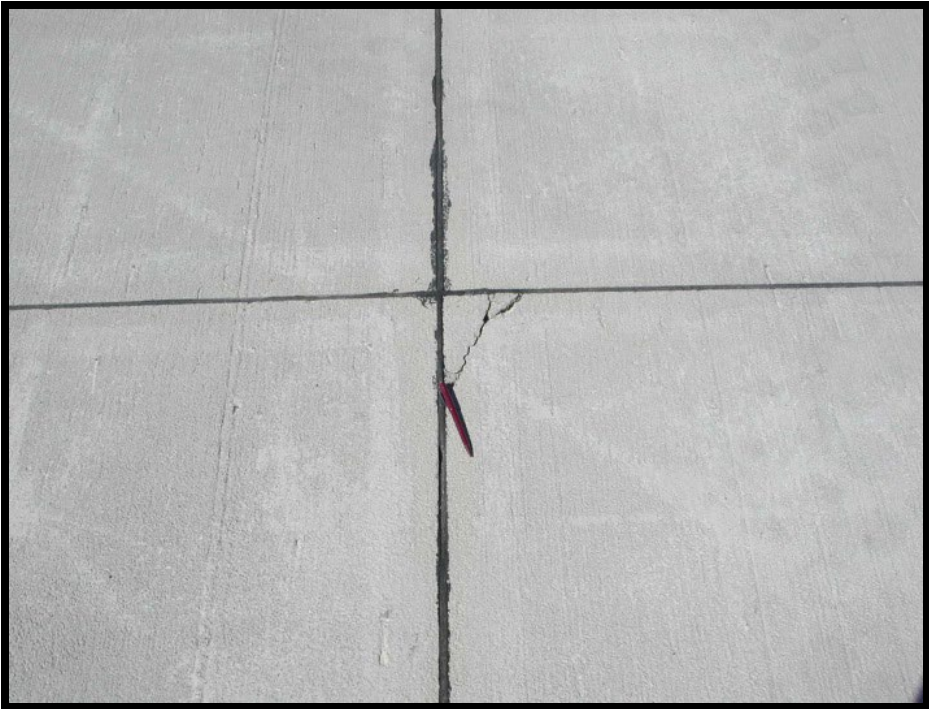
If one or more corner spalls having the same severity level are located in a slab, the slab is counted as one slab with corner spalling. If more than one severity level occurs, it is counted as one slab having the higher severity level.

A corner spall smaller than 3 inches (76 millimeters) wide, measured from the edge of the slab and filled with sealant, is not recorded.

**Figure A-278 Low-Severity Corner Spall**



**Figure A-279 Medium-Severity Corner Spall**



**Figure A-280 High-Severity Corner Spall**

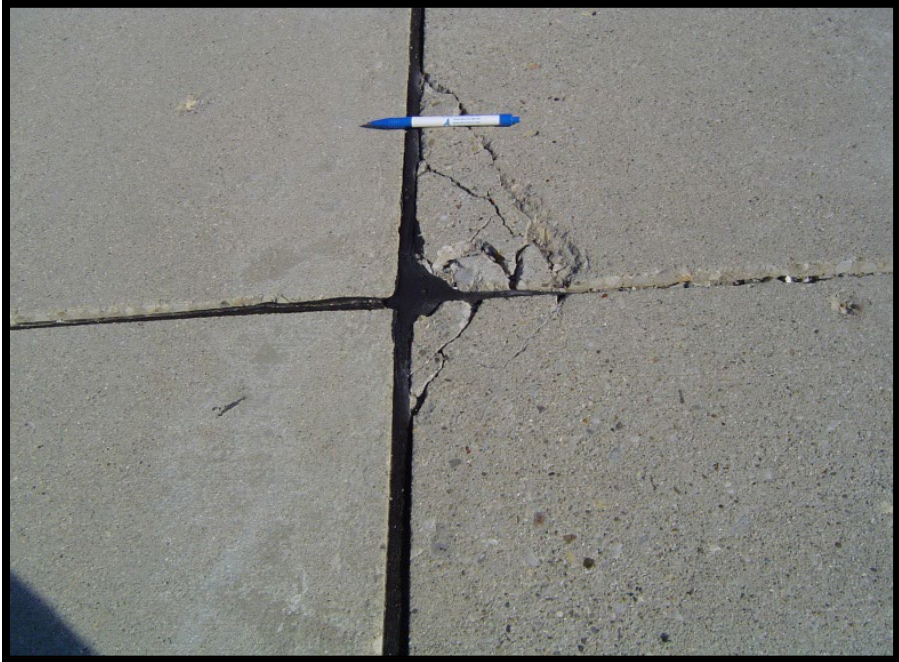
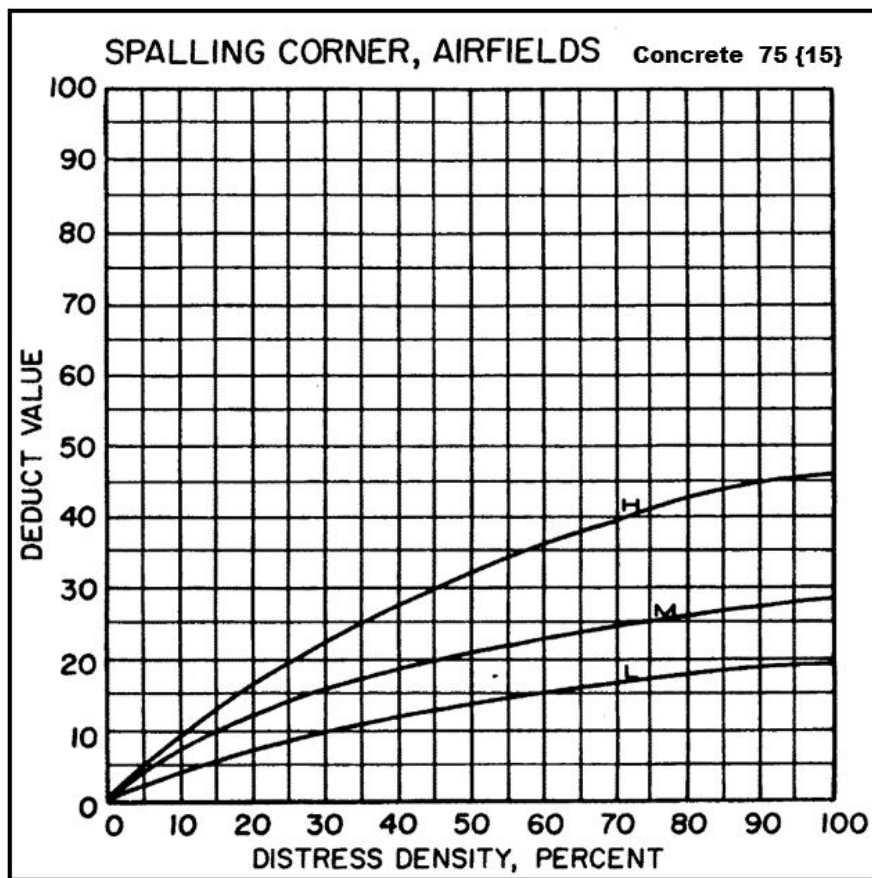


Figure A-281 Corner Spall Deduct Curve



**A-5.16 Alkali-Silica Reaction (ASR) (76).**

ASR is caused by a chemical reaction between alkalis and certain reactive silica minerals, which form a gel. The gel absorbs water, causing expansion that may damage the concrete and adjacent structures. Alkalis are most often introduced by the portland cement within the pavement. ASR cracking may be accelerated by chemical pavement deicers. Visual indicators that ASR is present include:

- Cracking of the concrete pavement (often in a map pattern)
- White, brown, gray, or other colored gel or staining possibly present at the crack surface
- Aggregate popouts
- Increase in concrete volume (expansion) that may result in distortion of adjacent or integral structures or physical elements. Examples of expansion include shoving of asphalt pavements, light can tilting, slab faulting, joint misalignment, and extrusion of joint seals or expansion joint fillers.

Because ASR is material-dependent, it is generally present throughout the pavement section. Coring and concrete petrographic analysis is the only definitive method to confirm ASR. Keep these factors in mind when identifying the presence of ASR through visual inspection:

- Generally, ASR distresses are not observed in the first few years after construction. In contrast, plastic shrinkage cracking can occur the day of construction and is apparent within the first year.
- ASR is differentiated from D-cracking by the presence of cracking perpendicular to the joint face. D-cracking predominantly develops as a series of parallel cracks to joint faces and linear cracking within the slab.
- ASR is differentiated from map cracking/scaling by the presence of visual signs of expansion.

#### **A-5.16.1 Severity Levels.**

**L** Minimal to no FOD potential from cracks, joints, or ASR-related popouts; cracks at the surface are tight (predominantly 0.04 inch [1 millimeter] or less). Little to no evidence of movement in pavement or surrounding structures or elements.

**M** Some FOD potential; increased sweeping or other FOD removal methods may be required; there may be evidence of slab movement and/or some damage to adjacent structures or elements. Medium-severity ASR distress is differentiated from low severity by having one or more of the following: increased FOD potential, increased cracking of the slab, some fragments along cracks or at crack intersections, possible surface popouts of concrete, and/or a pattern of wider cracks (predominantly 0.04 inch [1 millimeter] or wider) that may be subdivided by tighter cracks.

**H** One or both of these conditions exists: (1) loose or missing concrete fragments that pose high FOD potential; (2) slab surface integrity and function significantly degraded and pavement requires immediate repair; may also require repairs to adjacent structures or elements.

#### **A-5.16.2 How to Count.**

No other distresses are recorded if high-severity ASR is recorded.

Figure A-282 Low-Severity ASR

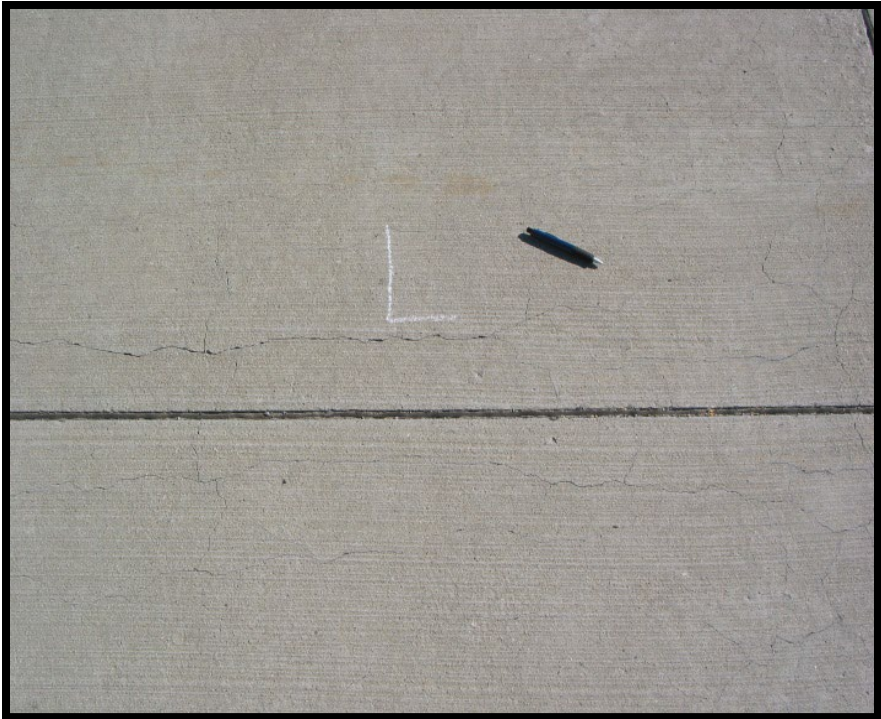


Figure A-283 Medium-Severity ASR

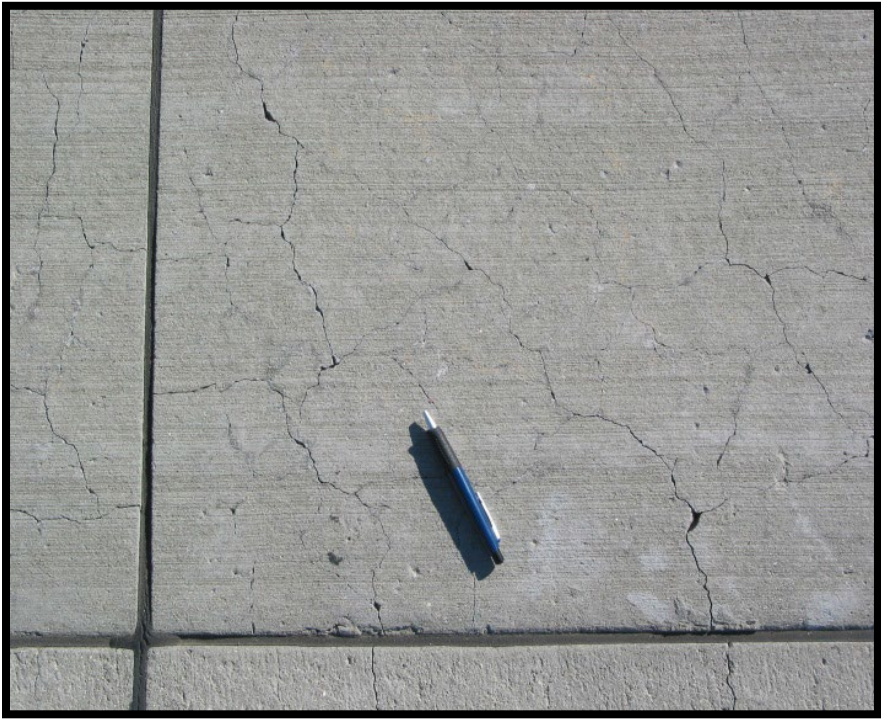


Figure A-284 High-Severity ASR



Figure A-285 ASR Deduct Curve

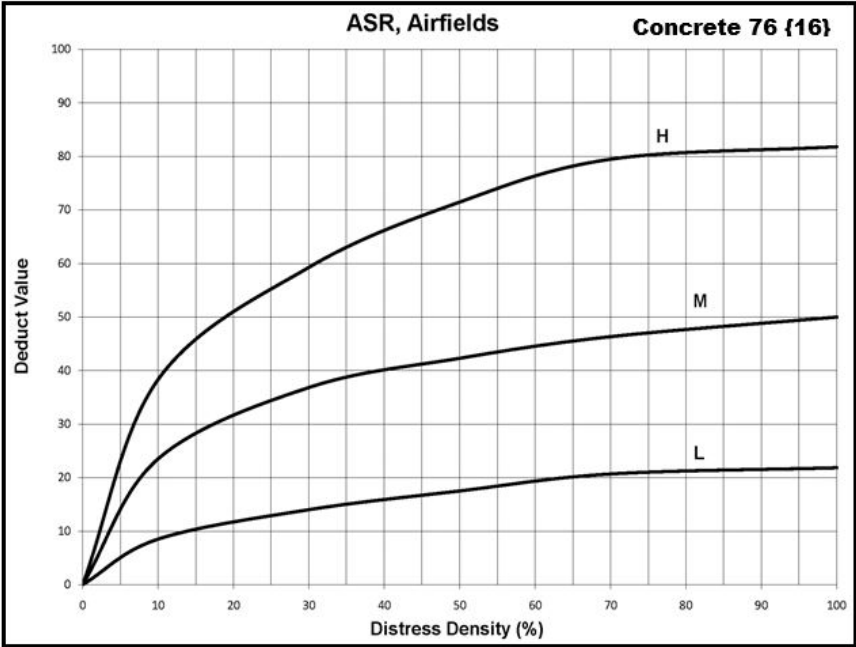
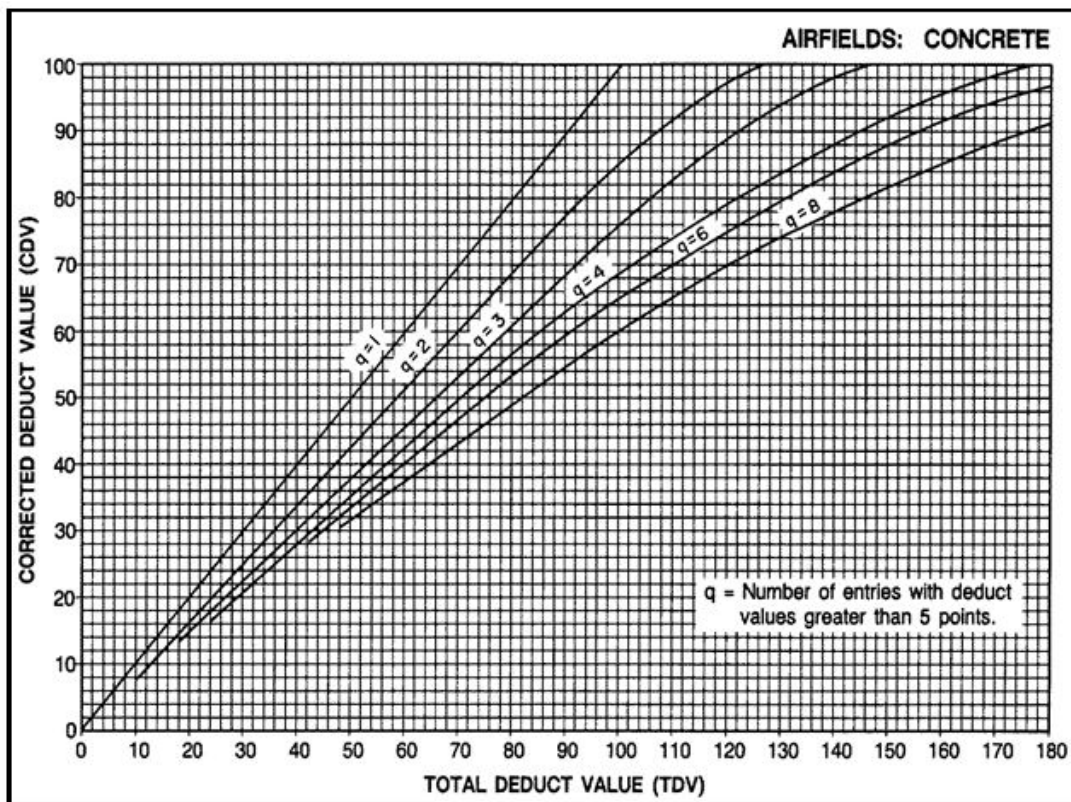


Figure A-286 Corrected Deduct Value Curves for Concrete Airfield Pavement



**A-6 UNSURFACED ROAD AND PARKING DISTRESSES.**

**A-6.1 Improper Cross-Section (81).**

An unsurfaced road should have a crown with enough slope from the centerline to the shoulder to drain all water from the road's surface. No crown is used on curves because they are usually banked. The cross-section is improper when the road surface is not shaped or maintained to carry water to the ditches.

**A-6.1.1 Severity Levels.**

**L** Small amounts of ponding water or evidence of ponding water on the road surface, or the road surface is completely flat (no cross slope).

**M** Moderate amounts of ponding water or evidence of ponding water on the road surface, or the road surface is bowl shaped.

**H** Large amounts of ponding water or evidence of ponding water on the road surface, or the road surface contains severe depressions.

See Figure A-287.

**A-6.1.2 How to Measure.**

Improper cross-section is measured in linear feet (linear meters) per sample unit (along the centerline or parallel to the centerline). The cross-section runs from the outside shoulder break on one side of the road to the outside shoulder break on the other side. Different severity levels may exist within the sample unit. For example, there could be 60 feet (18.3 meters) with medium severity and 40 feet (12.2 meters) with low severity. The maximum length would be equal to the length of the sample unit.

