Pavement Rating 101: PAVER

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PAVEMENT SERVICES, INC.

Overview

- PAVER Background
- Inspection Procedures
- Rating Considerations
- Pavement Condition Index Method & How it Integrates with PAVER
  - Benefits
  - Distress Identification
  - Pavement Inventory Basics
  - Summary of the Practice

PAVER™ -- A Pavement Management System

- Originally was developed in the late 1970s to help the Department of Defense (DOD) manage M&R for its vast inventory of pavements.
- In the early 1980s PAVER™ became widely used by APWA, cities, counties, and airports.
- It uses inspection data and a pavement condition index (PCI) rating from 0 (failed) to 100 (excellent) for consistently describing a pave
  and for predicting its
  many years into the future.
- The newest version of PAVER™ c
  with 2011 ASTM standards.

PAVER™ -- A Pavement Management System

- Develop and organize the pavement inventory
- Assess the current condition of pavements
- Stores M&R work history
- Develop models to predict future conditions
- Report on past and predict future pavement performance
- Develop scenarios for M&R based on budget or condition requirements
- Plan projects

Inspection Procedures

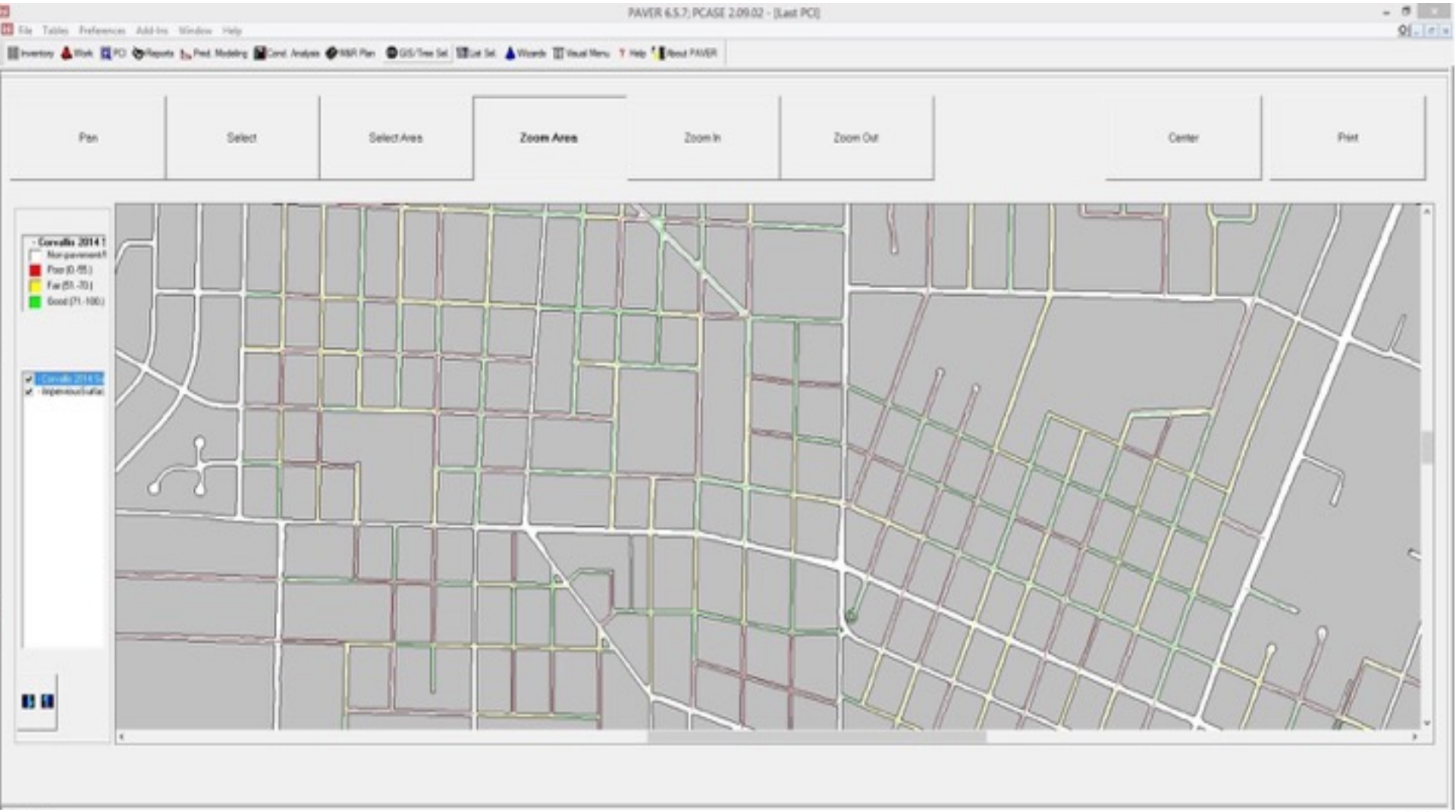
- Pavement Rating is the method of determ the pavement condition through visual observations.
  - Specifically, the type of distress/defect, the severity, and the quantity are recorded.

- PAVER Method
  - ASTM D6433 - *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys*

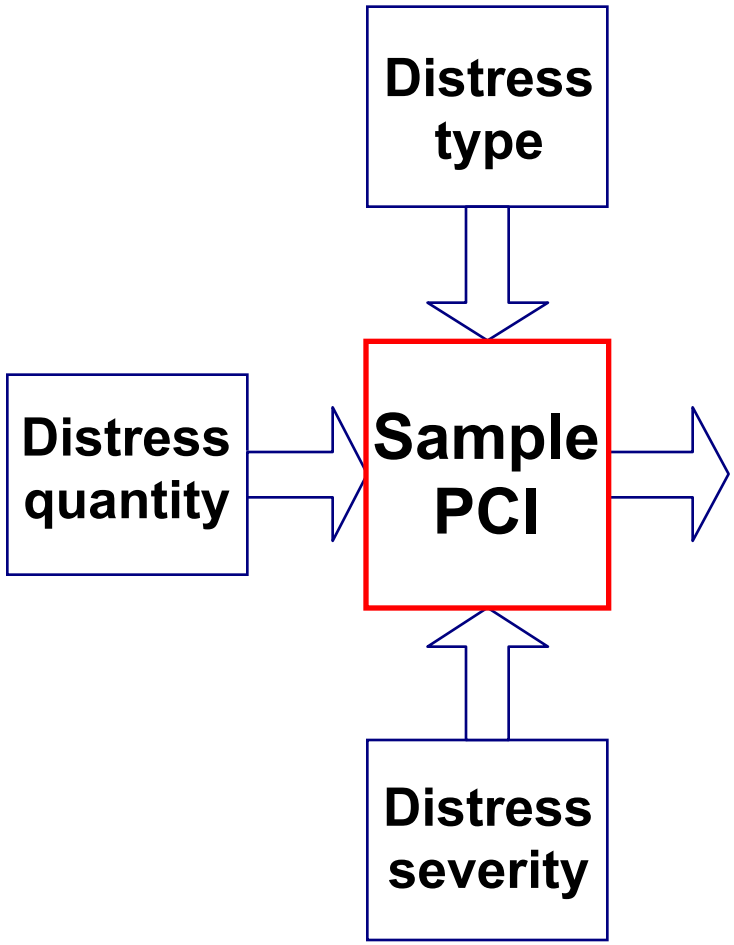
Rating Considerations

- Survey Method
  - Walking – Provides a higher level of detail. Traffic control often not required. Time intensive.
  - Semi-Automated – Safest method because collection occurs at posted speed limit. Time intensive. Rating is performed on a computer screen
  - Windshield – Lowest cost and least time intensive. Provides the lowest level of detail and often distress and severity levels are misjudged or not observed
- Weather
  - Moisture – Pavement surface must be dry in order to survey.
  - Sun – The angle/direction of the sun can affect the visual observations including distress type and severity.

