Pavement Rating 101 for

Local Agencies Using

MTC StreetSaver® PMP

Roger E. Smith, P.E., Ph.D.
Retired

StreetSaver®
Keeping good roads good!

Outline

- Introduction to PCI
- Importance of PCI
- Distress ID
- Methods of Collection
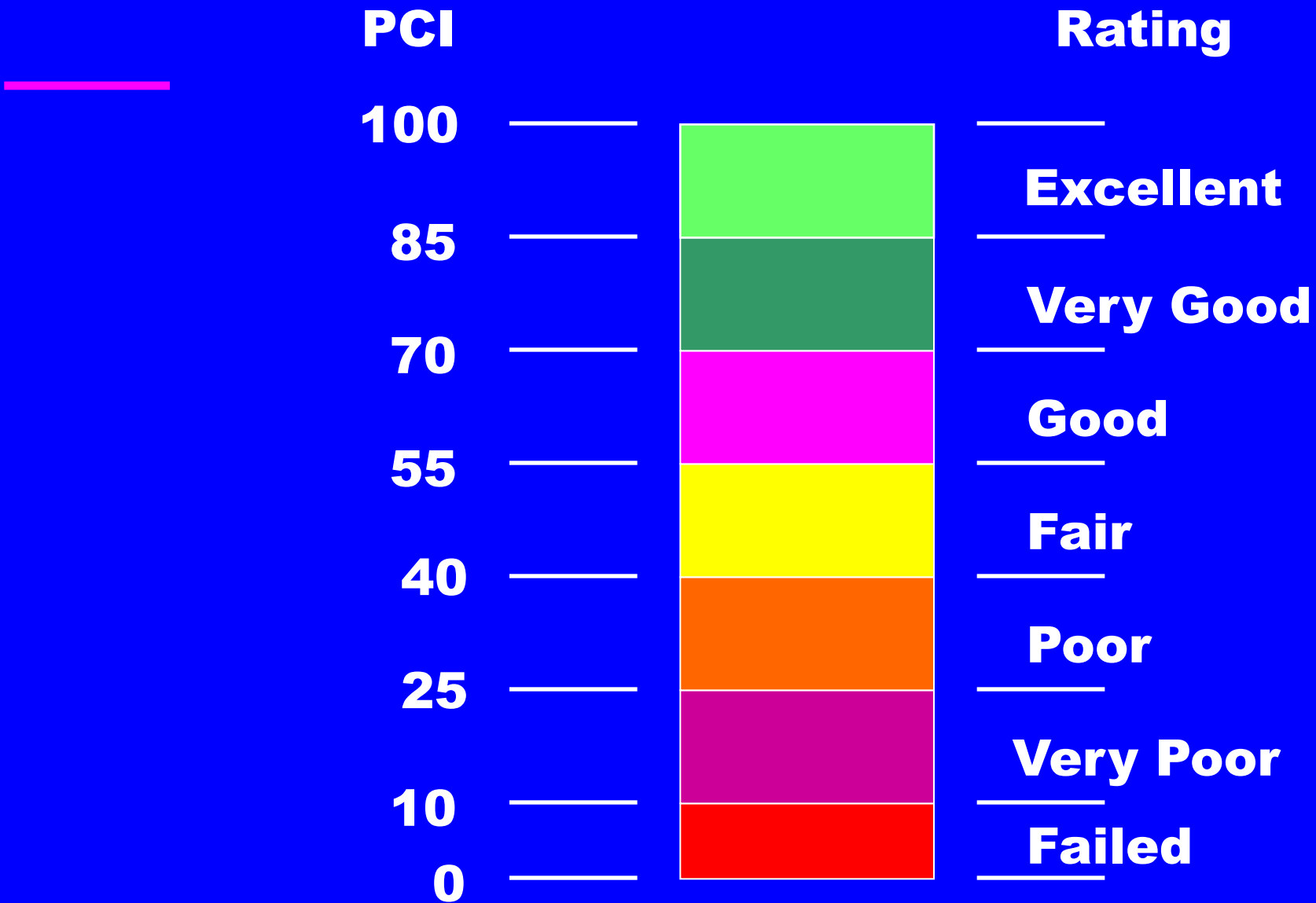- Quality Data
- Questions