**Figure A-287 Improper Cross-Section Severities**

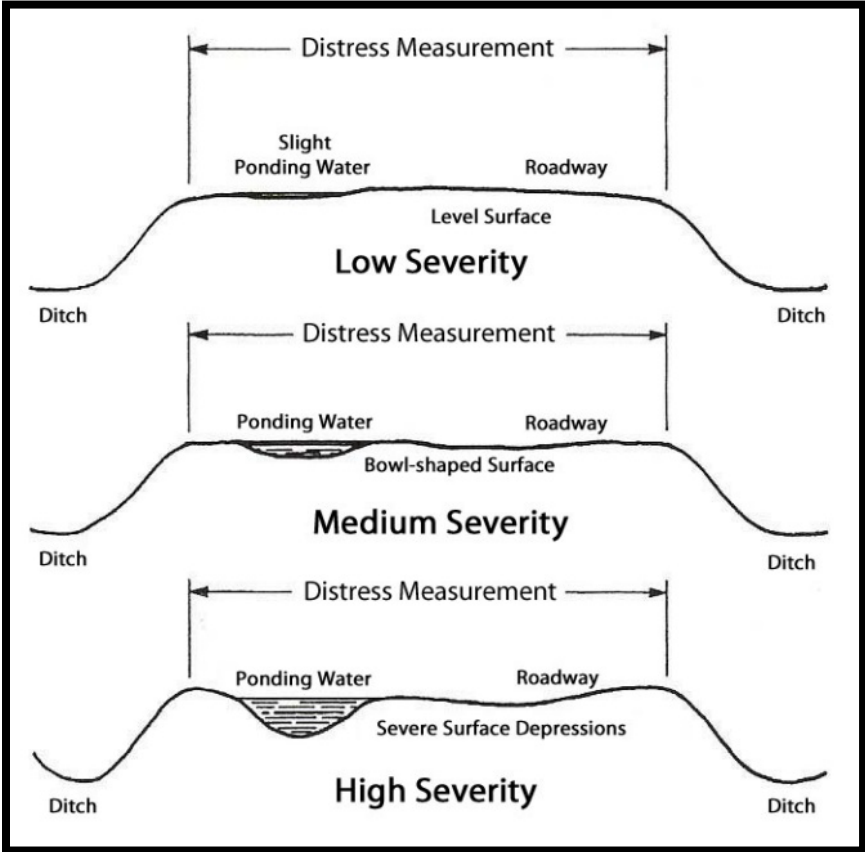
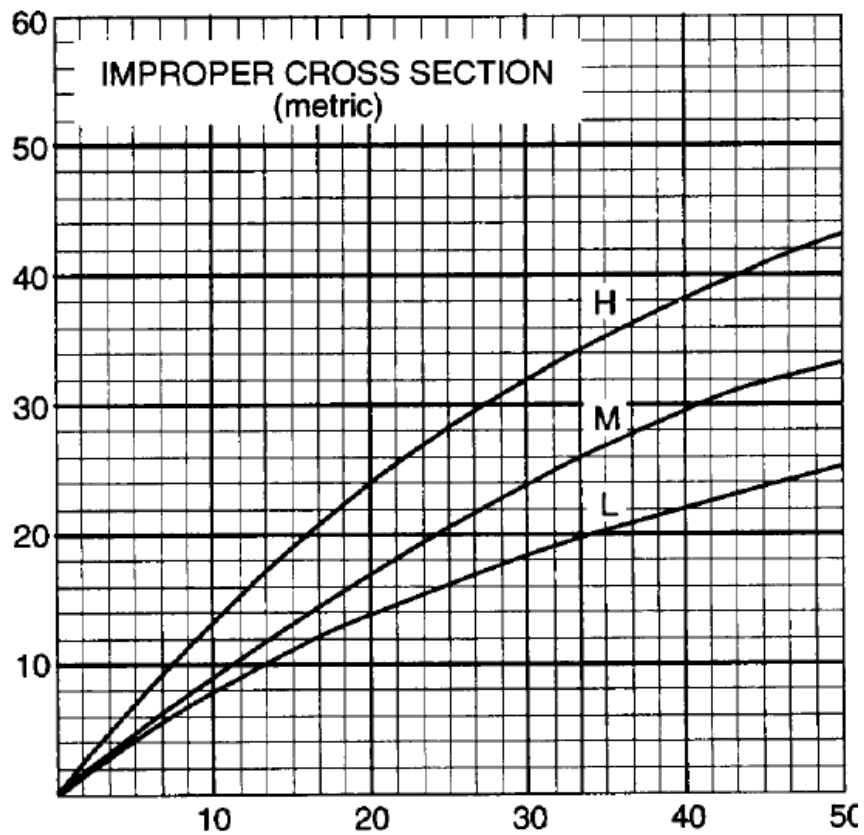
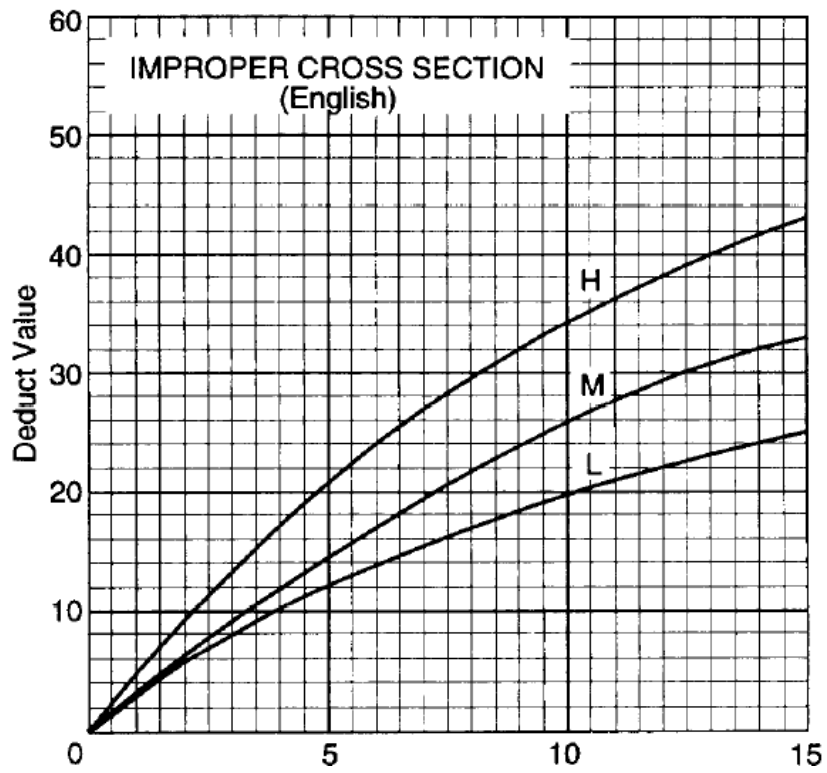


Figure A-288 Improper Cross-Section Deduct Curve



## A-6.2 Inadequate Roadside Drainage (82).

Poor drainage causes water to pond. Drainage becomes a problem when ditches and culverts are not in good enough condition to direct and carry runoff water because of improper shape or maintenance.

### A-6.2.1 Severity Levels.

**L** Small amounts of ponding water or evidence of ponding water in the ditches, or overgrowth or debris in the ditches.

**M** Moderate amounts of ponding water or evidence of ponding water in the ditches, overgrowth or debris in the ditches, or erosion of the ditches into the shoulders or roadway.

**H** Large amounts of ponding water or evidence of ponding water in the ditches, water running across or down the road, overgrowth or debris in the ditches, or erosion of the ditches into the shoulders or roadway.

See Figure A-289.

### A-6.2.2 How to Measure.

Drainage problems are measured in linear feet (linear meters) per section parallel to the centerline. The maximum length is two times the length of the sample unit (two ditches for the total length of the sample unit). For example, a sample unit may have 120 feet (36.6 meters) with low severity and 35 feet (10.7 meters) with high severity.

Figure A-289 Inadequate Roadside Drainage

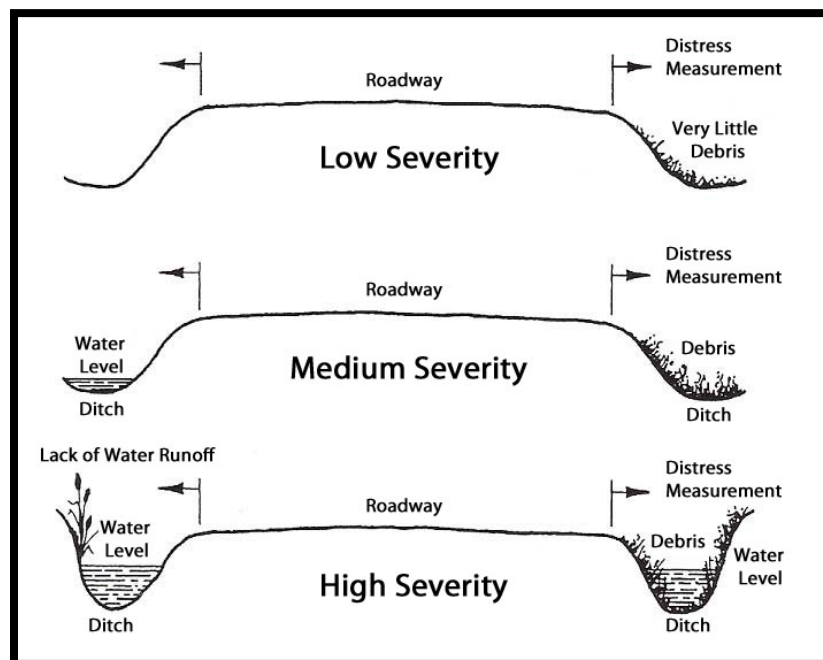
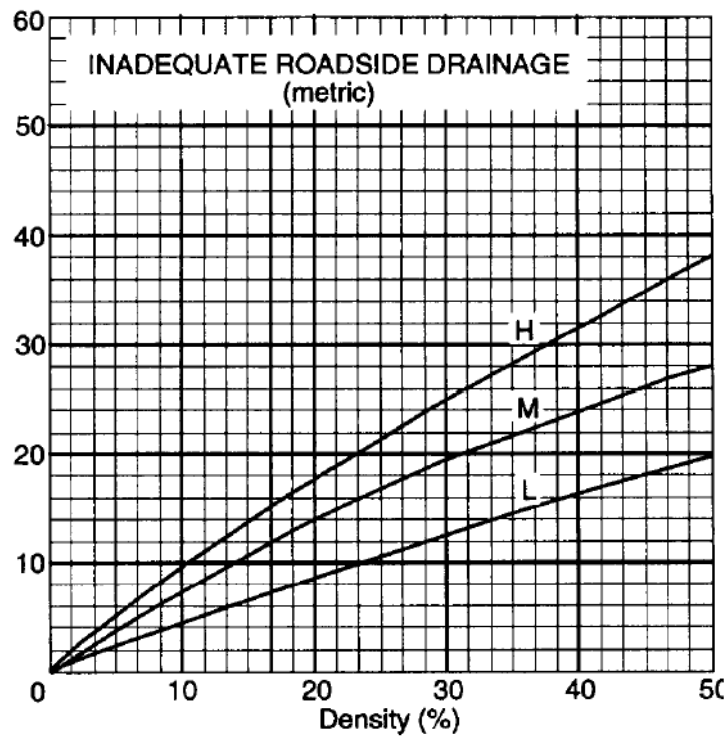
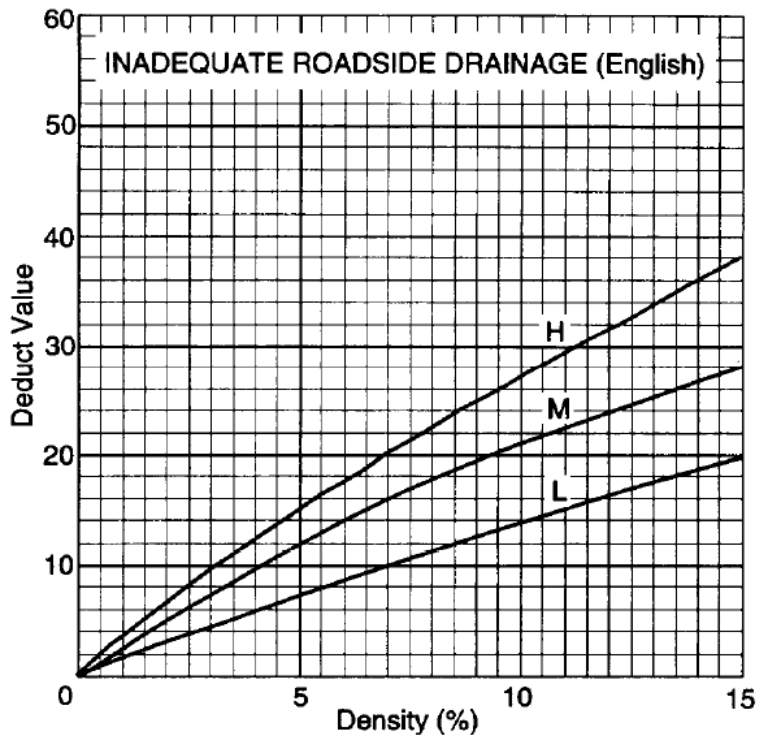


Figure A-290 Inadequate Roadside Drainage Deduct Curve



### A-6.3 Corrugations (83).

Corrugations (also known as washboarding) are closely spaced ridges and valleys (ripples) at fairly regular intervals. The ridges are perpendicular to the traffic direction. This type of distress is usually caused by traffic and loose aggregate. These ridges usually form on hills, on curves, in areas of acceleration or deceleration, or in areas where the road is soft or potholed.

#### A-6.3.1 Severity Levels.

**L** Corrugations are < 1 inch (< 25 millimeters) deep.

**M** Corrugations are between 1 and 3 inches (25 and 75 millimeters) deep.

**H** Corrugations are deeper than 3 inches (75 millimeters).

See Figure A-291.

#### A-6.3.2 How to Measure.

Corrugations are measured in square feet of surface area per sample unit. The amount cannot exceed the total area of the sample unit. For example, a sample unit may have 230 square feet (21 square meters) with moderate severity and 50 square feet (4.5 square meters) with high severity.

Figure A-291 Corrugations

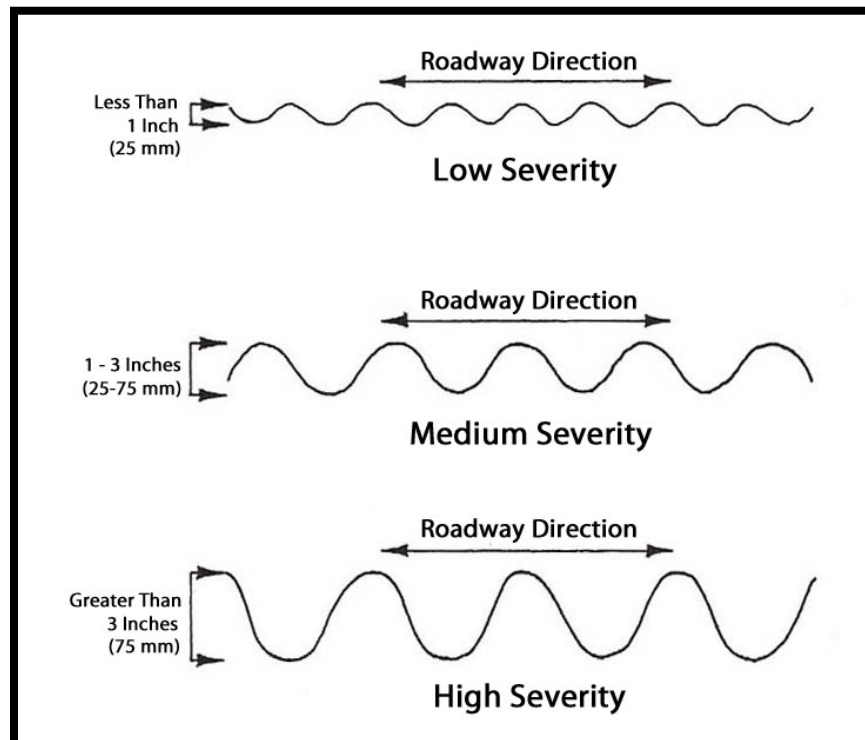
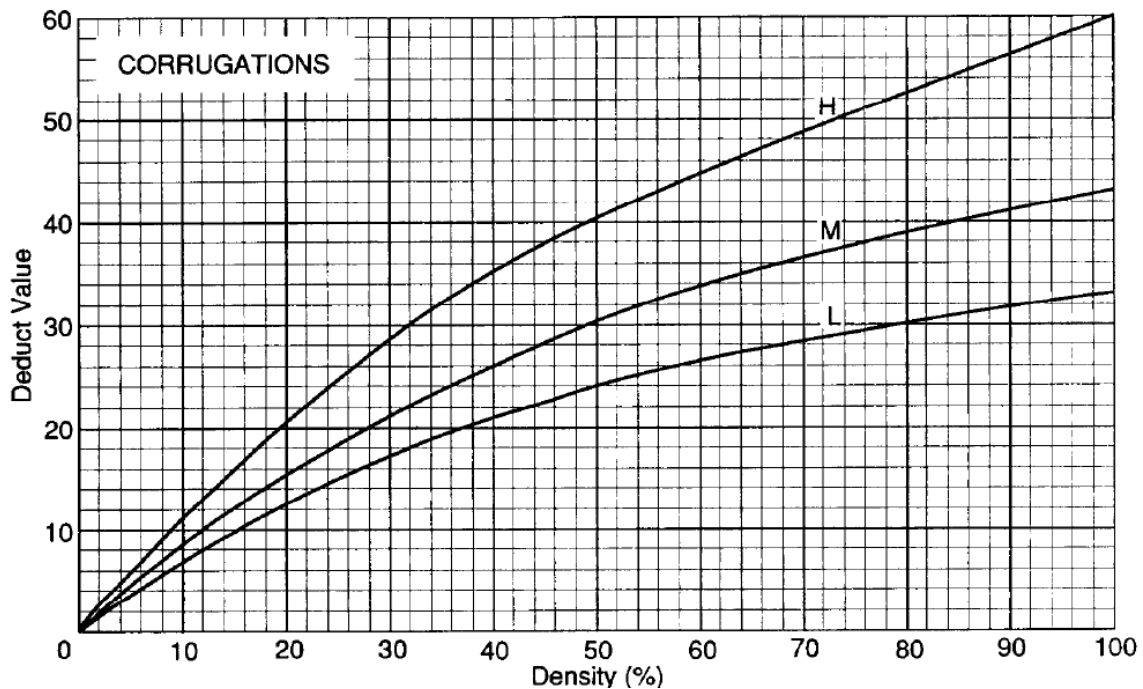


Figure A-292 Corrugations Deduct Curve (English or Metric Units)



#### A-6.4 Dust (84).

The wear and tear of traffic on unsurfaced roads will eventually loosen the larger particles from the soil binder. As traffic passes, dust clouds create a danger to trailing or passing vehicles and cause significant environmental problems.

##### A-6.4.1 Severity Levels.

**L** Normal traffic produces a thin dust that does not obstruct visibility.

**M** Normal traffic produces a moderately thick cloud that partially obstructs visibility and causes traffic to slow down.

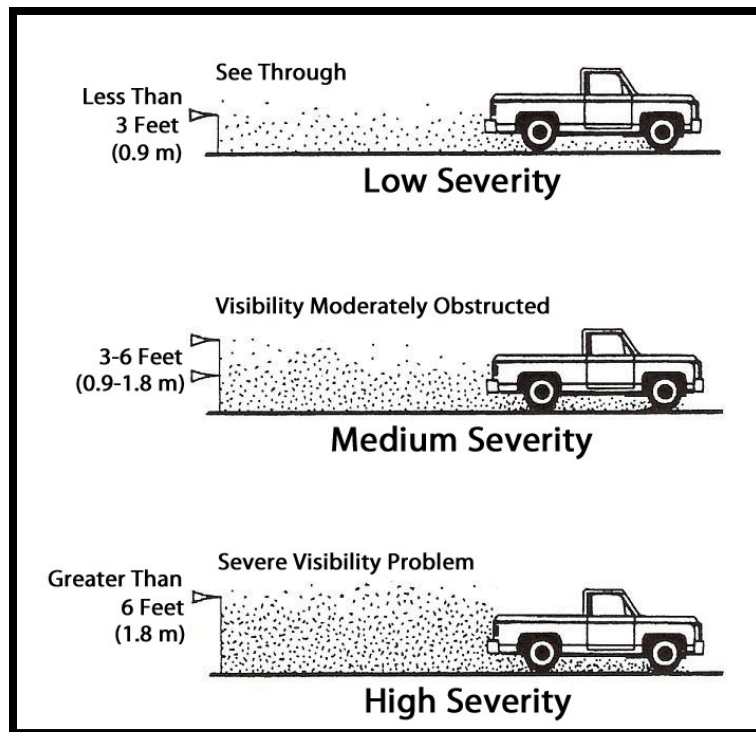
**H** Normal traffic produces a very thick cloud that severely obstructs visibility and causes traffic to slow down significantly or stop.

See Figure A-293.

##### A-6.4.2 How to Measure.

Drive a vehicle at 25 mph (40 km/h) and watch the dust cloud. Dust is measured as low-, medium- or high-severity for the sample unit.

Figure A-293 Dust



#### A-6.4.3 Deduct Values.

Dust is not rated by density. The DVs for the levels of severity are:

- Low = 2 points
- Medium = 4 points
- High = 15 points

#### A-6.5 Potholes (85).

Potholes are bowl-shaped depressions in the road surface. They are usually < 3 feet (0.9 meter) in diameter. Potholes are produced when traffic wears away small pieces of the road surface. They grow faster when water collects inside the hole. The road then continues to disintegrate because of loosening surface material or weak spots in the underlying soils.