Pavement Condition Index (PCI)



Pavement Condition Index (PCI) - Overview



Benefits of Pavement Condition Index (PCI)

- What It Provides: The PCI tells public works officials
  - The current condition of the road network
  - The rate of deterioration of the road network over time
- Benefits of PCI within PAVER Pavement Management System:
  - Identify immediate maintenance and rehabilitation needs
  - Monitor pavement condition over time
  - Develop a network preventive maintenance strategy
  - Develop road maintenance budgets
  - Evaluate pavement materials and designs

Distress Identification

ASTM D6433-11: Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys -- PORTLAND CEMENT CONCRETE DISTRESSES

- Blow-up
- Corner Break
- Divided Slab
- Durability Cracking
- Faulting
- Joint Seal Damage
- Lane Shoulder Drop Off
- Linear Crack
- Small Patch
- Large Patch
- Polished Aggregate
- Popouts
- Pumping
- Punchout
- Railroad Crossing
- Scaling
- Shrinkage Cracking
- Corner Spall
- Joint Spall

ASTM D6433-11: Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys -- ASPHALT DISTRESSES

- Alligator Cracking
- Bleeding
- Block Cracking
- Bumps and Sags
- Corrugation
- Depression
- Edge Cracking
- Joint Reflection Cracking
- Lane Shoulder Drop Off
- Longitudinal/ Transverse Cracking
- Patching/ Utility Cut Patching
- Polished Aggregate
- Pothole
- Railroad Crossing
- Rutting
- Shoving
- Slippage Cracking
- Swelling
- Raveling
- Weathering

Alligator or Fatigue CRACKING

Description:

A series of interconnecting cracks caused by fatigue failure of the asphalt concrete surface under repeated traffic loading.

Cracks begin at the bottom of the asphalt surface or stabilized base, where tensile stress and strain are highest under a wheel load.

Alligator Cracking only occurs in areas subjected to repeated loading such as wheel paths, i.e., taxiways, take off portion of the runway, or parking aprons.

How to Measure:

Square Area (Ft^2)

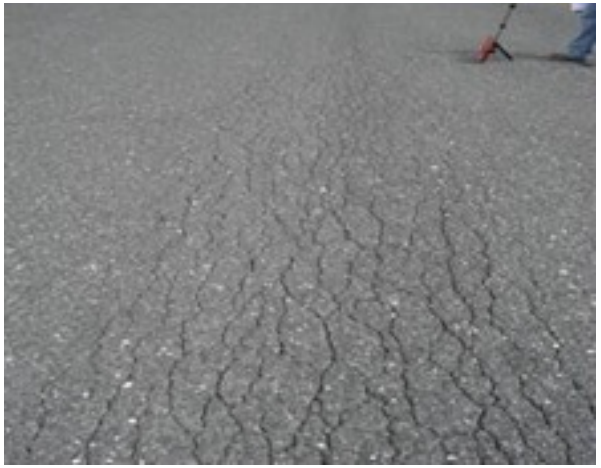
Alligator or Fatigue CRACKING

Severity:

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

MEDIUM – Further development of light alligator cracks into a pattern or network of cracks that may be lightly spalled

HIGH - 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



Longitudinal/ Transverse Cracking

Description:

Longitudinal cracks are parallel to the pavement's centerline.

May be caused by (1) a poorly constructed paving lane joint, (2) shrinkage of the AC due to temperature or hardening of the asphalt, or (3) a reflective crack beneath the surface course, including cracks in the PCC slabs (but not the PCC slab joint)

Transverse cracks extend across the pavement at approximately a 90 degree angle to the pavement's centerline.

May be caused by (2) or (3). These cracks are not usually load associated.

How to Measure:

Linear quantity (Ft)

Longitudinal/ Transverse Cracking

Severity:

LOW
- nonfilled crack width is less than 3⁄8”, or
- filled crack of any width (filler in satisfactory condition)

MEDIUM
- nonfilled crack width is greater than or equal to 3⁄8” and less than 3”

HIGH
- nonfilled crack greater than 3”
- crack of any width where approx. 4” of pavement around the crack is severely broken.

Patching/ Utility Cut Patching

Description:

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).

How to Measure:

Square Area (Ft^2)

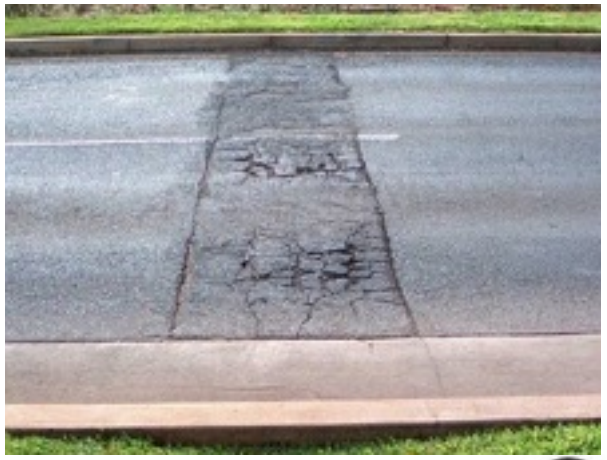
Patching/ Utility Cut Patching

Severity:

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

MEDIUM – Patch is moderately deteriorated, or ride quality is rated as medium severity, or both

HIGH - Patch is badly deteriorated, or ride quality is rated as high severity, or both; needs replacement soon



Rutting

Description:

- 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.

How to Measure:

Square Area (Ft^2)

Rutting

Severity:

LOW – Average rut depth is ¼” to ½”

MEDIUM – Average rut depth is >½” to 1”

HIGH - Average rut depth is > 1”

RAVELING

Description:

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

How to Measure:

Square Area (Ft^2)

RAVELING

Severity:

MEDIUM – Considerable loss of coarse aggregate, greater than 20 per square yard (square meter), or clusters of missing coarse aggregate are present (or both)

HIGH– Surface is very rough and pitted, may be completely removed in places

WEATHERING (SURFACE WEAR)

Description:

The wearing away of the asphalt binder and fine aggregate matrix.

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.