##### A-6.5.1 Severity Levels.

The levels of severity for potholes are based on both the diameter and the depth of the pothole according Table A-19. See Figure A-294.

Table A-19 Pothole Severity Levels

| Maximum Depth Of Pothole      | Average Diameter          |                             |                             |  |
|-------------------------------|---------------------------|-----------------------------|-----------------------------|--|
|                               | Less than 1 ft<br>(0.3 m) | 1 to 2 ft<br>(0.3 to 0.6 m) | 2 to 3 ft<br>(0.6 to 0.9 m) | More than 3 ft <sup>a</sup><br>(0.9 m) |
| 1/2 to 2 in.<br>(13 to 50 mm) | L                         | L                           | M                           | M                                      |
| 2 to 4 in.<br>(50 to 100 mm)  | L                         | M                           | H                           | H                                      |
| More than 4 in.<br>(100 mm)   | M                         | M                           | H                           | H                                      |

a. If the pothole is over 3 ft (0.9 m) in diameter, the area should be determined in square feet (square meter) and divided by 7 (.65) to find the equivalent number of potholes.

**A-6.5.2 How to Measure.**

Potholes are measured by counting the number that are low-, medium- and high-severity in a sample unit and recording them separately by severity level. For example, there may be 14 potholes of medium severity and 8 potholes of low severity.

Figure A-294 Potholes

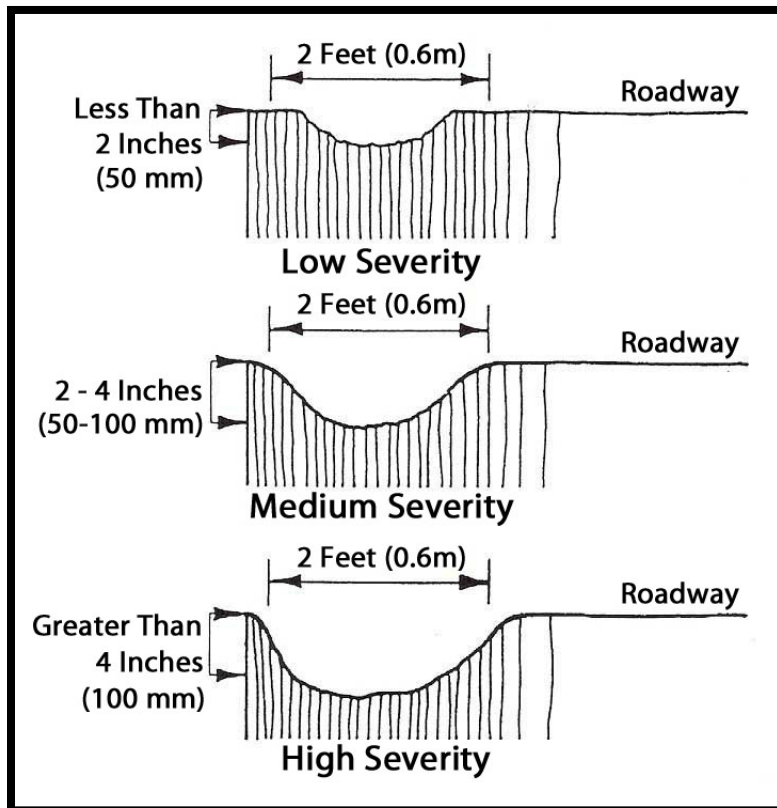
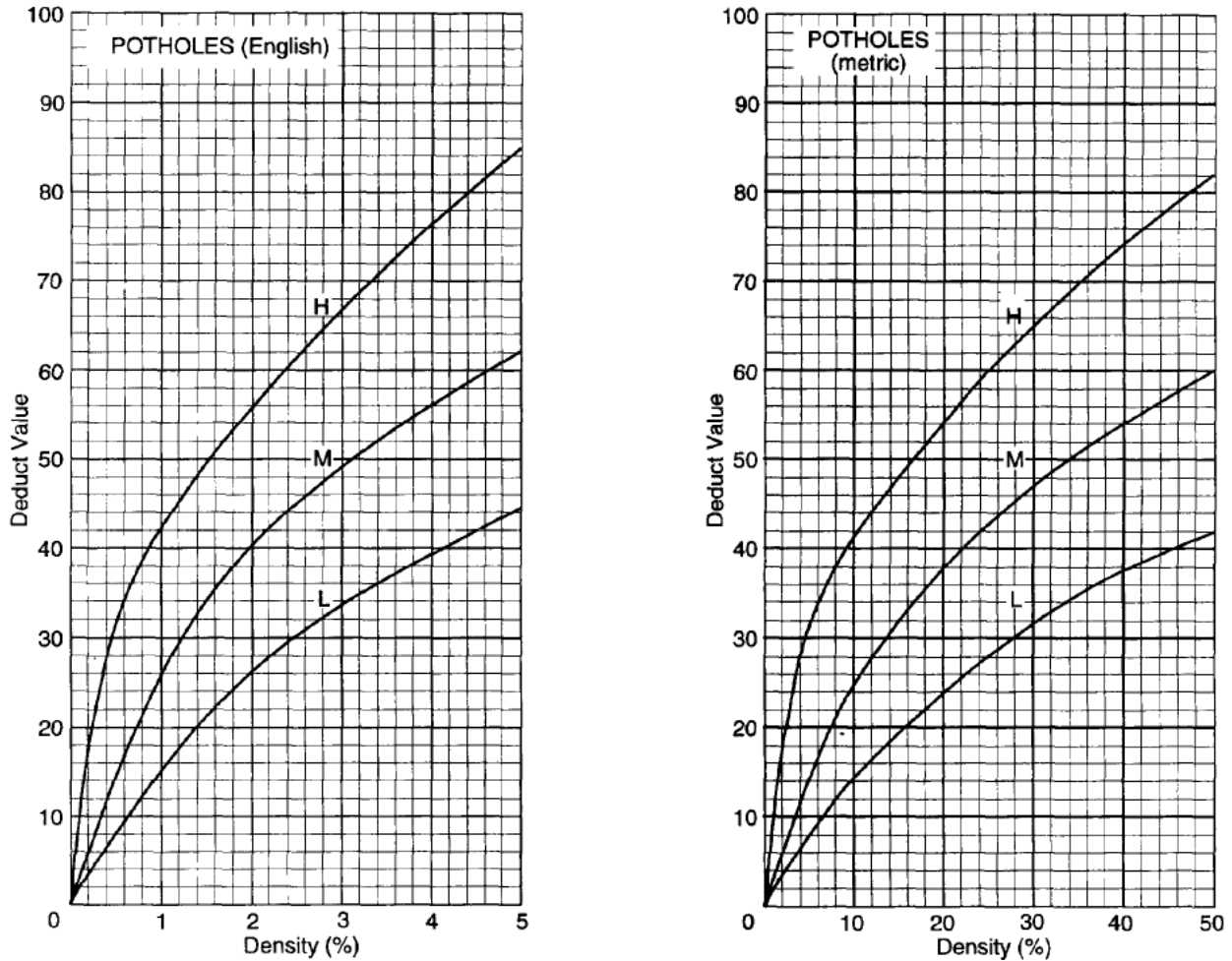


Figure A-295 Pothole Deduct Curves



**A-6.6 Ruts (86).**

A rut is a surface depression in the wheel path that is parallel to the road centerline. Ruts are caused by a permanent deformation in any of the road layers or subgrade. They result from repeated vehicle passes, especially when the road is soft. Significant rutting can destroy a road.

**A-6.6.1 Severity Levels.**

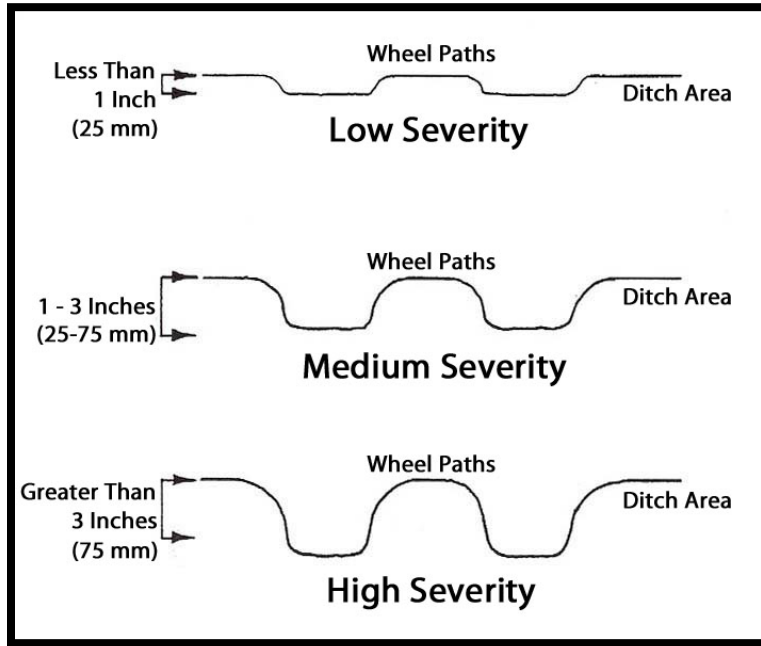
- L** Ruts are < 1 inch (25 millimeters) deep.
- M** Ruts are between 1 and 3 inches (25 and 75 millimeters) deep.
- H** Ruts are deeper than 3 inches (75 millimeters).

See Figure A-296.

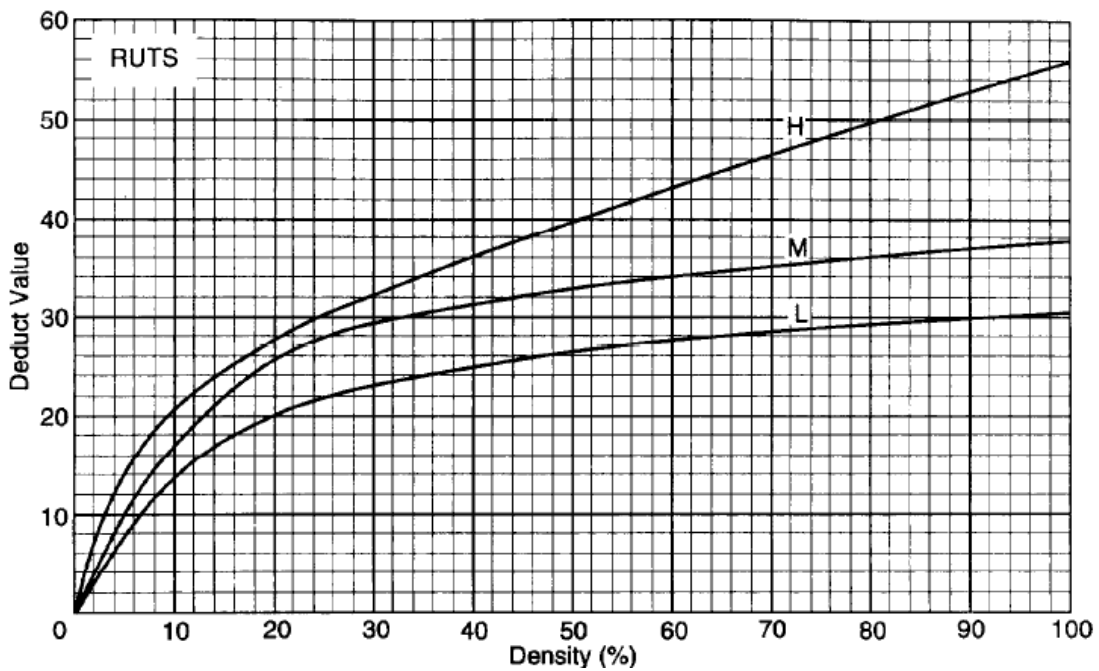
**A-6.6.2 How to Measure.**

Ruts are measured in square feet of surface area per sample unit. For example, a sample unit may have 75 square feet (7 square meters) with high severity and 240 square feet (22.3 square meters) with medium severity.

**Figure A-296 Ruts**



**Figure A-297 Rut Deduct Curve**



## A-6.7 Loose Aggregate (87).

The wear and tear of traffic on unsurfaced roads will eventually loosen the larger aggregate particles from the soil binder. This leads to loose aggregate particles on the road surface or shoulder. Traffic moves loose aggregate particles away from the normal road wheel path and forms a berm in the center or along the shoulder (the less-traveled areas).

### A-6.7.1 Severity Levels.

**L** Loose aggregate on the road surface or a berm of aggregate, < 2 inches (50 millimeters) deep, on the shoulder or less-traveled area.

**M** Moderate aggregate berm, between 2 to 4 inches (50 to 100 millimeters) deep, on the shoulder or less-traveled area. A large amount of fine soil particles is usually found on the roadway surface.

**H** Large aggregate berm, > 4 inches (100 millimeters) deep, on the shoulder or less-traveled area.

See Figure A-298.

### A-6.7.2 How to Measure.

Loose aggregate is measured in linear feet (linear meters) parallel to the centerline in a sample unit. Each berm is measure separately. For example, if a sample unit that is 100 feet (30 meters) long has three berms of medium-severity loose aggregate—one on each side and one down the middle—then the measurement would be 300 feet (90 meters) at medium severity.

**Figure A-298 Loose Aggregate**

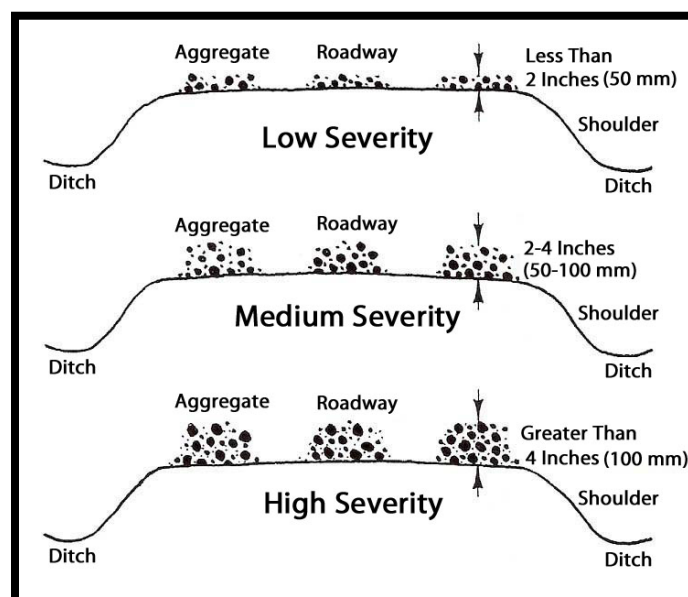
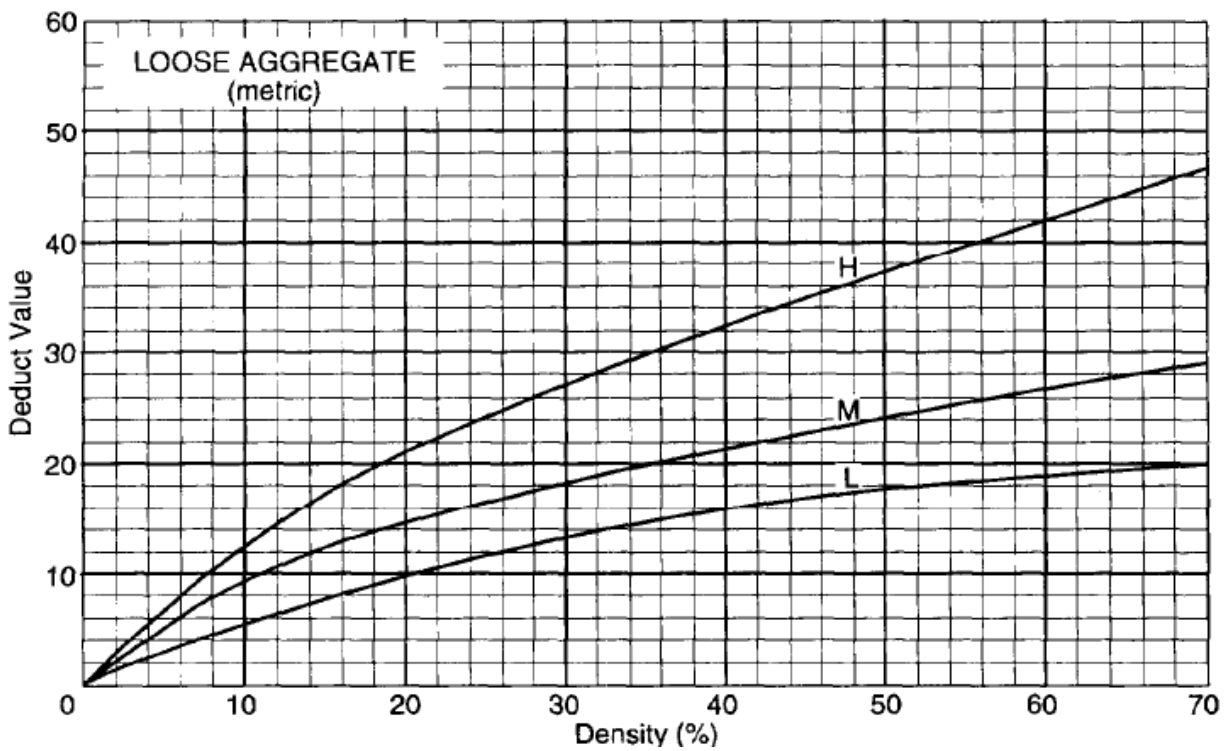
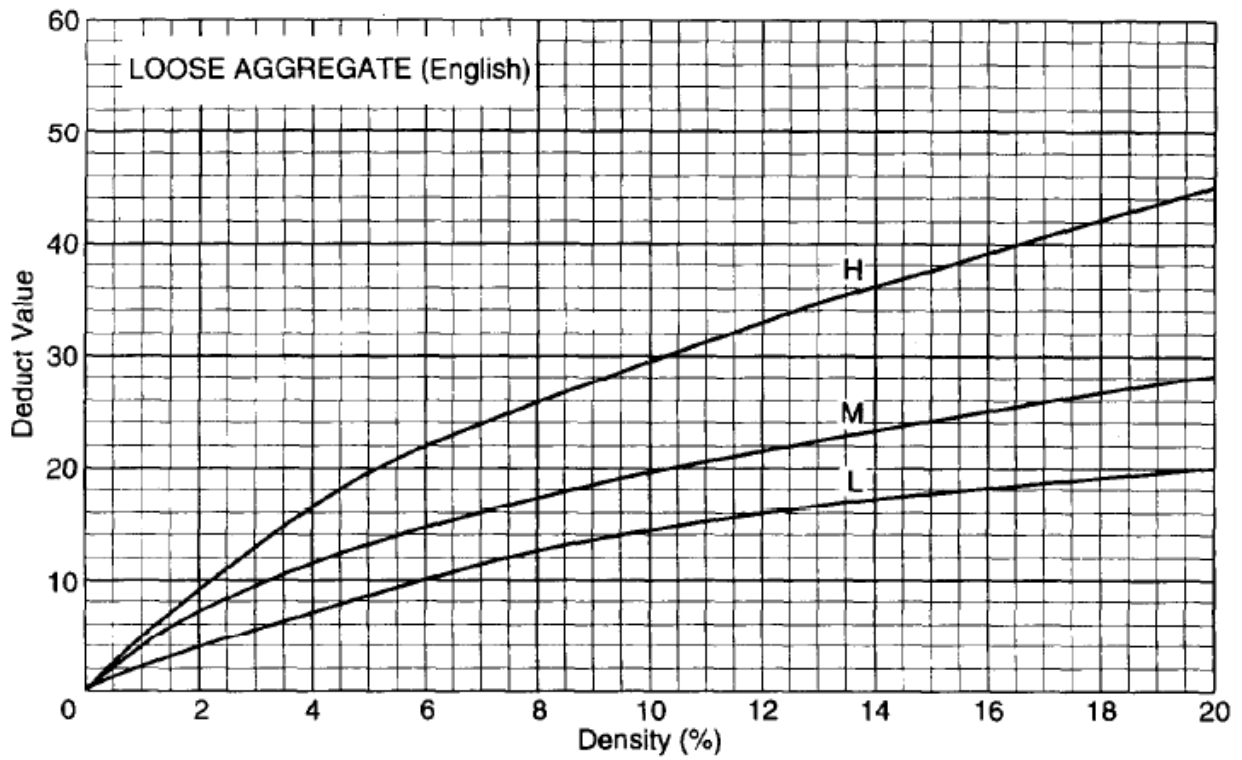


Figure A-299 Loose Aggregate Deduct Curve



## **A-7 INTERLOCKING CONCRETE (PAVER) SURFACED ROAD AND PARKING PAVEMENT DISTRESSES**

### **A-7.1 Damaged Pavers (101).**

Damaged pavers describe the condition of the pavers. Unit damage includes paver distresses such as a crack, chip, or spall. Cracks appear as thin jagged lines generally less than 0.125 inch (3 millimeters) wide. Chips and spalls appear at portions of the edges and/or surface. Damage would be indicative of load-related damage such as inadequate support causing shear breakage, etc., or weathering. Cracked pavers with little to no opening will not affect ride quality or performance

#### **A-7.1.1 Severity Levels.**

**L** One or two cracks with no separation, chips, or spalls in the pavers.

**M** Advanced cracking with no separation, spalling, or chips in the pavers but pavers are not disintegrated.

**H** Pavers are cracked into multiple pieces or are disintegrated from cracks, chips, and/or spalls.

#### **A-7.1.2 How to Measure.**

Measure damaged pavers in square feet (meters) of surface area. Random isolated pavers that are only cracked with little or no opening are not recorded. The severity is evaluated by degree of distress.

**Figure A-300 Low-Severity Damaged Pavers**



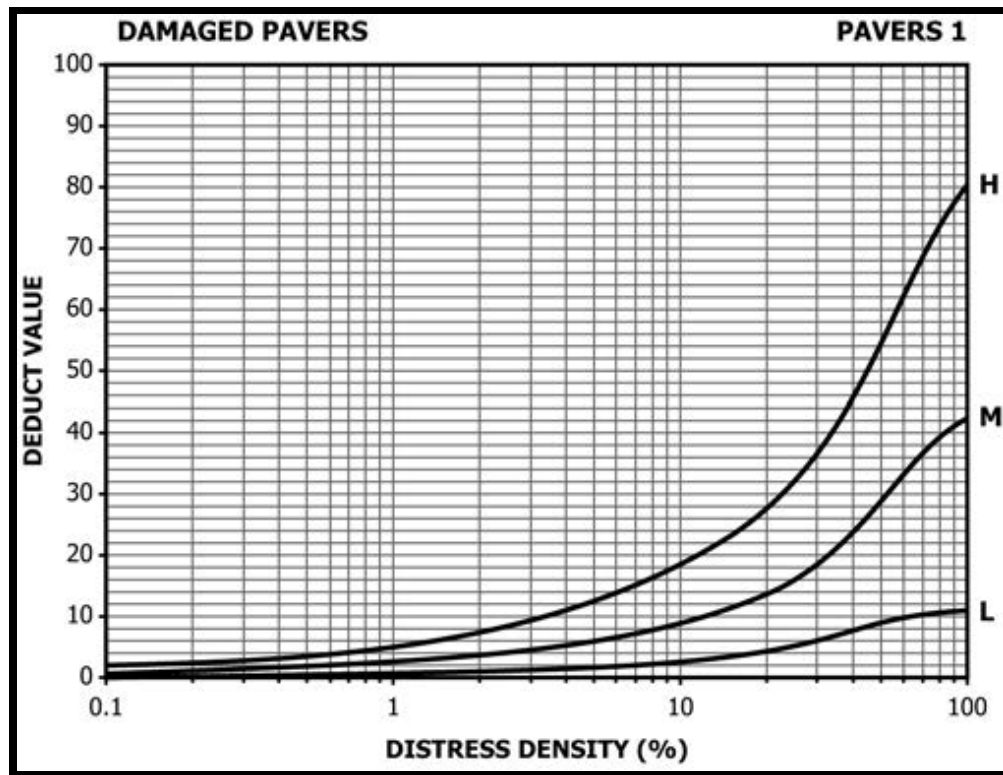
**Figure A-301 Medium-Severity Damaged Pavers**



**Figure A-302 High-Severity Damaged Pavers**



Figure A-303 Damaged Pavers Deduct Curve



### A-7.2 Depression (102).

Depressions are areas of the pavement surface that have elevations lower than the surrounding areas. Depressions are not typically load related and are caused by settlement of the underlying subgrade or granular base. Settlement is common over utility cuts and adjacent to road hardware. Depressions can cause roughness in the pavement and, when filled with water, can cause hydroplaning of vehicles.

#### A-7.2.1 Severity Levels.

- L** Maximum depth of depression is 0.1875 to 0.5 inch (5 to 13 millimeters).
- M** Maximum depth of depression is 0.5 to 1 inch (13 to 25 millimeters).
- H** Maximum depth of depression is > 1 inch (25 millimeters).

#### A-7.2.2 How to Measure.

Depressions are measured in square feet (meters) of surface area. The maximum depth of depression defines the severity. Depressions larger than 10 feet (3 meters) across should be measured with a string line. Visual examination is not always a reliable technique for detecting depressions, especially low-severity depressions. The most reliable method to identify depressions is to utilize a 10-foot (3-meter) straightedge. Changes in shades of color on a pavement surface can give the impression of

differential elevation where none exists. The apparent depth of differential elevation is often exaggerated by shadows in the early morning and late afternoon, as well as the chamfer on the paver edges. Standing water and stains can be used to visually identify a depression; however, the boundaries and depth should be established using the straightedge. Be careful to distinguish heaves from depressions.

**Figure A-304 Low-Severity Depression**



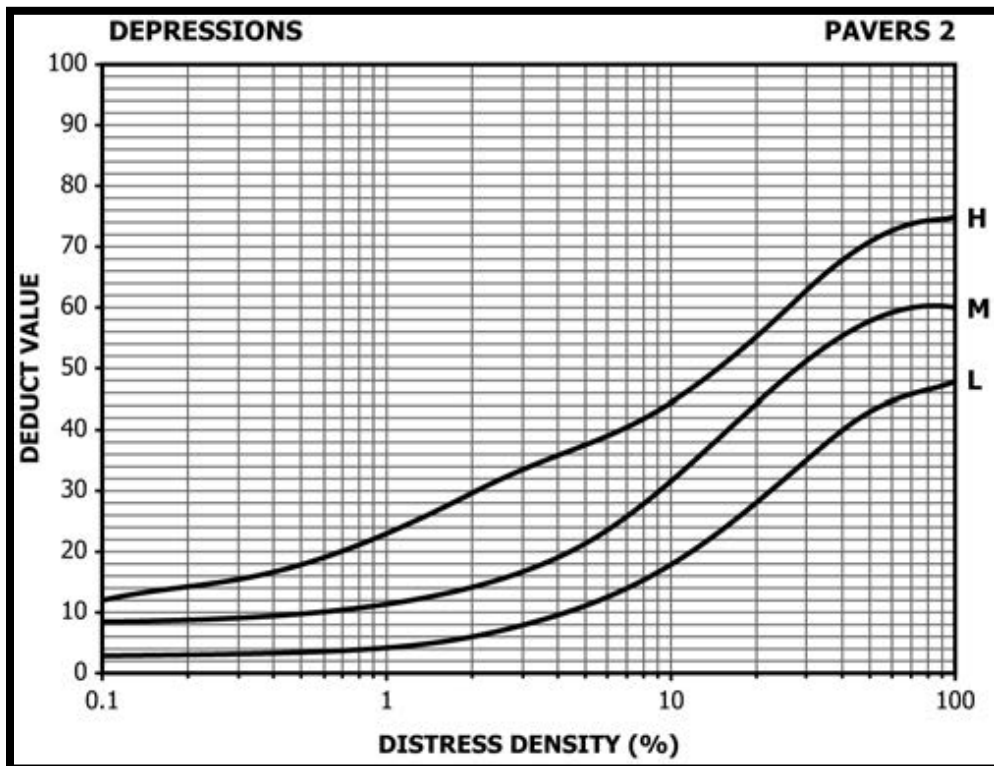
**Figure A-305 Medium-Severity Depression**



Figure A-306 High-Severity Depression



Figure A-307 Depression Deduct Curve



### **A-7.3 Edge Restraint Damage (103).**

Edge strips and curbing are forms of restraints that provide lateral support for paver pavements. Edge strips/curbs can comprise prefabricated angle supports, concrete curbs, etc. Damage to these edge restraint systems results in lateral movement of pavers, loss of joint and bedding sand, and paver rotation. This distress is accelerated by traffic loading.

#### **A-7.3.1 Severity Levels.**

**L** Evidence of increased joint width, 0.25 to 0.5 inch (6 to 13 millimeters) and no evidence of paver/curb rotation.

**M** Increased joint width 0.375 to 0.25 inch (10 to 13 millimeters), with evidence of paver/curb rotation.

**H** Increased joint width > 0.5 inch (> 13 millimeters), with considerable paver/curb rotation and local settlement.

#### **A-7.3.2 How to Measure.**

Measure loss of edge restraint in linear feet (linear meters) of pavement edge (measure the movement of the edge restraint). Loss of lateral restraint is characterized by widening of the paver joints at the outer pavement edge or at the transition of pavement types. Locally, pavers at the pavement edge can exhibit both vertical and horizontal rotation as well as local edge settlement. The distress is most notable within 1 to 2 feet (0.3 to 0.6 meter) of the pavement edge.

**Figure A-308 Low-Severity Edge Restraint Damage**



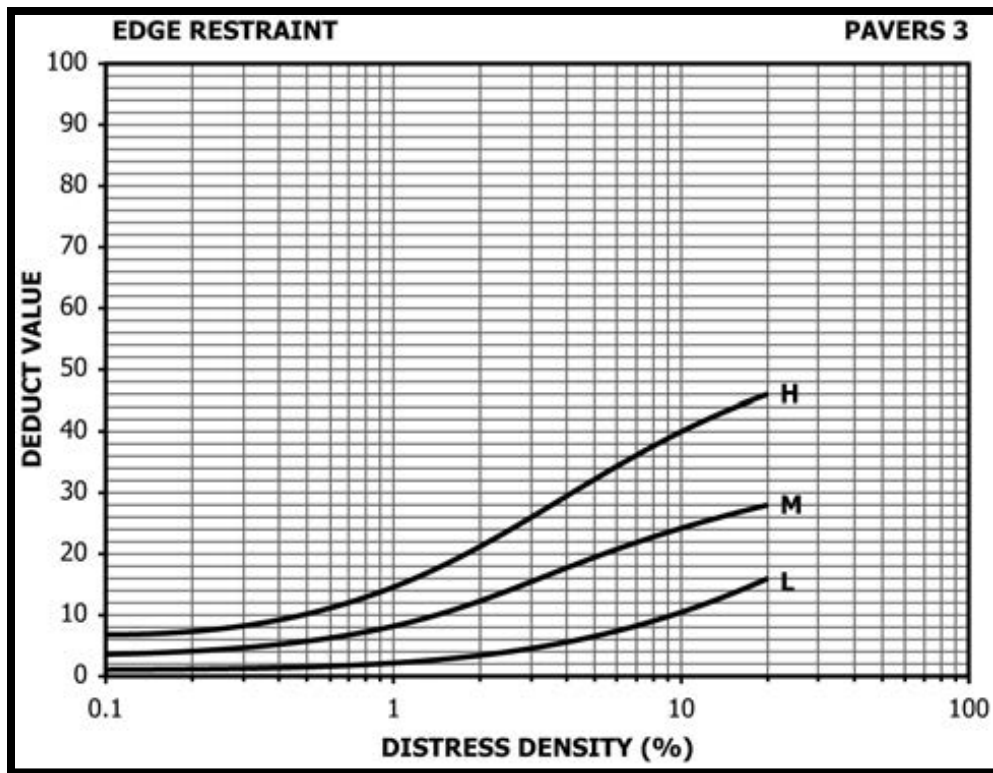
**Figure A-309 Medium-Severity Edge Restraint Damage**



**Figure A-310 High-Severity Edge Restraint Damage**



Figure A-311 Edge Restraint Damage Deduct Curve



#### A-7.4 Excessive Joint Width (104).

Excessive joint width is a surface distress feature in which the joints between pavers have widened. Excessive joint width can occur from a number of factors, including poor initial construction, lack of joint sand, poor edge restraint, adjacent settlement/heave, etc. As joints get wider, the paver layer becomes less stiff and can lead to overstressing the substructure layers.

##### A-7.4.1 Severity Levels.

- L Average joint width 0.25 to 0.375 inch (6 to 10 millimeters).
- M Average joint width 0.375 to 0.5 inch (10 to 13 millimeters).
- H Average joint width > 0.5 inch (13 millimeters).

##### A-7.4.2 How to Measure.

Measure excessive joint width in square feet (square meters) of surface area. The average joint width defines the severity. As most concrete pavers are manufactured with a beveled (chamfered) edge, care must be taken to ensure the actual joint width is measured. Optimal paver joint spacing is typically specified as 0.0625 to 0.1875 inch (1.5 to 4.5 millimeters). As joints get wider, the individual units may show signs of rotation

**Figure A-312 Low-Severity Excessive Joint Width**



**Figure A-313 Medium-Severity Excessive Joint Width**

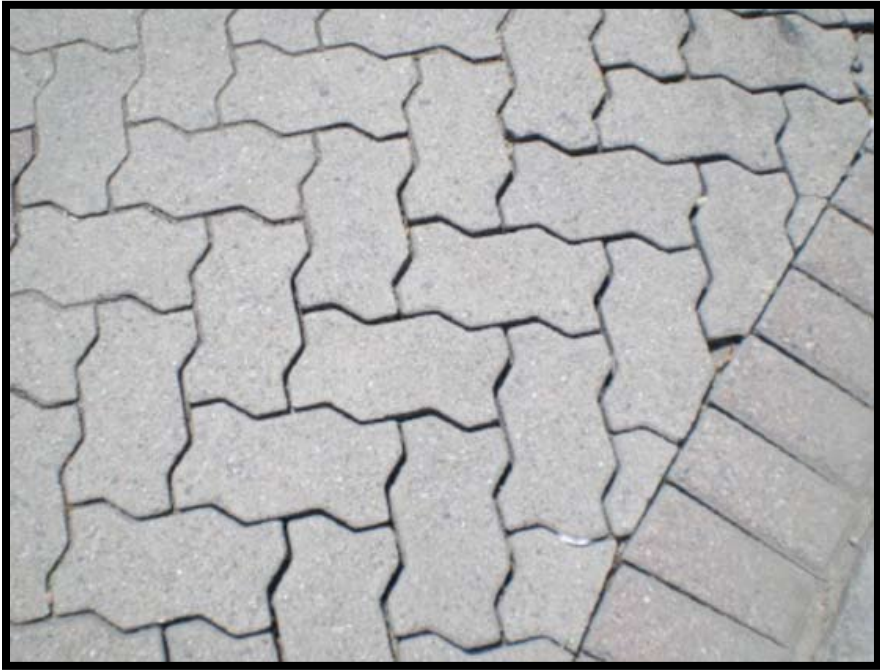
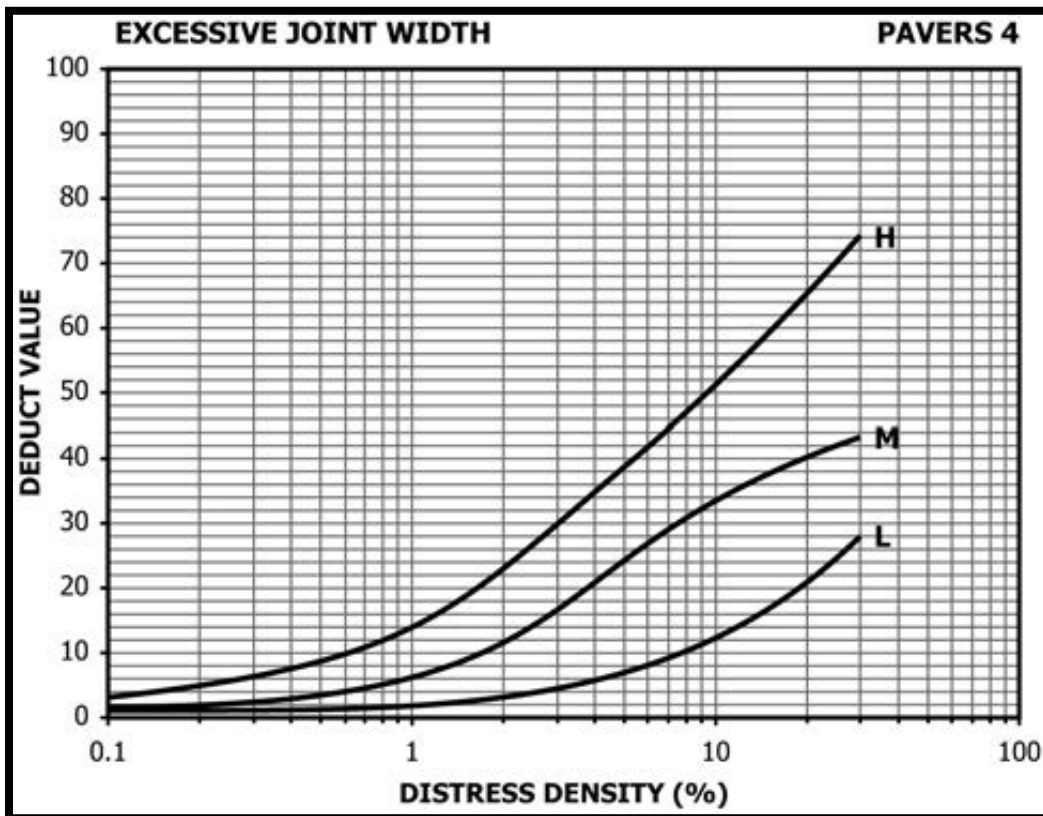


Figure A-314 High-Severity Excessive Joint Width



Figure A-315 Excessive Joint Width Deduct Curve



### **A-7.5      Faulting (105).**

Faulting are areas of the pavement surface where the elevation of adjacent pavers differ or have rotated. Faulting can be caused by surficial settlement of the bedding sand, poor installation, and/or pumping of the joint or bedding sand. Local roughness can reduce the ride quality. Faulting can pose a safety hazard for pedestrians. Faulting can be corrected by resetting the pavers.

#### **A-7.5.1      Severity Levels.**

**L**      Elevation difference 0.125 to 0.25 inch (3 to 6 millimeters).

**M**      Elevation difference 0.25 to 0.375 inch (6 to 10 millimeters).

**H**      Elevation difference > 0.375 inch (10 millimeters).

#### **A-7.5.2      How to Measure.**

Measure faulting in square feet (square meters) of surface area. The maximum elevation difference defines the severity. Measurement of differential elevation at joints is made under a straightedge 1 foot (0.3 meter) long (such as the edge of a clipboard). Faulting is characterized by areas of individual pavers with differential elevations. This distress is often associated with more severe distresses, such as settlement, heave, and rutting.

**Figure A-316 Low-Severity Faulting**



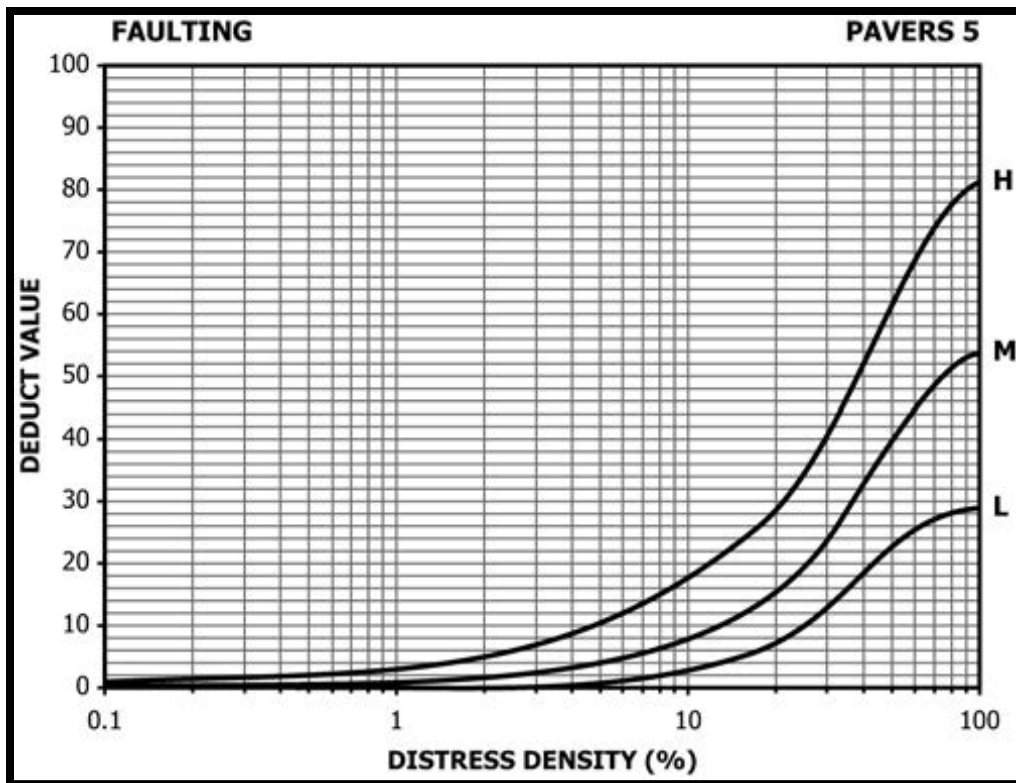
**Figure A-317 Medium-Severity Faulting**



**Figure A-318 High-Severity Faulting**



Figure A-319 Faulting Deduct Curve



**A-7.6 Heave (106).**

Heaves are areas of the pavement surface with elevations higher than the surrounding areas. Heaves are typically caused by differential frost heave of the underlying soils. Heaves can also occur as a result of subgrade instability and also occur in conjunction with settlement/rutting.