How to Measure:

Square Area (Ft^2)

WEATHERING (SURFACE WEAR)

Severity:

LOW – 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 1 mm

MEDIUM – Loss of fine aggregate matrix is noticeable & edges of coarse aggregate have been exposed up to ¼ width (of the longest side) of the coarse aggregate

HIGH - Edges of coarse aggregate have been exposed greater than ¼ width (of the longest side) of the coarse aggregate. There is considerable loss of fine aggregate matrix

Field Distress Manuals

ASPHALT SURFACED ROADS & PARKING LOTS

PAVER™ DISTRESS IDENTIFICATION MANUAL

DEVELOPED BY:

US ARMY CORPS OF ENGINEERS
ERDC-CERL

SPONSORED BY:

NAVFAC

CONCRETE SURFACED ROADS & PARKING LOTS

PAVER™ DISTRESS IDENTIF MANUAL

DEVELOPED BY:

US ARMY CO OF ENGINEE
ERDC-CERL

SPONSORED BY:

BLOCK CRACKING (3)

Description

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 m) to 10 by 10 feet (3 by 3 m). Block cracking is caused mainly 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 that the asphalt has hardened significantly. 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, alligator cracks are caused by repeated traffic loadings, and are therefore found only in traffic areas (i.e., wheel paths).

Severity Levels

L — Blocks are defined by low severity* cracks.

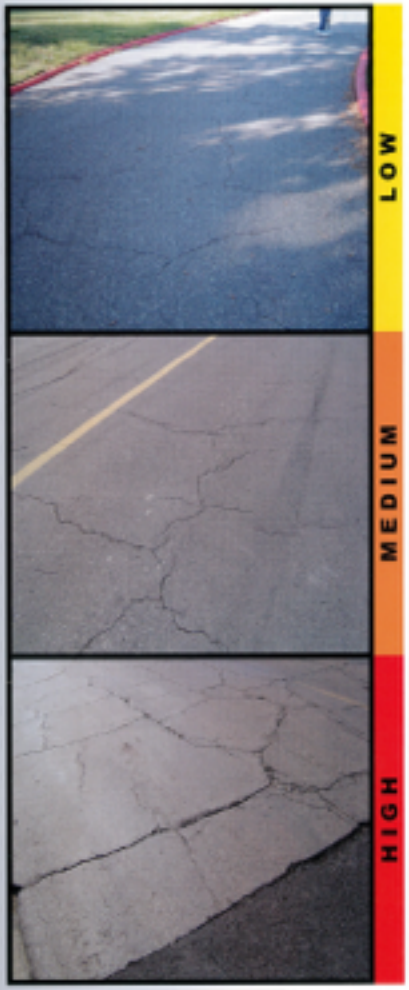
M — Blocks are defined by medium severity* cracks.

H — Blocks are defined by high severity* cracks.

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.

* See definitions of longitudinal transverse cracking



6 DEPRESSION
7 EDGE CRACK.
3 BLOCK CRACK.
4 BUMPS & SAGS
5 CORRUGATION

PAVER - Pavement Inventory Basics

1. **Network**
2. **Branch**
3. **Section**

PAVER - Pavement Inventory Basics

1. Network

A logical grouping of pavements that will usually be managed together.

<u>Examples:</u>

City, County, Political District, or Maintenance District

PAVER - Pavement Inventory Basics

2. **Branch**

A readily identifiable part of the pavement network that has a distinct use.

<u>Examples:</u>

Street or Parking Lo

Branch = Main Street

PAVER - Pavement Inventory Basics

3. Section

The smallest management unit when considering the application of Major M&R.

Section = Main Street: From 1st Ave to 2nd Ave

Examples:

Traffic, Construction History, Rank, Uniformity of Condition, or Section

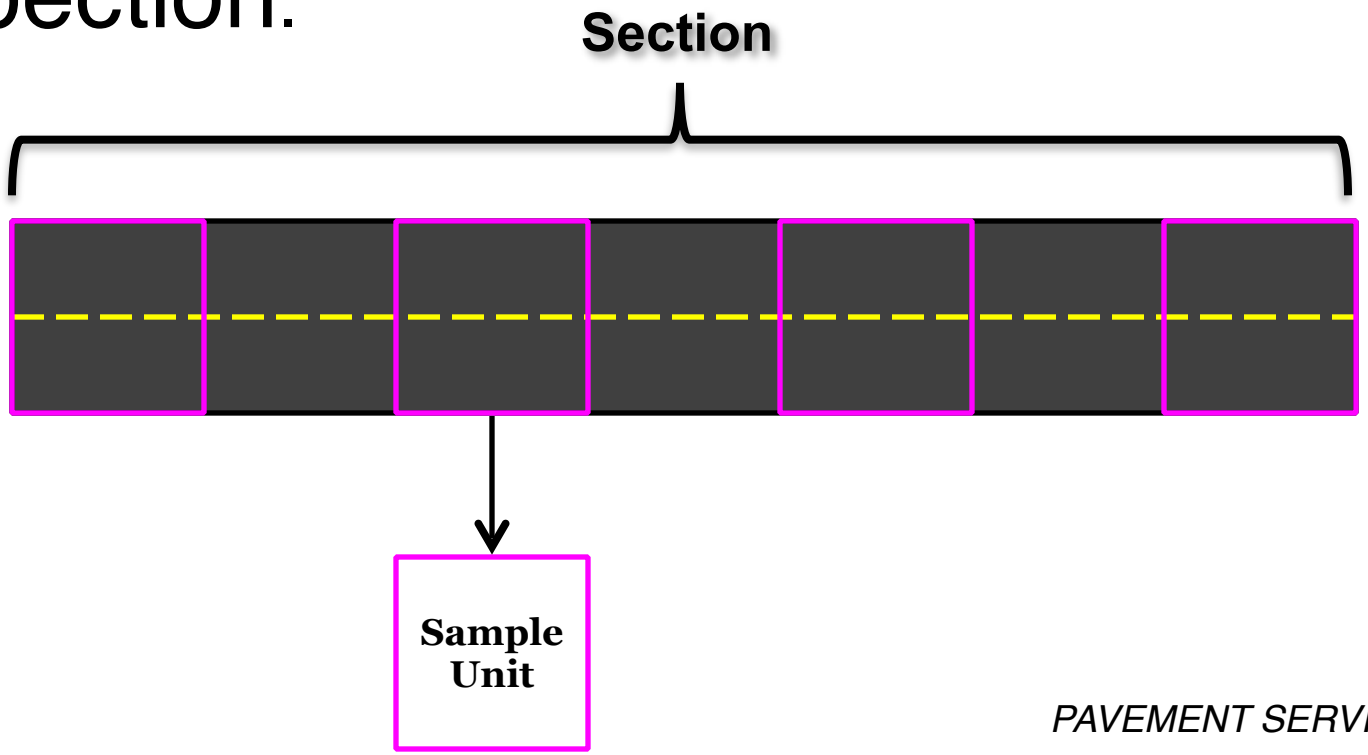
PCI Inspection

HOW DO WE CONDUCT A PCI SURVEY??

Sample Unit Method

Sample Unit Definition

In PAVER, Sample Units are portions of the pavement section, designated only for the purpose of a pavement inspection.