**A-7.6.1 Severity Levels.**

- L** Maximum height of heave is 0.25 to 0.5 inch (6 to 13 millimeters).
- M** Maximum height of heave is 0.5 to 1 inch (13 to 25 millimeters).
- H** Maximum height of heave is > 1 inch (25 millimeters).

**A-7.6.2 How to Measure.**

Measure heaves in square feet (square meter) of affected surface area. Place the end of the straightedge on an adjacent non-heaved area and extend the straightedge over the heaved area. Level the straightedge over the heaved area and measure the maximum height to the adjacent non-heaved area. The maximum height of heave defines the severity. Heaves larger than 10 feet (3 meters) across should be measured with a string line. Visual examination is not always a reliable technique for detecting

heaves, especially low-severity heaves. The most reliable method to identify heaves is to use a 10-foot (3-meter) straightedge.

**Figure A-320 Low-Severity Heave**



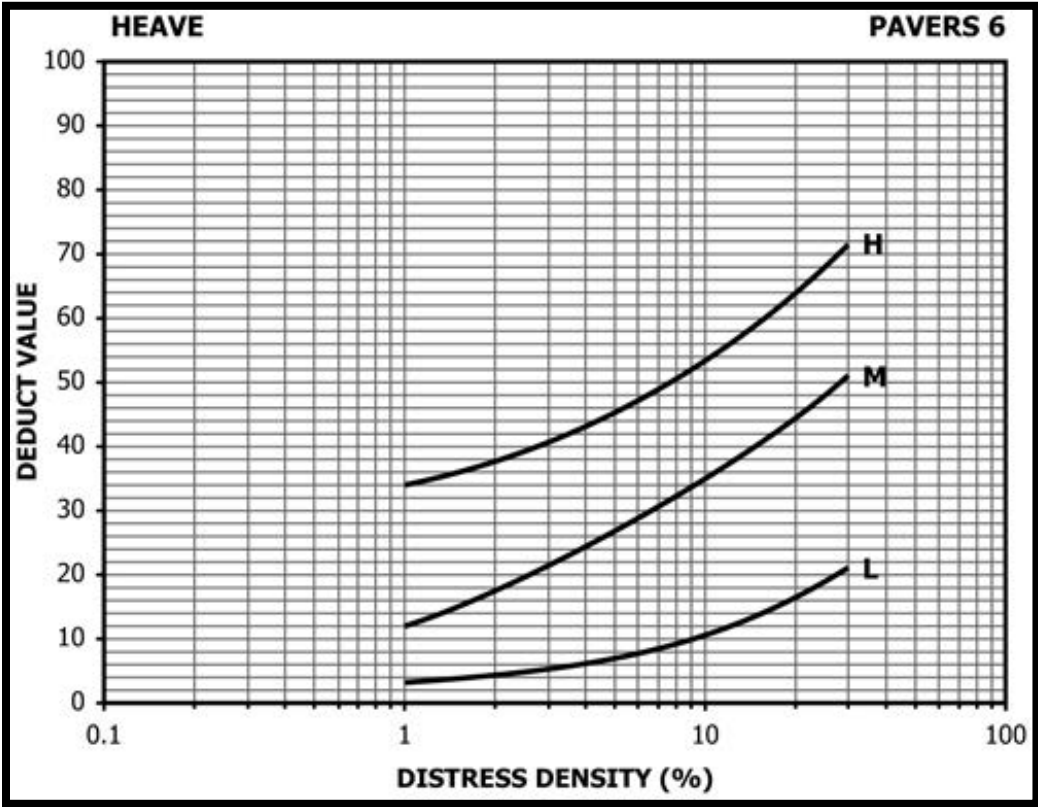
**Figure A-321 Medium-Severity Heave**



Figure A-322 High-Severity Heave



Figure A-323 Heave Deduct Curve



### **A-7.7 Horizontal Creep (107).**

Horizontal creep is the longitudinal displacement of the pavement caused by traffic loading. Horizontal creep should not be confused with changes in jointing patterns created by placing adjacent pavers at a different time.

#### **A-7.7.1 Severity Levels.**

- L** Horizontal movement 0.25 to 0.5 inch (6 to 13 millimeters) from the string line.
- M** Horizontal movement 0.5 to 0.75 inch (13 to 20 millimeters) from the string line.
- H** Horizontal movement > 0.75 inch (20 millimeters) from the string line.

#### **A-7.7.2 How to Measure.**

Horizontal creep is measured in square feet (square meters) of surface area. The deviation from the original position defines the severity. Severity is measured by pulling a 50-foot (15-meter) -long string in the longitudinal and transverse direction and measuring the distance from the string line center to the nearest line of joints. If the pavement area is less than 50 feet (15 meters) in the transverse or longitudinal direction, then pull the string line across the pavement width and measure. Regardless of the initial paver laying pattern, the pavement surface should have a uniform pattern. Shifting of the joints or pattern signifies horizontal creep.

**Figure A-324 Low-Severity Horizontal Creep**



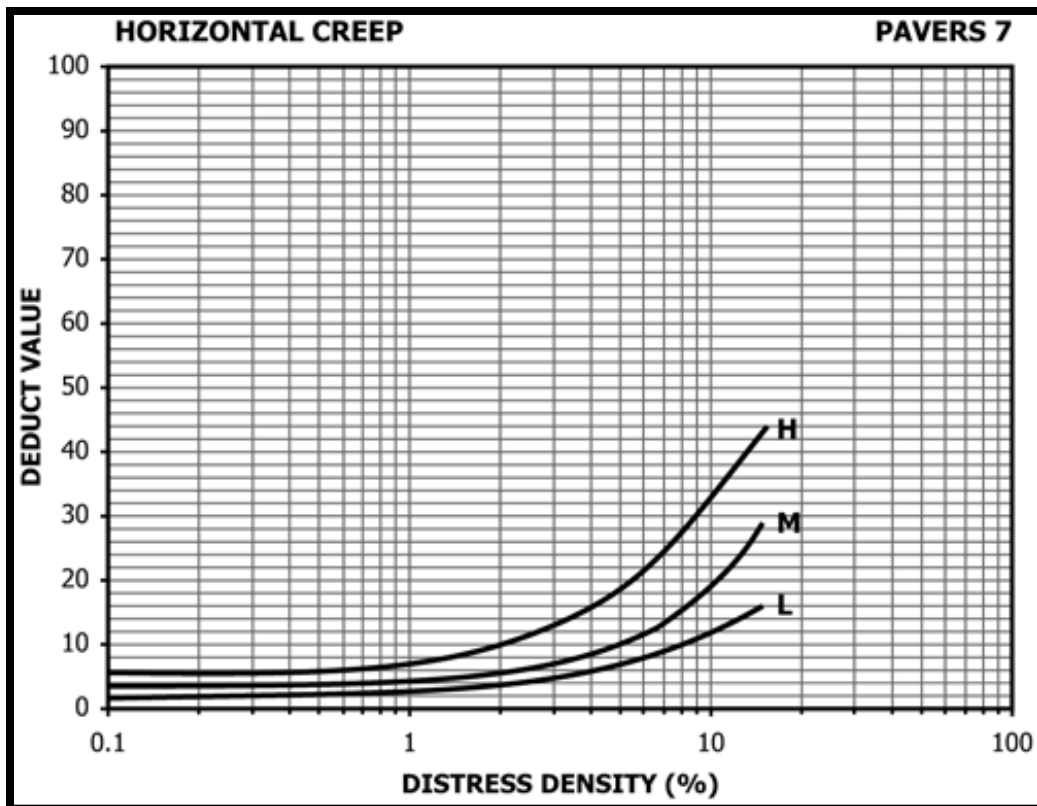
**Figure A-325 Medium-Severity Horizontal Creep**



**Figure A-326 High Severity Horizontal Creep**



Figure A-327 Horizontal Creep Deduct Curve



#### A-7.8 Joint Sand Loss/Pumping (108).

Joint sand loss/pumping is a distress feature in which the joint sand has been removed. Joint sand loss can occur from a number of factors including heavy rain, sweeping, pressure washing, and pumping under traffic loading. Joint sand is considered essential to providing interlock and stiffness of the paver course.

##### A-7.8.1 Severity Levels.

- L Depth of sand loss is < 0.5 inch (13 millimeters).
- M Depth of sand loss is 0.5 to 1 inch (13 to 25 millimeters).
- H Depth of sand loss is > 1 inch (25 millimeters).

##### A-7.8.2 How to Measure.

Measure joint sand loss/pumping in square feet (square meters) of surface area. The depth of sand loss defines the severity. Most concrete pavers have a beveled edge (chamfer). Therefore, depth of sand loss is measured from the bottom of this beveled edge. Insert a thin metal ruler with the end as the zero or beginning point into the joint until the ruler stops on the sand surface within the joint. Measure from the depth of joint sand loss on the ruler. Joint sand loss is identified by an absence or lack of joint sand.

Joint sand may be evident on the surface of the pavers or along the curbs and gutters from pumping of sand from joints.

**Figure A-328 Low-Severity Joint Sand Loss**



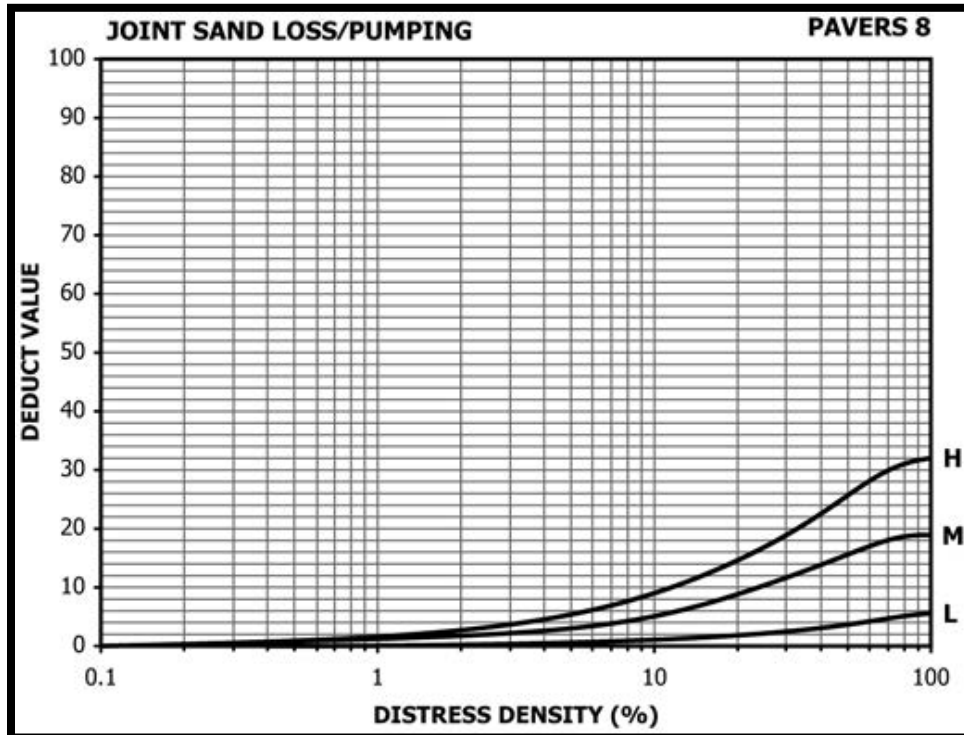
**Figure A-329 Medium-Severity Joint Sand Loss**



Figure A-330 High-Severity Joint Sand Loss



Figure A-331 Joint Sand Loss Deduct Curve



### **A-7.9 Missing Pavers (109).**

Missing pavers, as the name implies, refers to sections of pavement that are missing pavers, which may have resulted from removal or disintegration/damage. Missing pavers compromise the integrity of the pavement structure and promote surface roughness similar to potholes in flexible pavements.

#### **A-7.9.1 Severity Levels.**

- L** Random individual missing pavers.
- M** Missing two or more pavers in one area and ride quality unaffected.
- H** Missing ten or more pavers in one area and ride quality affected.

#### **A-7.9.2 How to Count.**

Measure missing pavers in square feet (square meters) of surface area in a sample unit. The severity is evaluated by degree of distress.

**Figure A-332 Low-Severity Missing Pavers**



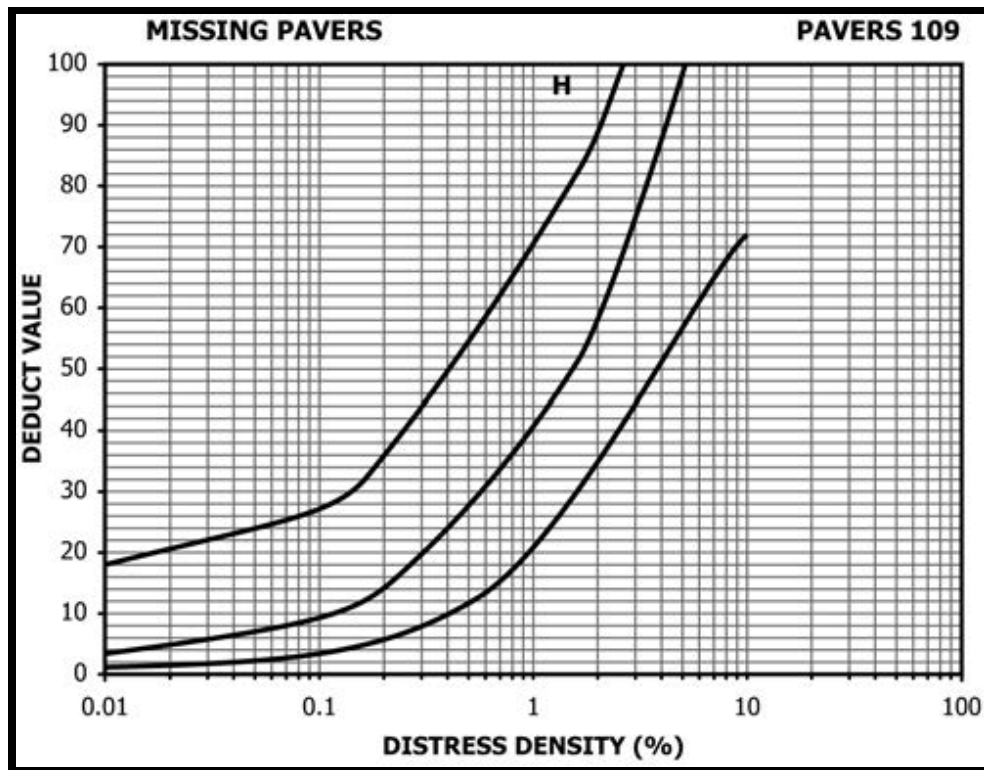
**Figure A-333 Medium-Severity Missing Pavers**



**Figure A-334 High-Severity Missing Pavers**



Figure A-335 Missing Pavers Deduct Curve



#### A-7.10 Patching (110).

Patching refers to sections of pavement that are missing pavers and have been reinstated with a dissimilar material (for example, asphalt, concrete or aggregates). Patch quality can compromise the integrity of the pavement structure and promote surface roughness similar to potholes in flexible pavements.

##### A-7.10.1 Severity Levels.

- L** Patch is in good condition and ride quality is unaffected.
- M** Patch is in good to fair condition and ride quality is starting to deteriorate.
- H** Patch is in poor condition and ride quality is affected.

##### A-7.10.2 How to Measure.

Measure patches in square feet (square meters) of surface area. The severity is evaluated by the quality of the patch.

Figure A-336 Low-Severity Patch



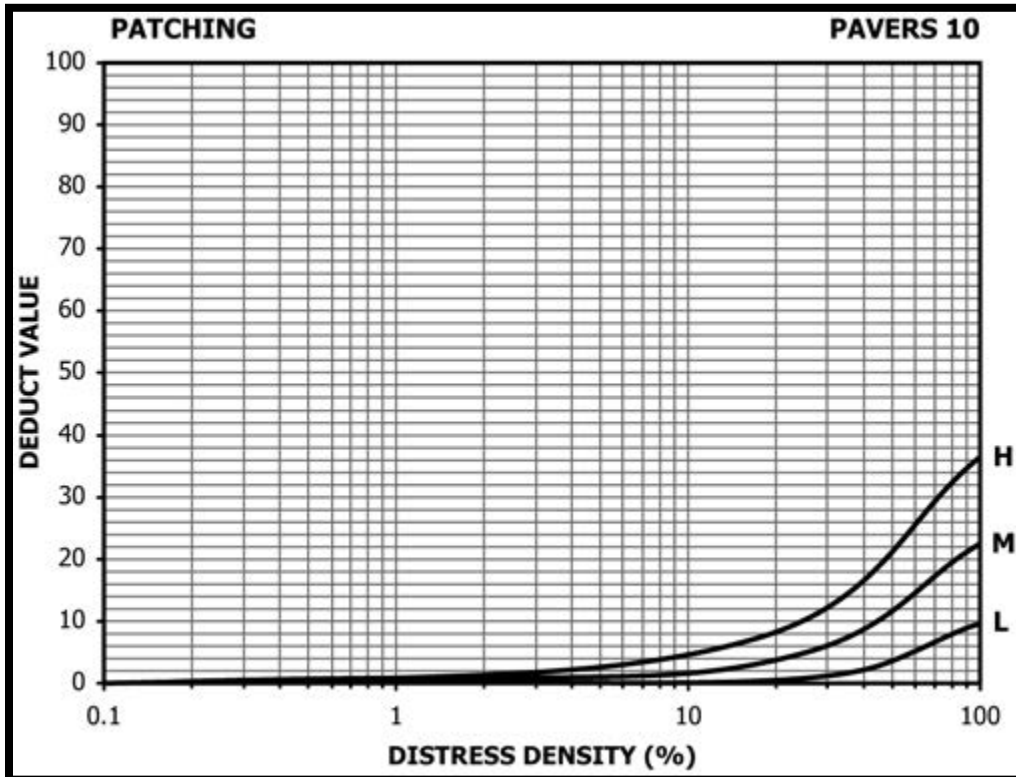
Figure A-337 Medium-Severity Patch



Figure A-338 High-Severity Patch



Figure A-339 Patching Deduct Curve



## **A-7.11 Rutting (111).**

Rutting is a surface depression in the wheel path and should not be confused with depressions. Depressions are areas of the pavement that have lower elevations than the surrounding areas. Rutting is typically caused by settlement of the underlying subgrade or granular base under vehicle loading. Rutting indicates a weakening or loss of bedding sand or base weakening and a loss of structural capacity. Like depressions, rutting can cause roughness in the pavement and can cause hydroplaning of vehicles when filled with water.

### **A-7.11.1 Severity Levels.**

**L** Maximum depth of rut is 0.25 to 0.5 inch (6 to 13 millimeters).

**M** Maximum depth of rut is 0.5 to 1 inch (13 to 25 millimeters).

**H** Maximum depth of rut is > 1 inch (25 millimeters).

### **A-7.11.2 How to Measure.**

Measure rutting in square feet (square meters) of surface area. The maximum rut depth defines the severity. To determine the rut depth, a straightedge should be placed across the rut and the depth measured in inches (millimeters). Rut depth measurements should be taken along the length of the rut. Varying severities of rutting along the length of the rut should be measured individually. Locate rutting by visual assessment and measure rutting with a straightedge. Rutting in a single wheel path is usually quite evident. However, depressions caused by static wheel loads are measured as rutting.