Sample Unit Definition

Sample Unit Sizes

- Asphalt Pavements
  - **2,500 SF** ± 1,000 Square Feet (1,500 – 3,500 SF)
- Concrete Pavements
  - **20 Slabs** ± 8 Slabs (12 – 28 Slabs)
    - Slab size less than or equal to 25 x 25 Ft

Number of Sample Units to Survey

- *Network* Level Inspection:
  - Used for budget planning
  - Limit number of sample units surveyed per section to minimize needed resources.

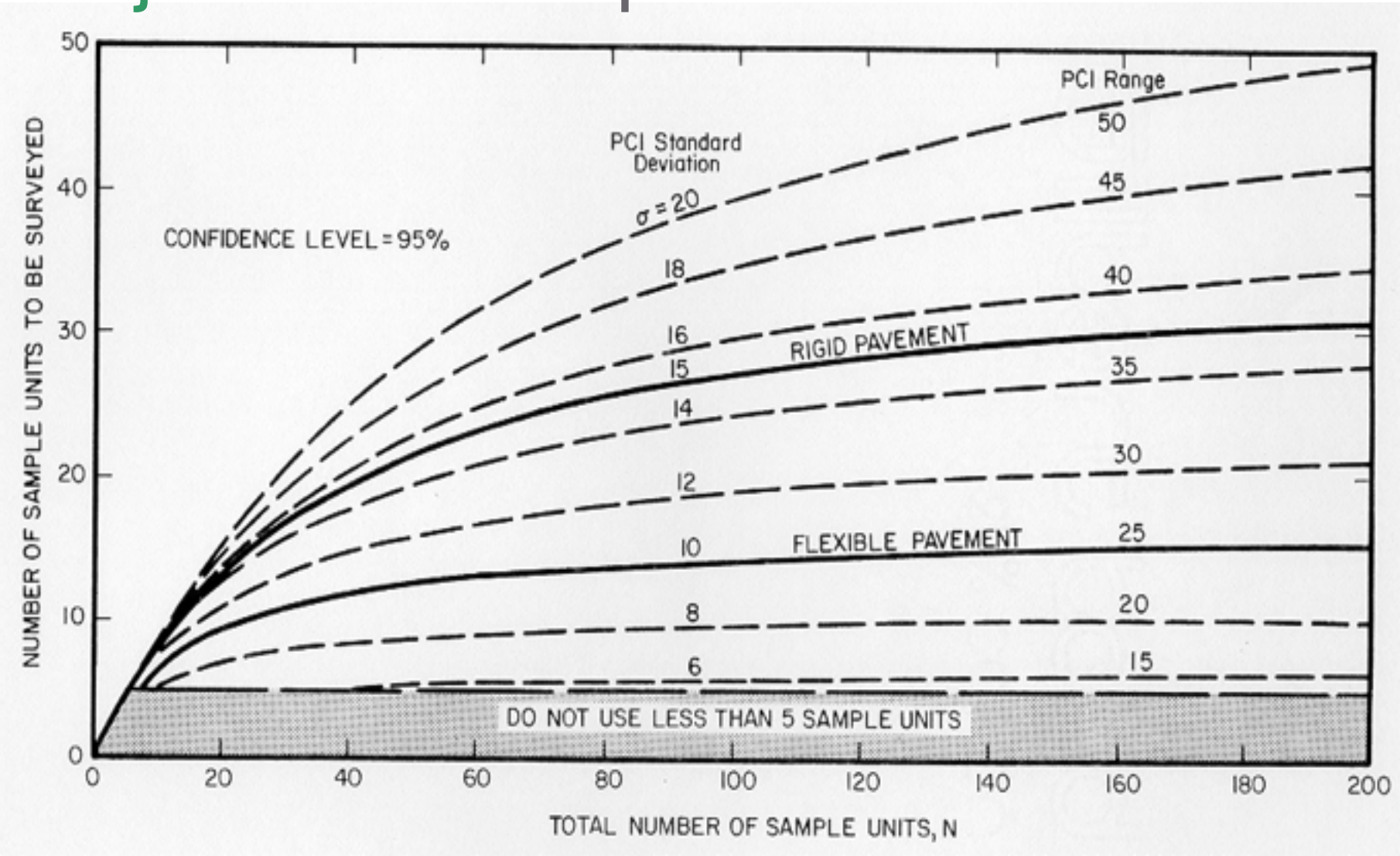
- *Project* Level Inspection
  - Used to estimate work for plans and contracts
  - Higher number of sample units surveyed per section to achieve higher PCI and distress quantity accuracy.

Network Level Inspection

No. of Sample Units in Section (N)	No. of Units to be Inspected (n)
1 to 5	1
6 to 10	2
11 to 15	3
16 to 40	4
over 40	10% (round up to next whole sample unit)

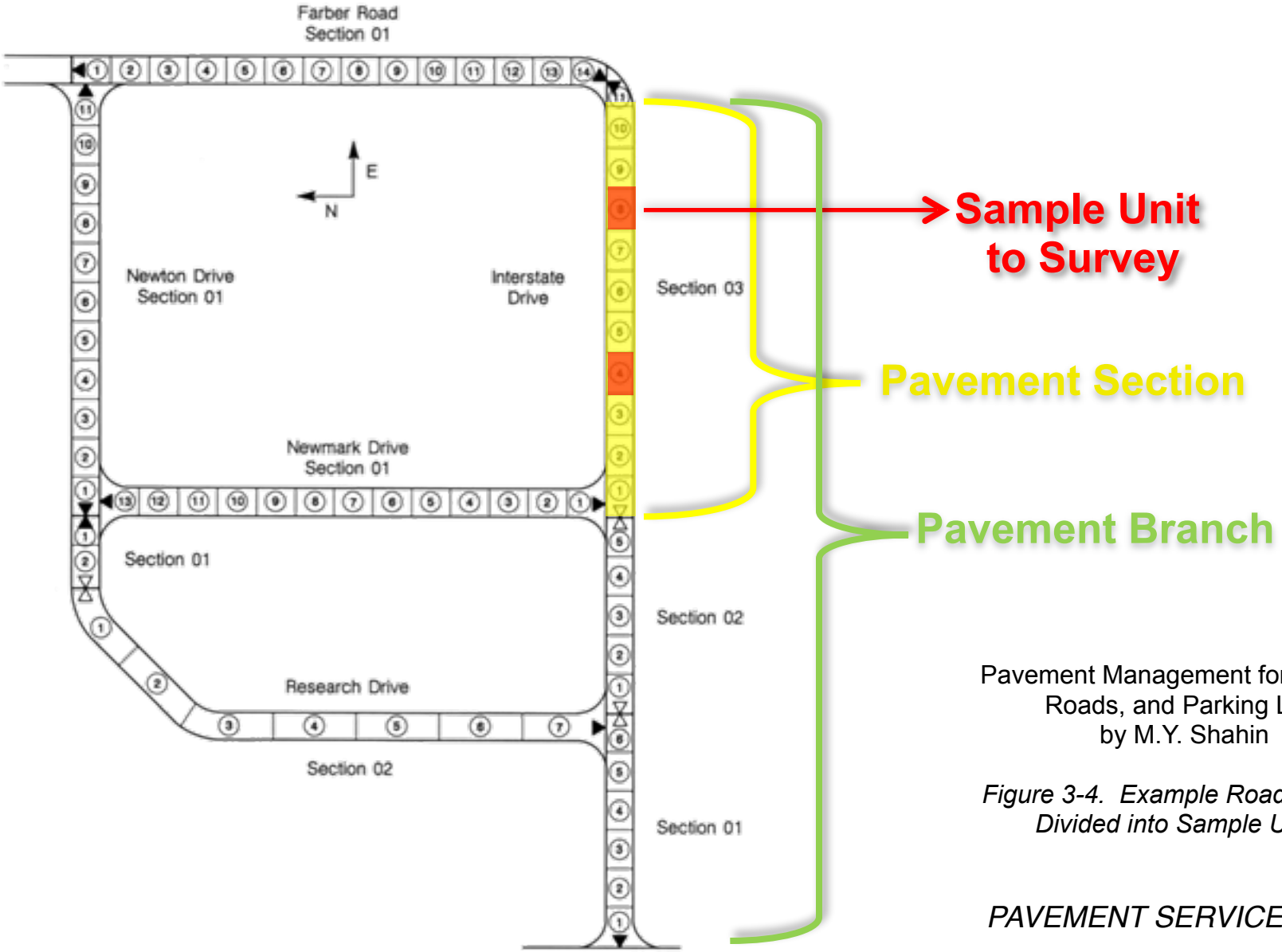
Figure 3-10. Example of Network Level Sampling Criteria Used by Some Agencies.