**Figure A-340 Low-Severity Rutting**



**Figure A-341 Medium-Severity Rutting**



**Figure A-342 High-Severity Rutting**



Figure A-343 Rutting Deduct Curve

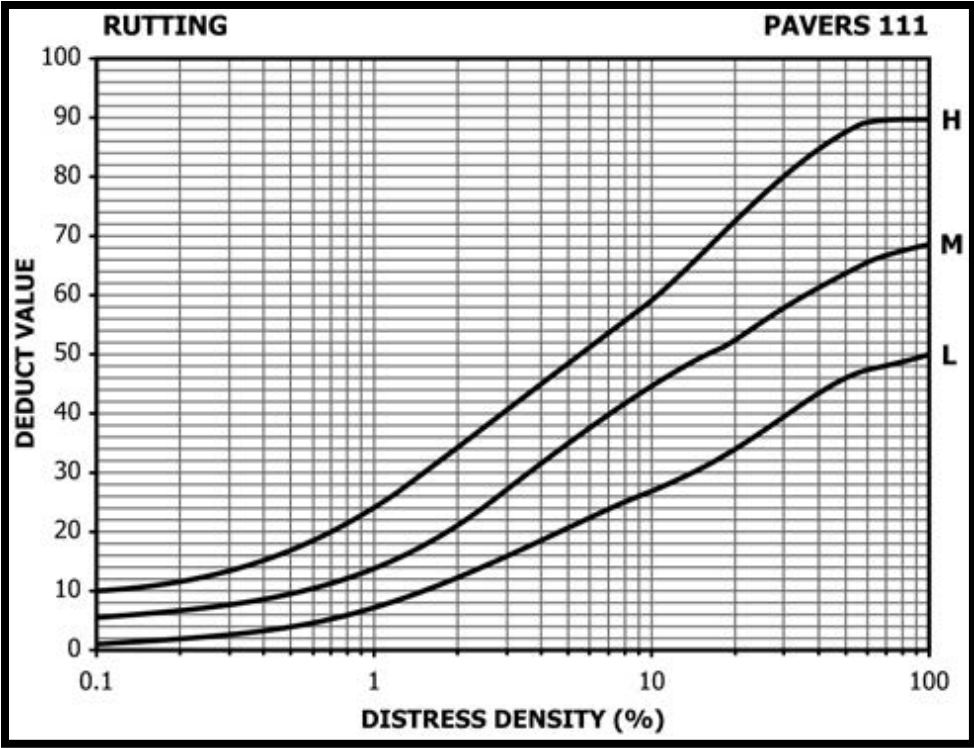
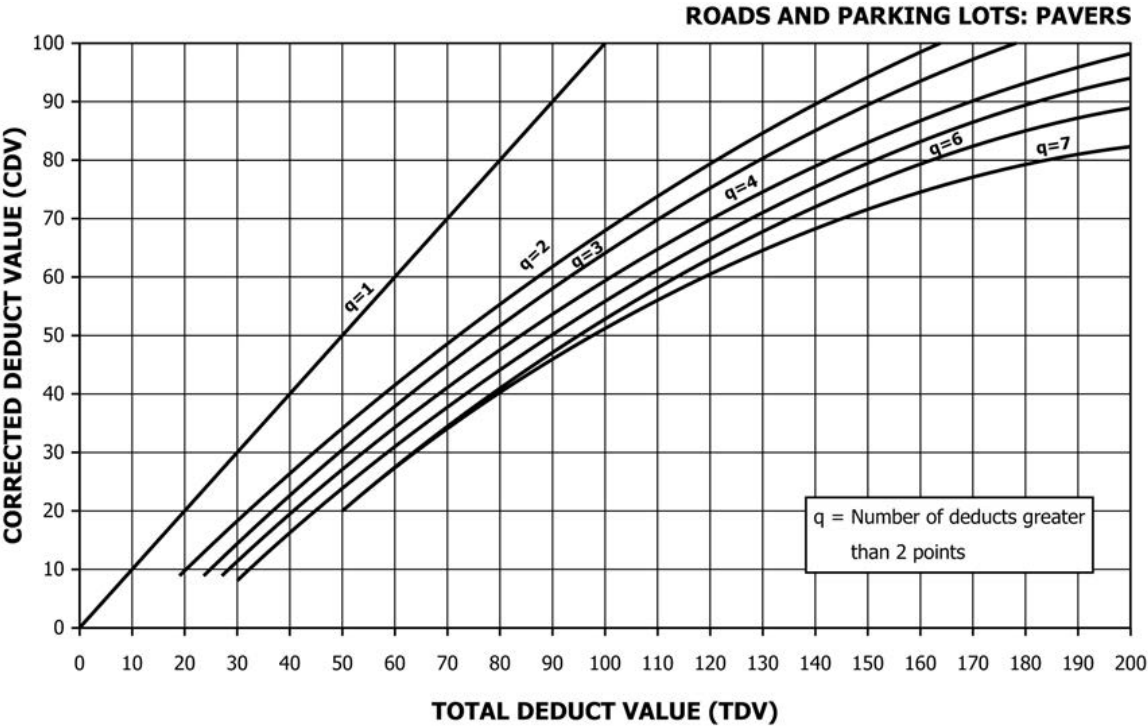


Figure A-344 Corrected Deduct Value Curve for Interlocking Concrete Pavers



## A-8 UNSURFACED (SEMI-PREPARED) AIRFIELD DISTRESSES.

Unsurfaced airfield distresses are used to determine the semi-prepared airfield condition index (SPACI). The term “semi-prepared” describes an unpaved aggregate-surfaced airfield. Stabilized surfaces have historically been evaluated as semi-prepared surfaces as well because these pavement surfaces are expected to experience deterioration similar to semi-prepared surfaces. Use asphalt or concrete distresses for paved LZ surfaces. Note that rather than low-, medium-, and high-severity distresses, the SPACI procedure uses green, amber, and red severity levels. Regardless of the overall SPACI rating, if any individual distress is rated as “red,” the LZ safety officer will determine the feasibility of each operation.

### A-8.1 Potholes (91).

Potholes are bowl-shaped depressions in the airfield surface. Once potholes have begun to form, they will continue to disintegrate because of loosening surface material or weak spots in the underlying soil. The number and location of potholes can be critical to aircraft operations.

#### A-8.1.1 Severity Levels.

To determine the severity, measure the depths and diameters of the largest potholes. Severity levels are shown in Table A-20.

**Table A-20 Pothole Severity Levels**

| Aircraft | Distress Type | Green  | Amber   | Red   |
|----------|---------------|--|---|---|
| C-17     | Potholes (91) | < 4 in. (100 mm) deep<br>and/or<br>< 15 in. (380 mm) in diameter | 4 to 9 in. (100 to 225 mm) deep<br>and<br>> 15 in. (280 mm) in diameter | > 9 in. (225 mm) deep<br>and<br>> 15 in. (280 mm) in diameter |
| C-130    |               |  |   |   |
| LTFW     |               |  |   |   |

#### A-8.1.2 How to Measure.

Potholes are measured by counting the number that are low, medium, and high severity in a sample unit and recording them separately by severity level. If the potholes have hard, abrupt, vertical sides, refer to stabilized layer failure criteria as described in paragraph A-8.7.

#### A-8.1.3 Deduct Values.

See Table A-28 for pothole DVs.

### A-8.2 Ruts (92).

Ruts are surface depressions in the wheel paths that generally run parallel with the centerline or direction of traffic.

**A-8.2.1 Severity Levels.**

Severity levels are shown in Table A-21.

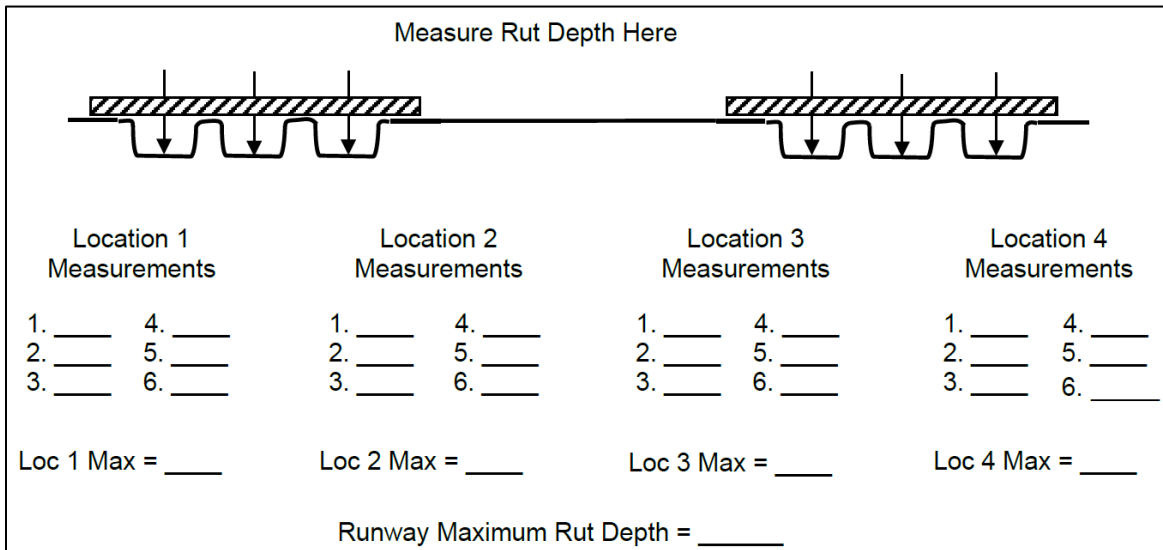
**Table A-21 Rut Severity Levels**

| Aircraft | Distress Type | Green                           | Amber                           | Red                   |
|----------|---------------|---------------------------------|---------------------------------|-----------------------|
| C-17     | Ruts (92)     | Exist but < 4 in. (100 mm) deep | 4 to 9 in. (100 to 225 mm) deep | > 9 in. (225 mm) deep |
| C-130    |               | Exist but < 3 in. (75 mm) deep  | 3 to 6 in. (75 to 150 mm) deep  | > 6 in. (150 mm) deep |
| LTFW     |               | Exist but < 1 in. (25 mm) deep  | 3 to 5 in. (75 to 125 mm) deep  | > 5 in. (125 mm) deep |

**A-8.2.2 How to Measure.**

Remove the loose rolling resistant material (RRM) and lay a straightedge across the ruts, with both ends resting on the solid runway surface. Measure the depth of the three deepest ruts on each side, from the bottom of the straightedge to the solid ground in the bottom of the rut (see Figure A-345). Use the maximum depth of the six measurements for that location. Rut width does not affect severity. Generally, check rut depths in the touchdown area, in the primary braking area, at the point of rotation, and in the last 500 feet (150 meters) of the runway or in other areas where the ruts are more severe. For a typical 4,000-foot (1200-meter) runway, take one set of measurements at approximately 4+00, 10+00, 20+00, and 35+00. The maximum rut depth measured determines the severity.

**Figure A-345 Rut Depth Measurements**



**A-8.2.3 Deduct Values.**

See Table A-28 for rut DVs.

### A-8.3 Loose Aggregate (93).

Loose aggregate is small stones 0.25 inch (6 millimeters) or larger that have separated from the soil binder. In large enough quantities and sizes, it can create problems.

#### A-8.3.1 Severity Levels.

To determine the severity, estimate coverage on the airfield. Severity levels are shown in Table A-22.

**Table A-22 Loose Aggregate Severity Levels**

| Aircraft | Distress Type                 | Green                    | Amber                                  | Red                     |
|----------|-------------------------------|--------------------------|--|-------------------------|
| C-17     | Loose aggregate coverage (93) | Covers < 1/10 of section | Covers between 1/10 and 1/2 of section | Covers > 1/2 of section |
| C-130    |                               |                          |  |                         |
| LTFW     |                               |                          |  |                         |

| Aircraft | Distress Type             | Green  | Amber  | Red                           |
|----------|---------------------------|--|--|-------------------------------|
| C-17     | Loose aggregate size (93) | Max. < ¾ in. (20 mm) diameter, Recommended < ½ in. (10 mm) | Max. = ¾ in. to 1 in. (20 to 25 mm) diameter | Max. > 1 in. (25 mm) diameter |
| C-130    |                           |  |  |                               |
| LTFW     |                           |  |  |                               |

#### A-8.3.2 How to Measure.

Loose aggregate is measured in terms of both the percentage of the sample unit that has loose aggregate and the size of the aggregate. Whichever has the highest rating in the sample will govern. For example, a section that has a maximum aggregate diameter of 0.75 inch (19 millimeters) (amber) but it covers over half the section (red) would be rated red. Remove rocks over 4 inches (100 millimeters) in diameter from the operational surface. If material crushes underfoot, it is not considered loose aggregate.

#### A-8.3.3 Deduct Values.

See Table A-28 for loose aggregate DVs.

### A-8.4 Dust (94).

Dust is fine material that becomes airborne when disturbed. These fines separate from the surface and become a significant problem for personnel, trailing aircraft, and the environment.

#### A-8.4.1 Severity Levels.

Severity levels are shown in Table A-23.

**Table A-23 Dust Severity Levels**

| Aircraft | Distress Types | Green                        | Amber                          | Red                         |
|----------|----------------|------------------------------|--------------------------------|-----------------------------|
| C-17     | Dust (94)      | Does not obstruct visibility | Partially obstructs visibility | Thick; obstructs visibility |
| C-130    |                |                              |                                |                             |
| LTFW     |                |                              |                                |                             |

**A-8.4.2 How to Measure.**

To determine the severity, drive a ground vehicle quickly down the runway and note the visibility through the trailing dust cloud. Dust is difficult to control; be aware of the problem to adequately phase aircraft operations.

**A-8.4.3 Deduct Values.**

See Table A-28 for dust DVs.

**A-8.5 ROLLING RESISTANT MATERIALS (95).**

RRM is any type of loose or unbound material that separates from the solid base and lies on top of the surface and in ruts. In sufficient quantities it increases the rolling resistance, thereby increasing the amount of runway required for takeoffs. It is more prevalent in dry soils and is a byproduct of severe rutting.

**A-8.5.1 Severity Levels.**

Severity levels are shown in Table A-24.

**Table A-24 Rolling Resistant Material Severity Levels**

| Aircraft | Distress Type                   | Green                            | Amber                               | Red                      |
|----------|---------------------------------|----------------------------------|-------------------------------------|--------------------------|
| C-17     | Rolling Resistant Material (95) | Exist but < 3.5 in. (90 mm) deep | 3.5 to 7.75 in. (90 to 200 mm) deep | > 7.75 in. (200 mm) deep |
| C-130    |                                 | Exist but < 1 in. (25 mm) deep   | 1 to 3 in. (25 to 75 mm) deep       | > 3 in. (75 mm) deep     |
| LTFW     |                                 | Exist but < 1 in. (25 mm) deep   | 1 to 2 in. (25 to 50 mm) deep       | > 2 in. (50 mm) deep     |

**A-8.5.2 How to Measure.**

To measure, stick a ruler into the RRM until you hit solid ground and read the number on the ruler at the top of the RRM to the nearest 0.25 inch (6 millimeters). Take seven measurements in each main gear path and average those measurements (see Figure A-346). Determine the average RRM depth by averaging the measurements in the touchdown area, in the primary braking area, at the point of rotation, and in the last 500 feet (150 meters) of the runway. For a typical 4,000-foot (1,200-meter) runway, take one set of measurements at approximately 4+00, 10+00, 20+00, and 35+00 and average those four sets of measurements.

**Figure A-346 Rolling Resistant Material Measurement**

Measure Thickness of RRM Here

| Location 1<br>Measurements       |           | Location 2<br>Measurements |           | Location 3<br>Measurements |           | Location 4<br>Measurements |           |
|----------------------------------|-----------|----------------------------|-----------|----------------------------|-----------|----------------------------|-----------|
| 1. _____                         | 8. _____  | 1. _____                   | 8. _____  | 1. _____                   | 8. _____  | 1. _____                   | 8. _____  |
| 2. _____                         | 9. _____  | 2. _____                   | 9. _____  | 2. _____                   | 9. _____  | 2. _____                   | 9. _____  |
| 3. _____                         | 10. _____ | 3. _____                   | 10. _____ | 3. _____                   | 10. _____ | 3. _____                   | 10. _____ |
| 4. _____                         | 11. _____ | 4. _____                   | 11. _____ | 4. _____                   | 11. _____ | 4. _____                   | 11. _____ |
| 5. _____                         | 12. _____ | 5. _____                   | 12. _____ | 5. _____                   | 12. _____ | 5. _____                   | 12. _____ |
| 6. _____                         | 13. _____ | 6. _____                   | 13. _____ | 6. _____                   | 13. _____ | 6. _____                   | 13. _____ |
| 7. _____                         | 14. _____ | 7. _____                   | 14. _____ | 7. _____                   | 14. _____ | 7. _____                   | 14. _____ |
| Loc 1 Avg = _____                |           | Loc 2 Avg = _____          |           | Loc 3 Avg = _____          |           | Loc 4 Avg = _____          |           |
| Runway RRM Average Depth = _____ |           |                            |           |                            |           |                            |           |

**A-8.5.3 Deduct Values.**

See Table A-28 for RRM DVs.

**A-8.6 Jet Blast Erosion (96).**

Jet blast erosion occurs when the top layer of soil is blown or stripped away in areas scoured by engine blast. Jet blast erosion outside of trafficked areas can be ignored. Jet blast erosion is characterized by no evidence of loose aggregate or by a serrated or dimpled surface.

**A-8.6.1 Severity Levels.**

Severity levels are shown in Table A-25.

**Table A-25 Jet Blast Erosion Severity Levels**

| Aircraft     | Distress Type             | Green                            | Amber                         | Red                  |
|--------------|---------------------------|----------------------------------|-------------------------------|----------------------|
| <b>C-17</b>  | Jet Blast Erosion<br>(96) | Exist but < 1 in. (25 mm) deep   | 1 to 3 in. (25 to 75 mm) deep | > 3 in. (75 mm) deep |
| <b>C-130</b> |                           | Exist but < 1 in. (25 mm) deep   | 1 to 3 in. (25 to 75 mm) deep | > 3 in. (75 mm) deep |
| <b>LTFW</b>  |                           | Exist but < 3/4 in. (20 mm) deep | ≤ 1 in. (25 mm) deep          | > 1 in. (25 mm) deep |

**A-8.6.2 How to Measure.**

Measure the depth of the erosion to determine the severity.

**A-8.6.3 Deduct Values.**

See Table A-28 for jet blast erosion DVs.

**A-8.7 Stabilized Layer Failure (97).**

Stabilized layer failure occurs in areas of a stabilized surface layer that begin to crack and delaminate; it is a progressive failure. It first appears as cracks that become more prevalent and begin to interconnect and resemble alligator cracking. These pieces then separate from the surface. This creates a dangerous FOD problem and leaves abrupt vertical edges in the surface that may cause gear damage.

**A-8.7.1 Severity Levels.**

Severity levels are shown in Table A-26.

**Table A-26 Stabilized Layer Failure Severity Levels**

| Aircraft | Distress Type                 | Green                            | Amber                         | Red                  |
|----------|-------------------------------|----------------------------------|-------------------------------|----------------------|
| C-17     | Stabilized Layer Failure (97) | Exist but < 1 in. (25 mm) deep   | 1 to 2 in. (25 to 50 mm) deep | > 2 in. (50 mm) deep |
| C-130    |                               | Exist but < 1 in. (25 mm) deep   | 1 to 2 in. (25 to 50 mm) deep | > 2 in. (50 mm) deep |
| LTFW     |                               | Exist but < 3/4 in. (20 mm) deep | ≤ 1 in. (25 mm) deep          | > 1 in. (25 mm) deep |

**A-8.7.2 How to Measure.**

Stabilized layer failure is recorded for stabilized surfaces when delamination of the surface layer occurs due to aging, cracking, and the loss of bond with the underlying layer. Over time, pieces or chunks of the surface layer (not just small aggregates) are dislodged and can cause FOD damage. The abrupt edges or changes in elevation caused by stabilized layer failure have a significant impact on aircraft operations due to their aircraft damage potential. Measure the depth of the failure to determine the severity.

**A-8.7.3 Deduct Values.**

See Table A-28 for stabilized layer failure DVs.

**A-8.8 Surface-Treatment and Macadam Surfaces.**

Unsurfaced pavements differ from paved surfaces in that unsurfaced pavements do not have a surface-wearing course capable of resisting the abrasive action of the wheel loads. Surface-treated and penetration macadam pavements have thin-wearing

surfaces (usually less than 1.5 inches [40 millimeters] thick) and these thin coverings are likewise not capable of resisting the shearing actions of the aircraft gears expected for contingency airfield operations. These pavement surfaces are expected to experience deterioration similar to semi-prepared surfaces. For visual condition inspection purposes, consider surface-treated and macadam pavements a “semi-prepared or unsurfaced pavement” and assess using the procedures outlined in paragraph A-8, but with different severity level criteria (see Table A-27).

### A-8.8.1 Severity Levels.

If the pavement section is in relatively good condition, with only low-severity distresses scattered across the section, and does not require more than routine maintenance to maintain aircraft operations, the pavement is considered in green (good) condition. However, if medium-severity distresses were present in addition to the low-severity distresses, or the section requires routine to major repair to maintain operations, then rate the section amber (fair). If high-severity distresses are prevalent, and the pavement requires constant maintenance and repairs to maintain operations, then consider the pavement red (poor). When the condition of the airfield approaches red, inspect it before and after each aircraft operation.

**Table A-27 Surface Treatment and Macadam Surface Severity Levels**

| Distress Types                  | Green   | Amber  | Red   |
|---------------------------------|---|--|---|
| Potholes (91)                   | < 1 in. (25 mm) deep and/or < 15 in. (380 mm) in diameter                                     | 1 to 2 in. (25 to 50 mm) deep and > 15 in. (380 mm) in diameter  | > 2 in. (50 mm) deep and > 15 in. (380 mm) in diameter  |
| Ruts (92)                       | Exist but < 1 in. (25 mm) deep  | 1 to 3 in. (25 to 75 mm) deep  | > 3 in. (75 mm) deep  |
| Loose aggregate (93)            | Binder is wearing away causing low FOD potential over < 10% of surface, surface mostly intact | Fine aggregate is missing and larger pieces are dislodged. Moderate FOD potential. Surface is rough and pitted with loose aggregate covering between 10 and 50% of the surface | High FOD potential. Surface texture is very rough and pitted. Loose aggregate covering > 50% of the surface |
| Dust (94)                       | Does not obstruct visibility  | Partially obstructs visibility   | Thick; obstructs visibility   |
| Rolling Resistant Material (95) | Exist but < 1 in. (25 mm) deep  | 1 to 3 in. (25 to 75 mm) deep  | > 3 in. (75 mm) deep  |
| Jet Blast Erosion (96)          | Exist but < in. (25 mm) deep  | 1 to 3 in. (25 to 75 mm) deep  | > 3 in. (75 mm) deep  |
| Stabilized Layer Failure (97)   | Exist but < in. (25 mm) deep  | 1 to 2 in. (25 to 50 mm) deep  | > 2 in. (50 mm) deep  |

### A-8.8.2 How to Measure.

In evaluating a surface-treated pavement or macadam, if the binder no longer holds the aggregate in place (usually due to oxidation of the binder), then record the distress as “loose aggregate. Identify loose aggregate separately from RRM. RRM is also loose material that has separated from the top surface but is usually the result of severe rutting and is located between and in rut locations. RRM is usually attributed to unsurfaced soil or aggregate airfields; however, this material can be produced through severe rutting of surface-treated surfaces.

Delamination due to aging and cracking of surface-treated surface courses have been identified as problems with these materials. Record these occurrences as “stabilized layer failure.” Stabilized layer failure is recorded for stabilized surfaces when delamination of the surface layer occurs due to aging, cracking, and the loss of bond with the underlying layer. Over time, pieces or chunks of the surface layer (not just small aggregates) are dislodged and can cause FOD damage. The abrupt edges or changes in elevation caused by stabilized layer failure have a significant impact on aircraft operations due to their aircraft damage potential.

**A-8.8.3 Deduct Values.**

See Table A-28 for DVs.

**A-8.9 SPACI Distress Deduct Values.**

**Table A-28 SPACI Distress Deduct Values**

| SPACI Distress Deduct Values |                            |                    |                      |                    |                      |                    |                      |
|------------------------------|----------------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|
| Distress #                   | Distress Types             | Green              |                      | Amber              |                      | Red                |                      |
|                              |                            | Runway/<br>Taxiway | Hammerhead/<br>Apron | Runway/<br>Taxiway | Hammerhead/<br>Apron | Runway/<br>Taxiway | Hammerhead/<br>Apron |
| 91                           | Potholes                   | 4                  | 2                    | 10                 | 6                    | 20                 | 12                   |
| 92                           | Ruts                       | 14                 | 4                    | 18                 | 6                    | 24                 | 10                   |
| 93                           | Loose aggregate            | 4                  | 15                   | 6                  | 30                   | 8                  | 45                   |
| 94                           | Dust                       | 2                  | 15                   | 4                  | 30                   | 6                  | 45                   |
| 95                           | Rolling Resistant Material | 18                 | 2                    | 22                 | 4                    | 26                 | 15                   |
| 96                           | Jet Blast Erosion          | 5                  | 10                   | 10                 | 30                   | 15                 | 40                   |
| 97                           | Stabilized Layer Failure   | 5                  | 15                   | 10                 | 25                   | 15                 | 35                   |

**A-8.10 SPACI Corrected Deduct Value Curves and Charts.**

**Figure A-347 SPACI Corrected Deduct Value Curves**

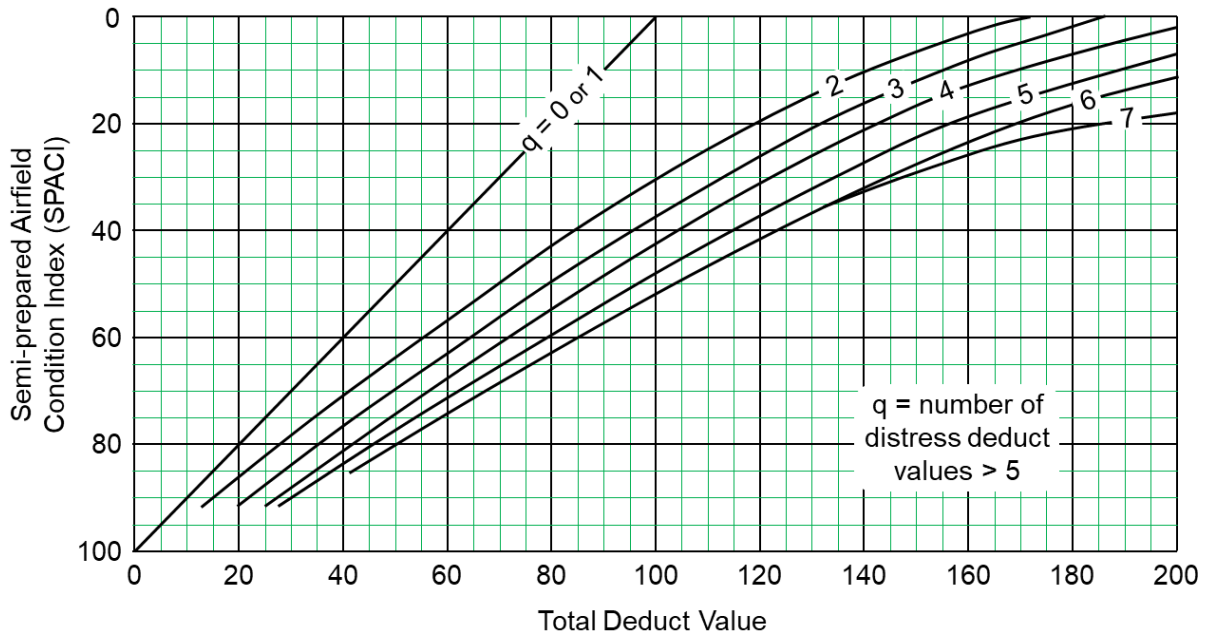


Figure A-348 Corrected SPACI, 0 to 100 TDV

| Semi-prepared Surface<br>Corrected SPACI Value Chart |   |    |    |    |    |    |   |
|--|---|----|----|----|----|----|---|
| Total<br>Deduct<br>Value                             | q = Number of distresses with deduct values<br>greater than 5 |    |    |    |    |    |   |
|  | 0 or 1  | 2  | 3  | 4  | 5  | 6  | 7 |
| 1  | 99  |    |    |    |    |    |   |
| 2  | 98  |    |    |    |    |    |   |
| 3  | 97  |    |    |    |    |    |   |
| 4  | 96  |    |    |    |    |    |   |
| 5  | 95  |    |    |    |    |    |   |
| 6  | 94  |    |    |    |    |    |   |
| 7  | 93  |    |    |    |    |    |   |
| 8  | 92  |    |    |    |    |    |   |
| 9  | 91  |    |    |    |    |    |   |
| 10   | 90  |    |    |    |    |    |   |
| 11   | 89  |    |    |    |    |    |   |
| 12   | 88  | 92 |    |    |    |    |   |
| 13   | 87  | 91 |    |    |    |    |   |
| 14   | 86  | 90 |    |    |    |    |   |
| 15   | 85  | 90 |    |    |    |    |   |
| 16   | 84  | 89 |    |    |    |    |   |
| 17   | 83  | 88 |    |    |    |    |   |
| 18   | 82  | 87 |    |    |    |    |   |
| 19   | 81  | 86 |    |    |    |    |   |
| 20   | 80  | 86 | 91 |    |    |    |   |
| 21   | 79  | 85 | 90 |    |    |    |   |
| 22   | 78  | 84 | 90 |    |    |    |   |
| 23   | 77  | 83 | 89 |    |    |    |   |
| 24   | 76  | 82 | 88 |    |    |    |   |
| 25   | 75  | 82 | 87 |    |    |    |   |
| 26   | 74  | 81 | 87 | 91 |    |    |   |
| 27   | 73  | 80 | 86 | 90 |    |    |   |
| 28   | 72  | 79 | 85 | 89 |    |    |   |
| 29   | 71  | 79 | 84 | 89 | 91 |    |   |
| 30   | 70  | 78 | 84 | 88 | 90 |    |   |
| 31   | 69  | 77 | 83 | 87 | 89 |    |   |
| 32   | 68  | 77 | 82 | 87 | 89 |    |   |
| 33   | 67  | 76 | 81 | 86 | 88 |    |   |
| 34   | 66  | 75 | 81 | 85 | 87 |    |   |
| 35   | 65  | 74 | 80 | 84 | 87 |    |   |
| 36   | 64  | 74 | 79 | 84 | 86 |    |   |
| 37   | 63  | 73 | 79 | 83 | 85 |    |   |
| 38   | 62  | 72 | 78 | 82 | 85 |    |   |
| 39   | 61  | 71 | 77 | 82 | 84 |    |   |
| 40   | 60  | 71 | 76 | 81 | 84 |    |   |
| 41   | 59  | 70 | 75 | 80 | 83 | 85 |   |
| 42   | 58  | 69 | 75 | 80 | 82 | 85 |   |
| 43   | 57  | 68 | 74 | 79 | 82 | 84 |   |
| 44   | 56  | 68 | 74 | 78 | 81 | 83 |   |
| 45   | 55  | 67 | 73 | 78 | 80 | 83 |   |
| 46   | 54  | 66 | 72 | 77 | 80 | 82 |   |
| 47   | 53  | 66 | 71 | 76 | 79 | 82 |   |
| 48   | 52  | 65 | 71 | 75 | 78 | 81 |   |
| 49   | 51  | 64 | 70 | 75 | 78 | 80 |   |
| 50   | 50  | 63 | 69 | 74 | 77 | 80 |   |

| Semi-prepared Surface<br>Corrected SPACI Value Chart |   |    |    |    |    |    |    |
|--|---|----|----|----|----|----|----|
| Total<br>Deduct<br>Value                             | q = Number of distresses with deduct values<br>greater than 5 |    |    |    |    |    |    |
|  | 0 or 1  | 2  | 3  | 4  | 5  | 6  | 7  |
| 51   | 49  | 63 | 69 | 73 | 77 | 79 |    |
| 52   | 48  | 62 | 68 | 73 | 76 | 79 |    |
| 53   | 47  | 61 | 67 | 72 | 75 | 78 |    |
| 54   | 46  | 61 | 67 | 71 | 74 | 78 |    |
| 55   | 45  | 60 | 66 | 71 | 74 | 77 |    |
| 56   | 44  | 59 | 65 | 70 | 73 | 76 |    |
| 57   | 43  | 59 | 65 | 69 | 73 | 76 |    |
| 58   | 42  | 58 | 64 | 69 | 72 | 75 |    |
| 59   | 41  | 57 | 63 | 68 | 71 | 74 |    |
| 60   | 40  | 57 | 63 | 67 | 71 | 74 |    |
| 61   | 39  | 56 | 62 | 67 | 70 | 73 |    |
| 62   | 38  | 55 | 61 | 66 | 70 | 73 |    |
| 63   | 37  | 54 | 61 | 65 | 69 | 72 |    |
| 64   | 36  | 54 | 60 | 65 | 69 | 72 |    |
| 65   | 35  | 53 | 59 | 64 | 68 | 71 |    |
| 66   | 34  | 53 | 59 | 64 | 67 | 71 |    |
| 67   | 33  | 52 | 58 | 63 | 67 | 70 |    |
| 68   | 32  | 51 | 57 | 62 | 66 | 69 |    |
| 69   | 31  | 50 | 57 | 61 | 66 | 69 |    |
| 70   | 30  | 49 | 56 | 61 | 65 | 68 |    |
| 71   | 29  | 49 | 55 | 60 | 65 | 68 |    |
| 72   | 28  | 48 | 54 | 60 | 64 | 67 |    |
| 73   | 27  | 47 | 54 | 59 | 63 | 67 | 67 |
| 74   | 26  | 47 | 53 | 58 | 63 | 66 | 66 |
| 75   | 25  | 46 | 52 | 58 | 62 | 65 | 65 |
| 76   | 24  | 45 | 52 | 57 | 62 | 65 | 65 |
| 77   | 23  | 45 | 51 | 56 | 61 | 64 | 64 |
| 78   | 22  | 44 | 50 | 56 | 60 | 64 | 64 |
| 79   | 21  | 43 | 50 | 55 | 60 | 63 | 63 |
| 80   | 20  | 42 | 49 | 54 | 59 | 62 | 62 |
| 81   | 19  | 42 | 49 | 54 | 59 | 62 | 62 |
| 82   | 18  | 41 | 48 | 53 | 58 | 61 | 61 |
| 83   | 17  | 40 | 47 | 53 | 58 | 61 | 61 |
| 84   | 16  | 40 | 47 | 52 | 57 | 60 | 60 |
| 85   | 15  | 39 | 46 | 51 | 57 | 60 | 60 |
| 86   | 14  | 39 | 46 | 51 | 56 | 59 | 59 |
| 87   | 13  | 38 | 45 | 50 | 55 | 59 | 59 |
| 88   | 12  | 37 | 44 | 49 | 55 | 58 | 58 |
| 89   | 11  | 37 | 44 | 49 | 54 | 58 | 58 |
| 90   | 10  | 36 | 43 | 48 | 54 | 57 | 57 |
| 91   | 9   | 36 | 43 | 48 | 53 | 57 | 57 |
| 92   | 8   | 35 | 42 | 47 | 52 | 56 | 56 |
| 93   | 7   | 34 | 41 | 46 | 52 | 55 | 55 |
| 94   | 6   | 34 | 41 | 46 | 51 | 55 | 55 |
| 95   | 5   | 33 | 40 | 45 | 51 | 54 | 54 |
| 96   | 4   | 33 | 40 | 45 | 50 | 54 | 54 |
| 97   | 3   | 32 | 39 | 44 | 50 | 53 | 53 |
| 98   | 2   | 31 | 38 | 43 | 49 | 53 | 53 |
| 99   | 1   | 31 | 38 | 43 | 48 | 52 | 52 |
| 100  | 0   | 30 | 37 | 42 | 48 | 52 | 52 |

Figure A-349 Corrected SPACI, 101 to 200 TDV

| Semi-prepared Surface<br>Corrected SPACI Value Chart |   |    |    |    |    |    |    |
|--|---|----|----|----|----|----|----|
| Total<br>Deduct<br>Value                             | q = Number of distresses with deduct values<br>greater than 5 |    |    |    |    |    |    |
|  | 0 or 1  | 2  | 3  | 4  | 5  | 6  | 7  |
| 101  | 0   | 30 | 37 | 42 | 47 | 51 | 51 |
| 102  | 0   | 29 | 36 | 41 | 47 | 51 | 51 |
| 103  | 0   | 29 | 35 | 40 | 46 | 50 | 50 |
| 104  | 0   | 28 | 35 | 40 | 46 | 49 | 49 |
| 105  | 0   | 27 | 34 | 39 | 45 | 49 | 49 |
| 106  | 0   | 27 | 34 | 39 | 45 | 48 | 48 |
| 107  | 0   | 26 | 33 | 38 | 44 | 48 | 48 |
| 108  | 0   | 26 | 33 | 38 | 43 | 47 | 47 |
| 109  | 0   | 25 | 32 | 37 | 43 | 47 | 47 |
| 110  | 0   | 25 | 32 | 36 | 42 | 46 | 46 |
| 111  | 0   | 24 | 31 | 36 | 42 | 46 | 46 |
| 112  | 0   | 24 | 30 | 35 | 41 | 45 | 45 |
| 113  | 0   | 23 | 30 | 35 | 41 | 45 | 45 |
| 114  | 0   | 22 | 29 | 34 | 40 | 44 | 44 |
| 115  | 0   | 22 | 29 | 34 | 40 | 44 | 44 |
| 116  | 0   | 21 | 28 | 33 | 39 | 43 | 43 |
| 117  | 0   | 21 | 28 | 33 | 39 | 43 | 43 |
| 118  | 0   | 20 | 27 | 32 | 38 | 42 | 42 |
| 119  | 0   | 20 | 26 | 31 | 38 | 42 | 42 |
| 120  | 0   | 19 | 26 | 31 | 37 | 41 | 41 |
| 121  | 0   | 19 | 25 | 30 | 37 | 41 | 41 |
| 122  | 0   | 18 | 25 | 30 | 36 | 40 | 40 |
| 123  | 0   | 18 | 24 | 29 | 36 | 40 | 40 |
| 124  | 0   | 17 | 24 | 29 | 35 | 39 | 39 |
| 125  | 0   | 17 | 23 | 28 | 35 | 39 | 39 |
| 126  | 0   | 16 | 23 | 28 | 34 | 38 | 38 |
| 127  | 0   | 16 | 22 | 27 | 34 | 38 | 38 |
| 128  | 0   | 15 | 22 | 27 | 33 | 37 | 37 |
| 129  | 0   | 15 | 21 | 26 | 33 | 37 | 37 |
| 130  | 0   | 14 | 21 | 26 | 32 | 36 | 36 |
| 131  | 0   | 14 | 20 | 25 | 32 | 36 | 36 |
| 132  | 0   | 14 | 20 | 25 | 31 | 35 | 35 |
| 133  | 0   | 13 | 19 | 24 | 31 | 35 | 35 |
| 134  | 0   | 13 | 19 | 24 | 30 | 34 | 35 |
| 135  | 0   | 12 | 18 | 23 | 30 | 34 | 34 |
| 136  | 0   | 12 | 18 | 23 | 29 | 33 | 34 |
| 137  | 0   | 12 | 17 | 22 | 29 | 33 | 34 |
| 138  | 0   | 11 | 17 | 22 | 28 | 32 | 33 |
| 139  | 0   | 11 | 16 | 21 | 28 | 32 | 33 |
| 140  | 0   | 10 | 16 | 21 | 27 | 32 | 33 |
| 141  | 0   | 10 | 16 | 21 | 27 | 31 | 32 |
| 142  | 0   | 9  | 15 | 20 | 26 | 31 | 32 |
| 143  | 0   | 9  | 15 | 20 | 26 | 31 | 31 |
| 144  | 0   | 9  | 14 | 19 | 25 | 30 | 31 |
| 145  | 0   | 8  | 14 | 19 | 25 | 30 | 31 |
| 146  | 0   | 8  | 14 | 18 | 24 | 29 | 30 |
| 147  | 0   | 8  | 13 | 18 | 24 | 29 | 30 |
| 148  | 0   | 7  | 13 | 17 | 23 | 28 | 30 |
| 149  | 0   | 7  | 12 | 17 | 23 | 28 | 29 |
| 150  | 0   | 6  | 12 | 16 | 22 | 27 | 29 |

| Semi-prepared Surface<br>Corrected SPACI Value Chart |   |   |    |    |    |    |    |
|--|---|---|----|----|----|----|----|
| Total<br>Deduct<br>Value                             | q = Number of distresses with deduct values<br>greater than 5 |   |    |    |    |    |    |
|  | 0 or 1  | 2 | 3  | 4  | 5  | 6  | 7  |
| 151  | 0   | 6 | 12 | 16 | 22 | 27 | 29 |
| 152  | 0   | 6 | 11 | 16 | 21 | 27 | 28 |
| 153  | 0   | 5 | 11 | 15 | 21 | 26 | 28 |
| 154  | 0   | 5 | 10 | 15 | 21 | 26 | 28 |
| 155  | 0   | 5 | 10 | 14 | 20 | 25 | 27 |
| 156  | 0   | 4 | 10 | 14 | 20 | 25 | 27 |
| 157  | 0   | 4 | 9  | 14 | 20 | 24 | 27 |
| 158  | 0   | 4 | 9  | 13 | 19 | 24 | 26 |
| 159  | 0   | 3 | 8  | 13 | 19 | 24 | 26 |
| 160  | 0   | 3 | 8  | 13 | 19 | 23 | 26 |
| 161  | 0   | 3 | 8  | 12 | 18 | 23 | 25 |
| 162  | 0   | 2 | 7  | 12 | 18 | 22 | 25 |
| 163  | 0   | 2 | 7  | 12 | 18 | 22 | 25 |
| 164  | 0   | 2 | 7  | 11 | 17 | 22 | 24 |
| 165  | 0   | 1 | 6  | 11 | 17 | 21 | 24 |
| 166  | 0   | 1 | 6  | 11 | 17 | 21 | 24 |
| 167  | 0   | 1 | 6  | 10 | 16 | 21 | 24 |
| 168  | 0   | 1 | 5  | 10 | 16 | 20 | 23 |
| 169  | 0   | 0 | 5  | 10 | 16 | 20 | 23 |
| 170  | 0   | 0 | 5  | 10 | 15 | 20 | 23 |
| 171  | 0   | 0 | 5  | 9  | 15 | 19 | 23 |
| 172  | 0   | 0 | 4  | 9  | 15 | 19 | 22 |
| 173  | 0   | 0 | 4  | 9  | 14 | 19 | 22 |
| 174  | 0   | 0 | 4  | 8  | 14 | 18 | 22 |
| 175  | 0   | 0 | 3  | 8  | 14 | 18 | 22 |
| 176  | 0   | 0 | 3  | 8  | 14 | 18 | 21 |
| 177  | 0   | 0 | 3  | 8  | 13 | 17 | 21 |
| 178  | 0   | 0 | 2  | 7  | 13 | 17 | 21 |
| 179  | 0   | 0 | 2  | 7  | 13 | 17 | 21 |
| 180  | 0   | 0 | 2  | 7  | 12 | 16 | 21 |
| 181  | 0   | 0 | 1  | 7  | 12 | 16 | 21 |
| 182  | 0   | 0 | 1  | 6  | 12 | 16 | 20 |
| 183  | 0   | 0 | 1  | 6  | 11 | 15 | 20 |
| 184  | 0   | 0 | 0  | 6  | 11 | 15 | 20 |
| 185  | 0   | 0 | 0  | 5  | 11 | 15 | 20 |
| 186  | 0   | 0 | 0  | 5  | 11 | 15 | 20 |
| 187  | 0   | 0 | 0  | 5  | 11 | 14 | 20 |
| 188  | 0   | 0 | 0  | 5  | 10 | 14 | 19 |
| 189  | 0   | 0 | 0  | 4  | 10 | 14 | 19 |
| 190  | 0   | 0 | 0  | 4  | 10 | 14 | 19 |
| 191  | 0   | 0 | 0  | 4  | 9  | 13 | 19 |
| 192  | 0   | 0 | 0  | 4  | 9  | 13 | 19 |
| 193  | 0   | 0 | 0  | 3  | 9  | 13 | 19 |
| 194  | 0   | 0 | 0  | 3  | 8  | 13 | 19 |
| 195  | 0   | 0 | 0  | 3  | 8  | 12 | 18 |
| 196  | 0   | 0 | 0  | 3  | 8  | 12 | 18 |
| 197  | 0   | 0 | 0  | 2  | 8  | 12 | 18 |
| 198  | 0   | 0 | 0  | 2  | 7  | 12 | 18 |
| 199  | 0   | 0 | 0  | 2  | 7  | 11 | 18 |
| 200  | 0   | 0 | 0  | 2  | 7  | 11 | 18 |