Project Level Inspection



Can also be used for Network Level Survey

Roadway Divided Into Sample Units



Pavement Management for Airports, Roads, and Parking Lots
by M.Y. Shahin

Figure 3-4. Example Road Network Divided into Sample Units.

Tools to Conduct a PCI Survey

Asphalt Inspection Forms

ASPHALT PAVEMENT CONDITION SURVEY DATA SHEET

PID	Delta_R1230_B01	INSPECTOR NAME	G. Gadget
FROM	1 + 50	BRANCH USE	Runway
TO	2 + 50	SECTION WIDTH	100 FT
DATE INSPECTED	09/01/2008	SECTION LENGTH	4000 FT

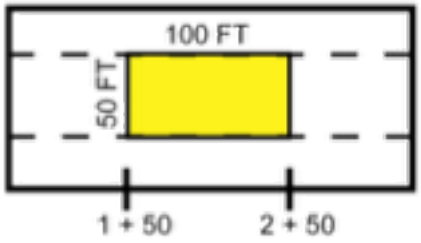
AC Surfaced Distress Codes

41. Alligator Cracking Sq Ft	46. Jet Blast Sq Ft	51. Polished Aggregate Sq Ft	56. Swell Sq Ft
42. Bleeding Sq Ft	47. Jt. Reflection (PCC) Ft	52. Raveling Sq Ft	57. Weathering Sq Ft
43. Block Cracking Sq Ft	48. Long. & Trans. Cracking Ft	53. Rutting Sq Ft	
44. Corrugation Sq Ft	49. Oil Spillage Sq Ft	54. Shoving From PCC Sq Ft	
45. Depression Sq Ft	50. Patching Sq Ft	55. Slippage Cracking Sq Ft	

SAMPLE NUMBER 008 — SAMPLE AREA 5000 SF

DISTRESS CODE	L	M	H
48	47 FT	16 FT	
41	53 SF		
45	75 SF		
53		25 SF	

Sketch / Comments



SAMPLE NUMBER		SAMPLE AREA	
DISTRESS CODE	L	M	H

SAMPLE NUMBER		SAMPLE AREA	
DISTRESS CODE	L	M	H

PAVEMENT SERVICES, INC.

Concrete Inspection Form

CONCRETE PAVEMENT CONDITION SURVEY DATA SHEET

PID	Delta_R1230_B03	INSPECTOR NAME	S. Smith		
FROM	0 + 00	BRANCH USE	Runway	DATE INSPECTED	09/01/2008
TO	0 + 50	SECTION WIDTH	125 FT	SECTION LENGTH	120 FT
SLAB WIDTH	12.5 FT	SLAB LENGTH	15 FT	NUMBER OF SLABS	80

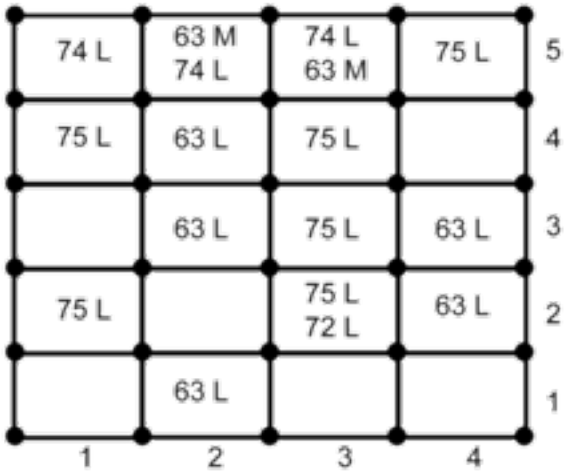
PCC Surfaced Distress Codes

61. Blow-Up	65. Joint Seal Damage	69. Pumping	73. Shrinkage Crack
62. Corner Break	66. Patching, ≤ 5 SF	70. Scaling	74. Spalling - Joints
63. Long./ Trans./ Diagonal Crack	67. Patching/ Utility Cut	71. Settlement/ Fault	75. Spalling - Corner
64. Durability Crack	68. Popouts	72. Shattered Slab	76. ASR

SAMPLE NUMBER	005	SLABS IN SAMPLE	20

DISTRESS CODE	L	M	H
63	5	2	
74	3		
72	1		
75	6		

Sketch / Comments



SAMPLE NUMBER		SLABS IN SAMPLE	

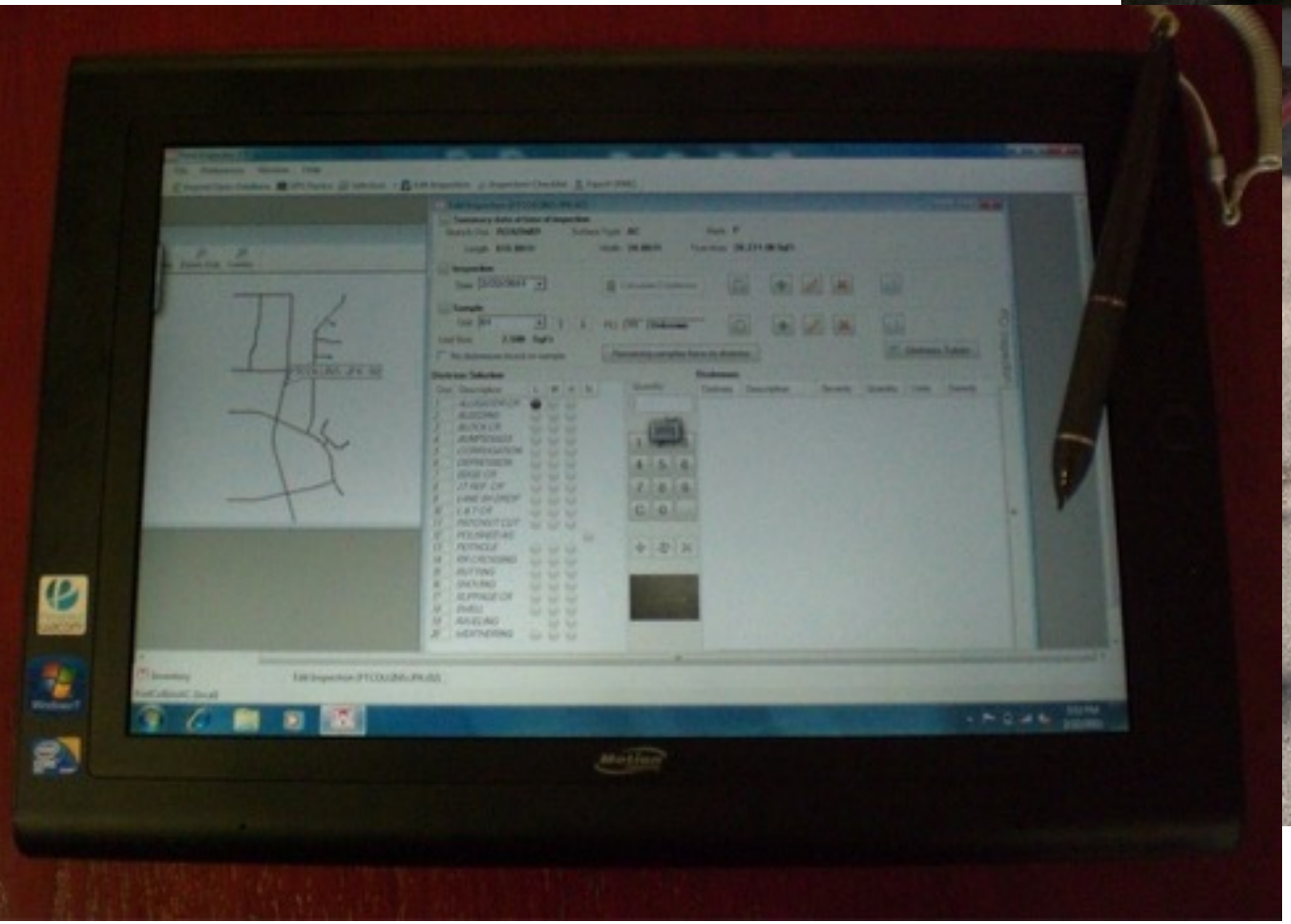
DISTRESS CODE	L	M	H

Sketch / Comments

PAVEMENT SERVICES, INC.