**A-9 BLANK FORMS**

**A-9.1 Asphalt Airfield Pavement Condition Survey Data Sheet.**

| AC Airfield Pavement Condition Survey Data Sheet |   |                             |   |                        |   |                |   |
|--|---|-----------------------------|---|------------------------|---|----------------|---|
| PID:   |   |                             |   | SURFACE TYPE:          |   |                |   |
| INSPECTOR NAME:                                  |   |                             |   | DATE INSPECTED:        |   |                |   |
| SECTION LENGTH:                                  |   | SECTION WIDTH:              |   | SECTION TRUE AREA:     |   |                |   |
| AC Surfaced Airfield Distress Codes              |   |                             |   |                        |   |                |   |
| 41. Alligator Cracking                           |   | 46. Jet Blast               |   | 51. Polished Aggregate |   | 56. Swell      |   |
| 42. Bleeding                                     |   | 47. JT. Reflection (PCC)    |   | 52. Raveling           |   | 57. Weathering |   |
| 43. Block Cracking                               |   | 48. Long. & Trans. Cracking |   | 53. Rutting            |   |                |   |
| 44. Corrugation                                  |   | 49. Oil Spillage            |   | 54. Shoving From PCC   |   |                |   |
| 45. Depression                                   |   | 50. Patching                |   | 55. Slippage Cracking  |   |                |   |
| SAMPLE NUMBER                                    |   | SAMPLE AREA                 |   | SKETCH/COMMENTS        |   |                |   |
| DISTRESS CODE                                    | L | M                           | H |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
| SAMPLE NUMBER                                    |   | SAMPLE AREA                 |   | SAMPLE NUMBER          |   | SAMPLE AREA    |   |
| DISTRESS CODE                                    | L | M                           | H | DISTRESS CODE          | L | M              | H |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |
|  |   |                             |   |                        |   |                |   |

**A-9.2 Asphalt Road and Parking Pavement Condition Survey Data Sheet.**

| AC Road and Parking Pavement Condition Survey Data Sheet |   |                              |   |                        |   |                       |   |
|--|---|------------------------------|---|------------------------|---|-----------------------|---|
| PID:   |   |                              |   | SURFACE TYPE:          |   |                       |   |
| INSPECTOR NAME:  |   |                              |   | DATE INSPECTED:        |   |                       |   |
| SECTION LENGTH:  |   | SECTION WIDTH:               |   | SECTION TRUE AREA:     |   |                       |   |
| AC Surfaced Road and Parking Distress Codes              |   |                              |   |                        |   |                       |   |
| 1. Alligator Cracking                                    |   | 6. Depression                |   | 11. Patch/Utility Cut  |   | 16. Shoving           |   |
| 2. Bleeding  |   | 7. Edge Cracking             |   | 12. Polished Aggregate |   | 17. Slippage Cracking |   |
| 3. Block Cracking  |   | 8. Joint Reflection Cracking |   | 13. Pothole            |   | 18. Swell             |   |
| 4. Bumps and Sags  |   | 9. Lane/Shoulder Drop Off    |   | 14. Railroad Crossing  |   | 19. Raveling          |   |
| 5. Corrugation   |   | 10. Long/Trans Cracking      |   | 15. Rutting            |   | 20. Weathering        |   |
| SAMPLE NUMBER  |   | SAMPLE AREA                  |   | SKETCH/COMMENTS        |   |                       |   |
| DISTRESS CODE  | L | M                            | H |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
| SAMPLE NUMBER  |   | SAMPLE AREA                  |   | SAMPLE NUMBER          |   | SAMPLE AREA           |   |
| DISTRESS CODE  | L | M                            | H | DISTRESS CODE          | L | M                     | H |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |
|  |   |                              |   |                        |   |                       |   |

A-9.3 Concrete Airfield Pavement Condition Survey Data Sheet.

| PCC Airfield Pavement Condition Survey Data Sheet |                                      |                              |                           |                 |
|---|--------------------------------------|------------------------------|---------------------------|-----------------|
| PID:  |                                      | SURFACE TYPE:                |                           |                 |
| INSPECTOR NAME:                                   |                                      | DATE INSPECTED:              |                           |                 |
| SECTION LENGTH:                                   | SECTION WIDTH:                       | SECTION TRUE AREA:           |                           |                 |
| SLAB LENGTH:                                      | SLAB WIDTH:                          | NUMBER OF SLABS:             |                           |                 |
| PCC Surfaced Airfield Distress Codes              |                                      |                              |                           |                 |
| 61. Blowup {1}                                    | 65. Joint Seal Damage {5}            | 69. Pumping {9}              | 73. Shrinkage Cracks {13} |                 |
| 62. Corner Break {2}                              | 66. Patching, Small {6} (< 5 ft)     | 70. Scaling {10}             | 74. Spalling, Joints {14} |                 |
| 63. Cracks {3}                                    | 67. Patching, Large/ Utility Cut {7} | 71. Settlement/Faulting {11} | 75. Spalling, Corner {15} |                 |
| 64. Durability Cracking {4}                       | 68. Popouts {8}                      | 72. Shattered Slab {12}      | 76. ASR {16}              |                 |
| SAMPLE NUMBER                                     |                                      | SAMPLE AREA                  |                           | SKETCH/COMMENTS |
| DISTRESS CODE                                     | L                                    | M                            | H                         | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
| SAMPLE NUMBER                                     |                                      | SAMPLE AREA                  |                           | SKETCH/COMMENTS |
| DISTRESS CODE                                     | L                                    | M                            | H                         | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |
|   |                                      |                              |                           | • • • • •       |

**A-9.4 Concrete Road/Parking Pavement Condition Survey Data Sheet.**

| PCC Road and Parking Pavement Condition Survey Data Sheet |                             |                        |                        |                 |
|---|-----------------------------|------------------------|------------------------|-----------------|
| PID:  |                             | SURFACE TYPE:          |                        |                 |
| INSPECTOR NAME:   |                             | DATE INSPECTED:        |                        |                 |
| SECTION LENGTH:   | SECTION WIDTH:              | SECTION TRUE AREA:     |                        |                 |
| SLAB LENGTH:  | SLAB WIDTH:                 | NUMBER OF SLABS:       |                        |                 |
| PCC Surfaced Road and Parking Distress Codes              |                             |                        |                        |                 |
| 21. Blow Up   | 26. Joint Seal Damage       | 31. Polished Aggregate | 36. Scaling            |                 |
| 22. Corner Break  | 27. Lane/Shoulder Dropp Off | 32. Popouts            | 37. Shrinkage Cracking |                 |
| 23. Divided Slab  | 28. Linear Cracking         | 33. Pumping            | 38. Corner Spalling    |                 |
| 24. Durability Cracking                                   | 29. Large Patch/Utility Cut | 34.0 Punchout          | 39. Joint Spalling     |                 |
| 25. Faulting  | 30. Small Patch             | 35. Railroad Crossing  |                        |                 |
| SAMPLE NUMBER   |                             | SAMPLE AREA            |                        | SKETCH/COMMENTS |
| DISTRESS CODE   | L                           | M                      | H                      | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
| SAMPLE NUMBER   |                             | SAMPLE AREA            |                        | SKETCH/COMMENTS |
| DISTRESS CODE   | L                           | M                      | H                      | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |
|   |                             |                        |                        | • • • • •       |

**A-9.5 Unpaved Airfield Condition Survey Data Sheet.**

| Unsurfaced Airfield Condition Survey Data Sheet |   |                |   |                                 |                 |   |             |  |
|---|---|----------------|---|---------------------------------|-----------------|---|-------------|--|
| PID:  |   |                |   | SURFACE TYPE:                   |                 |   |             |  |
| INSPECTOR NAME:                                 |   |                |   | DATE INSPECTED:                 |                 |   |             |  |
| SECTION LENGTH:                                 |   | SECTION WIDTH: |   | SECTION TRUE AREA:              |                 |   |             |  |
| Unsurfaced Airfield Distress Codes              |   |                |   |                                 |                 |   |             |  |
| 91. Potholes                                    |   |                |   | 95. Rolling Resistance Material |                 |   |             |  |
| 92. Ruts  |   |                |   | 96. Jet Blast Erosion           |                 |   |             |  |
| 93. Loose Aggregate                             |   |                |   | 97. Stabilized Layer Failure    |                 |   |             |  |
| 94. Dust  |   |                |   |                                 |                 |   |             |  |
| SAMPLE NUMBER                                   |   | SAMPLE AREA    |   |                                 | SKETCH/COMMENTS |   |             |  |
| DISTRESS CODE                                   | L | M              | H |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
| SAMPLE NUMBER                                   |   | SAMPLE AREA    |   |                                 | SAMPLE NUMBER   |   | SAMPLE AREA |  |
| DISTRESS CODE                                   | L | M              | H | DISTRESS CODE                   | L               | M | H           |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |

**A-9.6 Unpaved Road and Parking Condition Survey Data Sheet.**

| Unsurfaced Road and Parking Condition Survey Data Sheet |   |                |   |                                 |                 |   |             |  |
|---|---|----------------|---|---------------------------------|-----------------|---|-------------|--|
| PID:  |   |                |   | SURFACE TYPE:                   |                 |   |             |  |
| INSPECTOR NAME:   |   |                |   | DATE INSPECTED:                 |                 |   |             |  |
| SECTION LENGTH:   |   | SECTION WIDTH: |   | SECTION TRUE AREA:              |                 |   |             |  |
| Unsurfaced Road and Parking Distress Codes              |   |                |   |                                 |                 |   |             |  |
| 81. Improper Cross Section (Linear Ft)                  |   |                |   | 85. Potholes (Count)            |                 |   |             |  |
| 82. Indadequate Roadside Drainage (Sq Ft)               |   |                |   | 86. Ruts (Sq Ft)                |                 |   |             |  |
| 83. Corrugations (Sq Ft)                                |   |                |   | 87. Loose Aggregate (Linear Ft) |                 |   |             |  |
| 84. Dust  |   |                |   |                                 |                 |   |             |  |
| SAMPLE NUMBER   |   | SAMPLE AREA    |   |                                 | SKETCH/COMMENTS |   |             |  |
| DISTRESS CODE   | L | M              | H |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
| SAMPLE NUMBER   |   | SAMPLE AREA    |   |                                 | SAMPLE NUMBER   |   | SAMPLE AREA |  |
| DISTRESS CODE   | L | M              | H | DISTRESS CODE                   | L               | M | H           |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |
|   |   |                |   |                                 |                 |   |             |  |

**A-9.7 Interlocking Paver Road and Parking Condition Survey Data Sheet.**

| Interlocking Concrete Pavers Road and Parking Condition Survey Data Sheet |   |                                |   |                     |   |             |   |
|---|---|--------------------------------|---|---------------------|---|-------------|---|
| PID:  |   |                                |   | SURFACE TYPE:       |   |             |   |
| INSPECTOR NAME:   |   |                                |   | DATE INSPECTED:     |   |             |   |
| SECTION LENGTH:   |   | SECTION WIDTH:                 |   | SECTION TRUE AREA:  |   |             |   |
| Interlocking Concrete Pavers for Roads and Parking Distress Codes         |   |                                |   |                     |   |             |   |
| 101. Damaged Pavers   |   | 105. Faulting                  |   | 109. Missing Pavers |   |             |   |
| 102. Depressions  |   | 106. Heaving                   |   | 110. Patching       |   |             |   |
| 103. Edge Restraint   |   | 107. Horizontal Creep          |   | 111. Rutting        |   |             |   |
| 104. Excessive Joint Width  |   | 108. Joint Sand Loss / Pumping |   |                     |   |             |   |
| SAMPLE NUMBER   |   | SAMPLE AREA                    |   | SKETCH/COMMENTS     |   |             |   |
| DISTRESS CODE   | L | M                              | H |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
| SAMPLE NUMBER   |   | SAMPLE AREA                    |   | SAMPLE NUMBER       |   | SAMPLE AREA |   |
| DISTRESS CODE   | L | M                              | H | DISTRESS CODE       | L | M           | H |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |
|   |   |                                |   |                     |   |             |   |

**A-9.8 Density and Deduct Calculation Form.**

This form is used for paved airfield and both paved (including interlocking concrete pavers) and unpaved road and parking inspections.

| Density and Deduct Calculation Form |             |             |       |                  |          |             |        |
|-------------------------------------|-------------|-------------|-------|------------------|----------|-------------|--------|
| BRANCH ID:                          |             | SECTION ID: |       | SAMPLE UNIT #:   |          |             |        |
| CALCULATED BY:                      |             |             |       | DATE CALCULATED: |          |             |        |
| Distress                            | Description | Severity    | Units | Sample Area      | Quantity | Density (%) | Deduct |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
|                                     |             |             |       |                  |          |             |        |
| TOTAL DEDUCT                        |             |             |       |                  |          |             |        |

A-9.9 Paved Airfield PCI Calculation Form.

| AIRFIELD PCI CALCULATION FORM  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
|--|---------------------------------------|--|-------------|--|--|--|--|--|--------------|--|--------------|------------------|------------------------------|
| BRANCH ID:   |                                       |  | SECTION ID: |  |  |  |  |  | SAMPLE UNIT: |  |              |                  |                              |
| CALCULATED BY: S. Smith  |                                       |  | DATE:       |  |  |  |  |  |              |  |              |                  |                              |
| Calculate $m$ , maximum number of deduct values allowed where $m = 1 + (9 / 95) * (100 - HDV)$ with Minimum = 1 and Maximum = 10 |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| Iteration Number   | Deduct Values (See notes 1, 2, and 3) |  |             |  |  |  |  |  |              |  | DEDUCT TOTAL | q Value (Note 4) | Corrected Deduct Value (CDV) |
| 1  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 2  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 3  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 4  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 5  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 6  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 7  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 8  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 9  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 10   |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| Notes:   |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 1. Arrange Deduct Values from Highest Value to Lowest Value  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 2. Do not list more values than the Adjustment Number of Deduct Values (round to the next higher integer if a fraction/decimal)  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 3. The last (lowest) value listed may be a fraction of one of the Deduct Values in the Condition Survey Data Sheet               |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 4. q is the number of Deduct Values Greater than (but not equal to) 5.0  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| <b>MAXIMUM CDV =</b>   |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| <b>Corrected Pavement Condition Index (PCI) = 100 - MAXIMUM CDV =</b>  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |

**A-9.10 Paved and Unpaved PCI Calculation Form.**

| PAVED OR UNPAVED ROAD PCI CALCULATION FORM   |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
|--|---------------------------------------|--|-------------|--|--|--|--|--|--------------|--|--------------|------------------|------------------------------|
| BRANCH ID:   |                                       |  | SECTION ID: |  |  |  |  |  | SAMPLE UNIT: |  |              |                  |                              |
| CALCULATED BY: S. Smith  |                                       |  | DATE:       |  |  |  |  |  |              |  |              |                  |                              |
| Calculate $m$ , maximum number of deduct values allowed where $m = 1 + (9 / 98) * (100 - HDV)$ with Minimum = 1 and Maximum = 10 |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| Iteration Number   | Deduct Values (See notes 1, 2, and 3) |  |             |  |  |  |  |  |              |  | DEDUCT TOTAL | q Value (Note 4) | Corrected Deduct Value (CDV) |
| 1  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 2  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 3  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 4  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 5  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 6  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 7  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 8  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 9  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 10   |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| Notes:   |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 1. Arrange Deduct Values from Highest Value to Lowest Value  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 2. Do not list more values than the Adjustment Number of Deduct Values (round to the next higher integer if a fraction/decimal)  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 3. The last (lowest) value listed may be a fraction of one of the Deduct Values in the Condition Survey Data Sheet               |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| 4. q is the number of Deduct Values Greater than (but not equal to) 2.0  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| <b>MAXIMUM CDV =</b>   |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |
| <b>Corrected Pavement Condition Index (PCI) = 100 - MAXIMUM CDV =</b>  |                                       |  |             |  |  |  |  |  |              |  |              |                  |                              |



## APPENDIX A GLOSSARY

### A-1

### ACRONYMS.

|         |  |
|---------|--|
| AC      | Alternating Current                        |
| CDV     | Corrected Deduct Value                     |
| DV      | Deduct Value                               |
| FOD     | Foreign Object Damage                      |
| GPS     | Global Positioning System                  |
| HDV     | Highest Deduct Value                       |
| km/h    | Kilometers Per Hour                        |
| L&T     | Longitudinal and Transverse (Cracking)     |
| LZ      | Landing Zone                               |
| M&R     | Maintenance and Repair                     |
| mph     | Miles Per Hour                             |
| PCC     | Portland Cement Concrete                   |
| PCI     | Pavement Condition Index                   |
| RRM     | Rolling Resistant Material                 |
| SPACI   | Semi-Prepared Airfield Condition Index     |
| TSPWG M | Tri-Service Pavements Working Group Manual |
| URCI    | Unsurfaced Road Condition Index            |

## APPENDIX B REFERENCES

### UNIFIED FACILITIES DOCUMENTS

<https://www.wbdg.org/dod/ufc>

UFC 1-200-01, *DoD Building Code*

UFM 3-260-03, *Standard Practice for Airfield Pavement Evaluation*

UFM 3-270-08, *Pavement Management*

TSPWG M 3-260-03.02-19, *Airfield Pavement Evaluation Standards and Procedures*,  
<https://www.wbdg.org/dod/supp-tech-documents>

### NATO

NATO STANAG 7181, *NATO Standard Method for Airfield Pavement Condition Index (PCI) Surveys – Allied Engineering Publication (AEP)-56*

### ASTM

<https://www.astm.org/>

ASTM D5340, *Standard Test Method for Airport Pavement Condition Index Surveys*

ASTM D6433, *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys*

ASTM E2840, *Standard Practice for Pavement Condition Index Surveys for Interlocking Concrete Roads and Parking Lots*