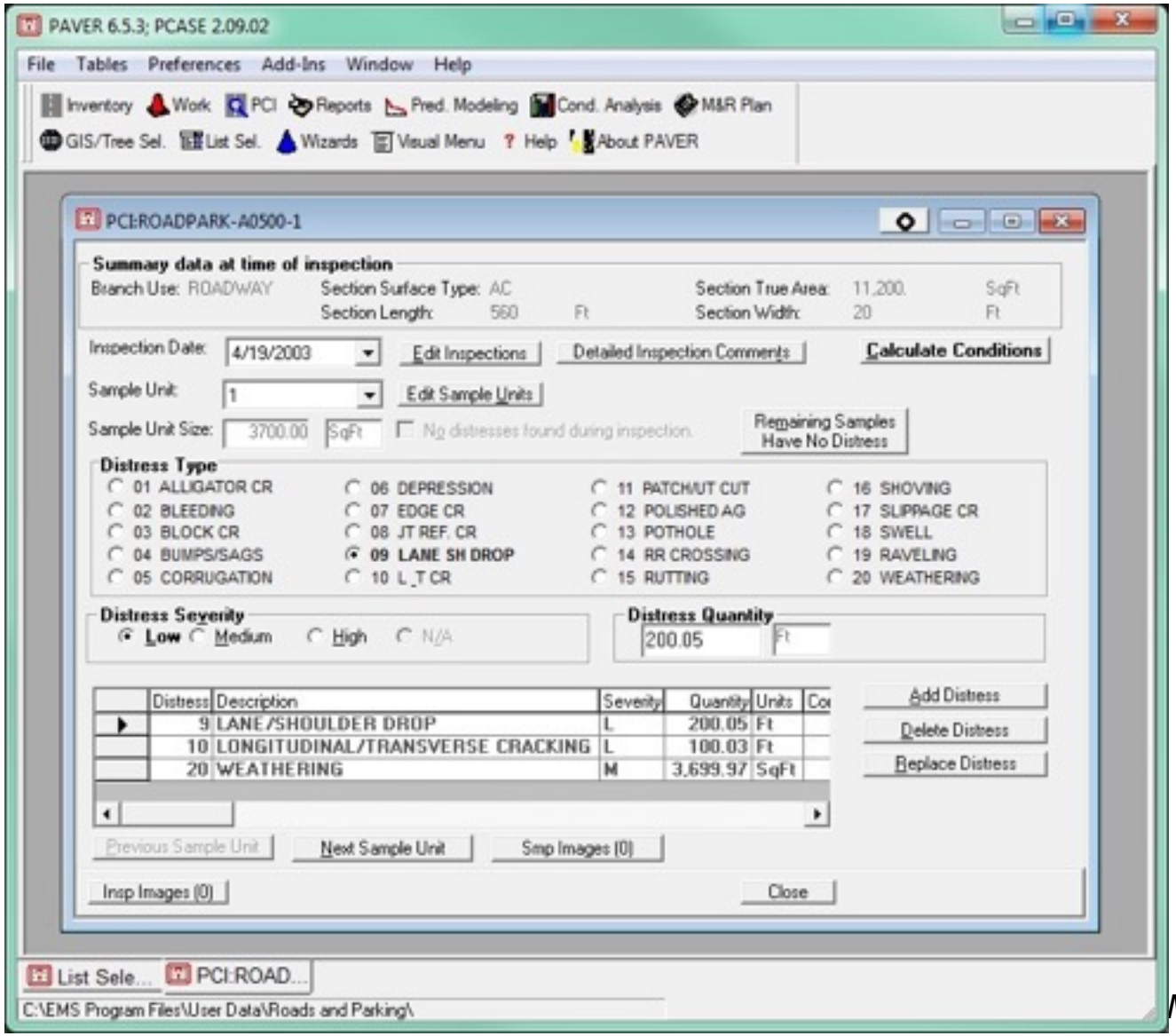
PAVER FieldInspector™

Tablet Based Data Entry

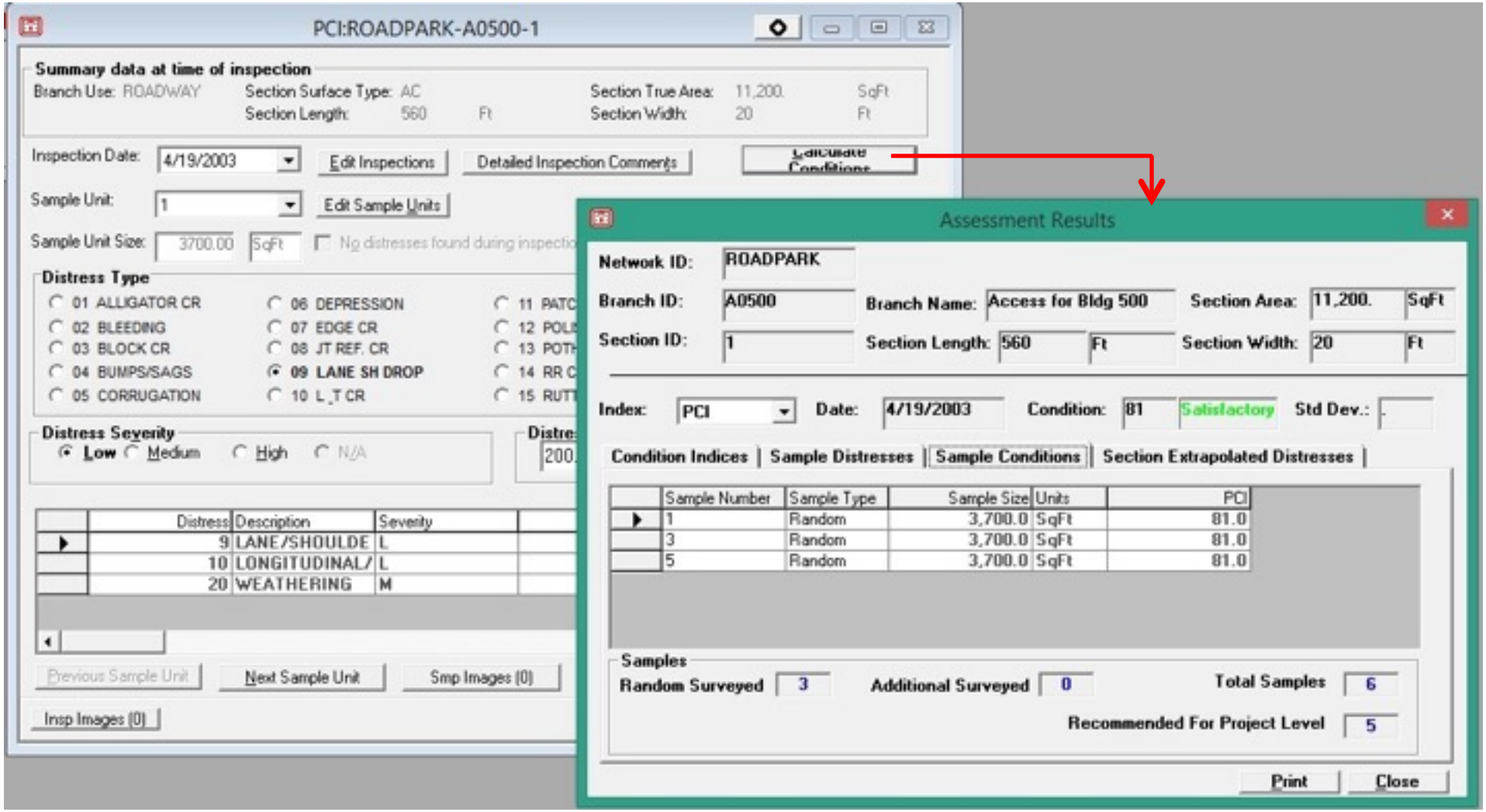


PAVEMENT SERVICES, INC.

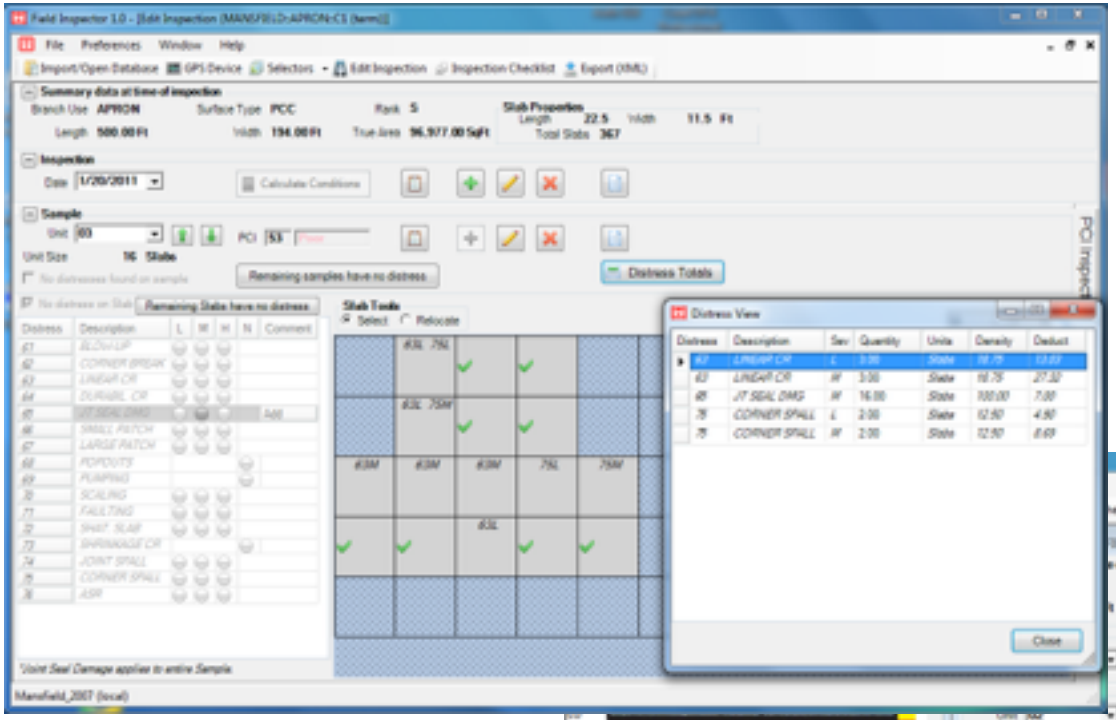
PAVER v6.5 Inspection Data Entry Form



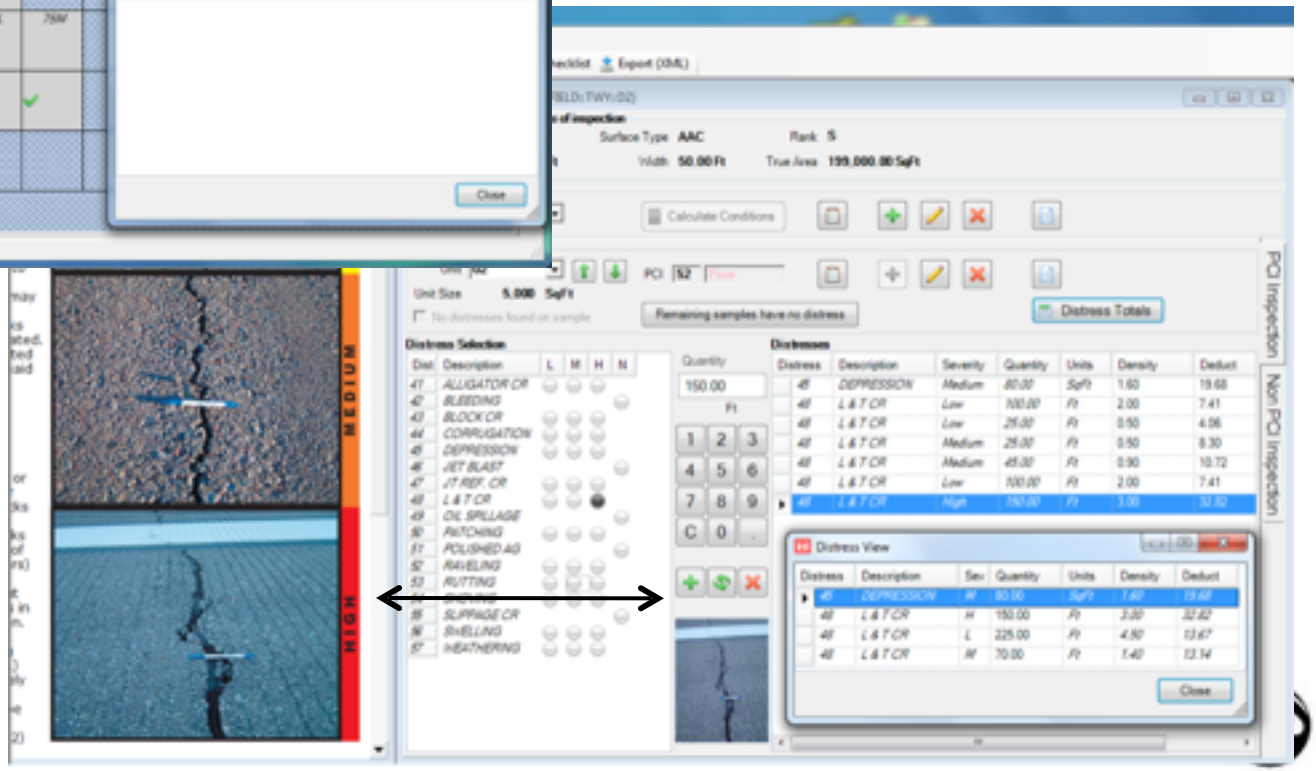
PAVER v6.5 Inspection Data Entry Form



PAVER v7 Inspection Form

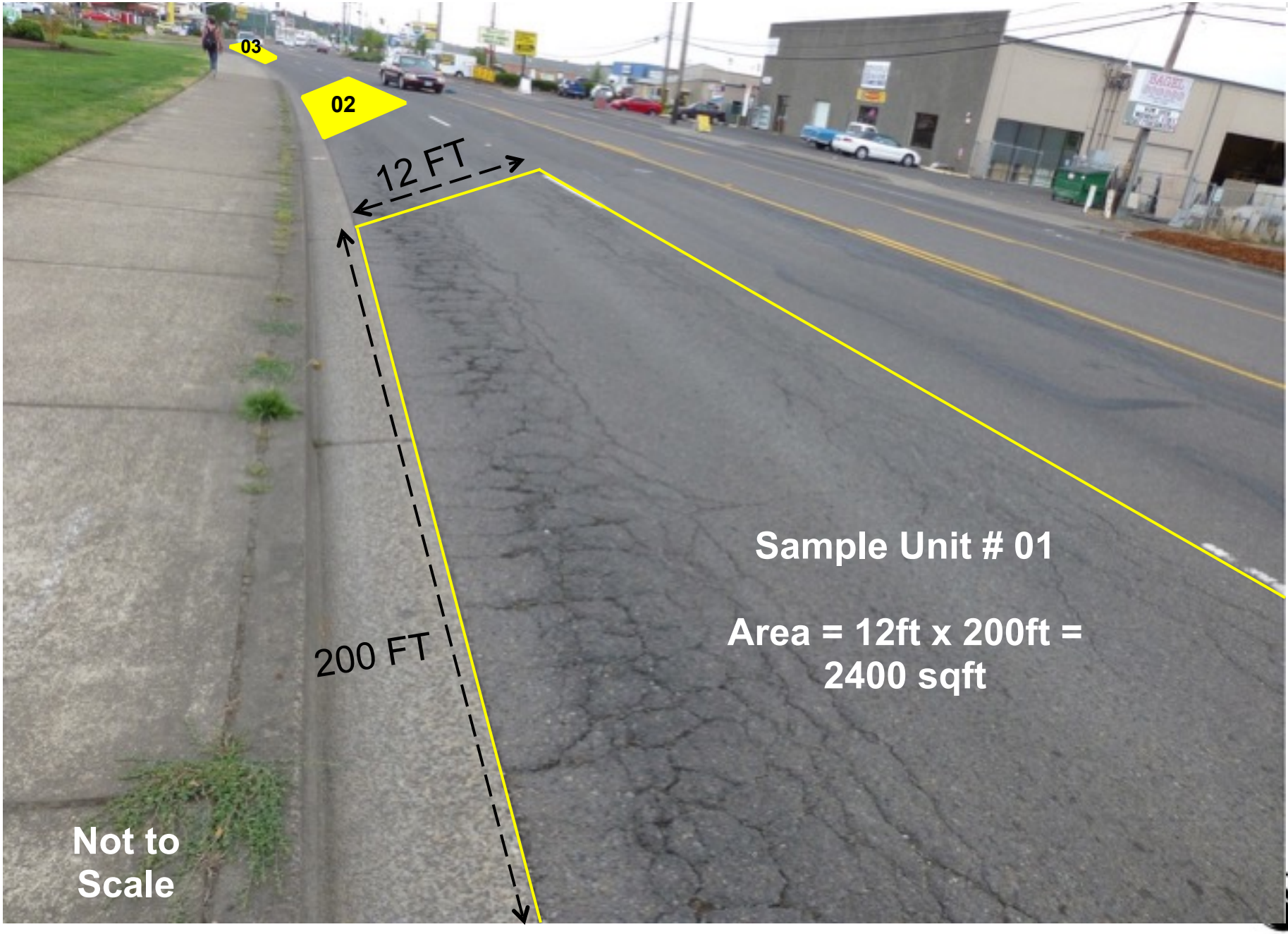


Concrete Sample Grid Distress Entry Form



Asphalt Distress Entry Form w/ Distress Manual View

Rate That Pavement



PCI Procedure Review

- PAVER uses the ASTM D6433 PCI Method for Pavement Rating
- Distress Identification (distress type, distress severity, & distress quantity)
- Define Sample Units (inspection units)
- Survey Tools
  - Paper Forms
  - PAVER FieldInspector

Questions?

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