StreetSaver® Pavement Management Program (PMP)

- PCI is basic measure of condition

- Method to uniformly characterize condition of paved surface
  - Along road/street
  - Over time

PCI Scale

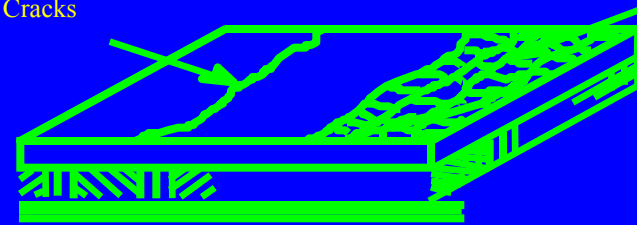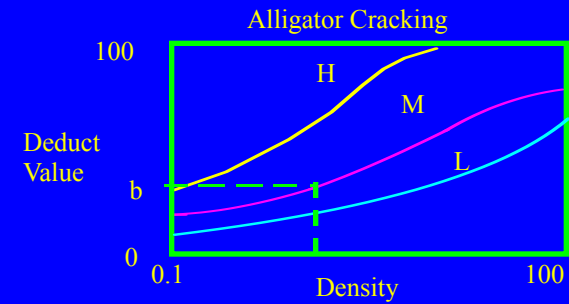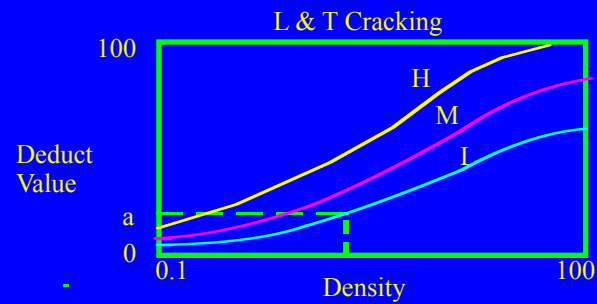| PCI		Rating
100		
		Excellent
85		
		Very Good
70		
		Good
55		
		Fair
40		
		Poor
25		
		Very Poor
10		
0		Failed

PCI Process

Step 1. Inspect sample units to determine type, quantity and severity level of pavement distresses

Low Severity Longitudinal Cracks
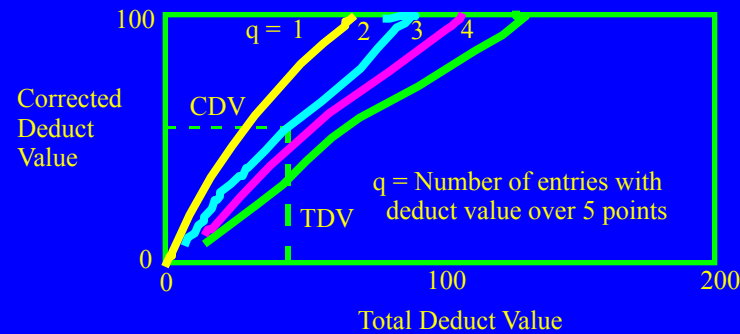
Medium Severity Alligator Cracks

Step 2. Determine Deduct Values.

L & T Cracking

Deduct Value

100

a

0

0.1   Density   100

H
M
I

Alligator Cracking

Deduct Value

100

b

0

0.1   Density   100

H
M
L

Step 3. Compute Total Deduct Value, TDV = a + b.
Step 4. Adjust Total Deduct Value.

Corrected Deduct Value

100

CDV

0

0   100   200

q = 1   2   3   4

TDV

q = Number of entries with deduct value over 5 points

Total Deduct Value

Step 5. Compute Pavement Condition Index,
PCI=100-CDV, for each sample unit inspected.
Step 6. Determine Pavement Condition Rating.

Pavement Management is a Decision Making Process

- To find cost-effective treatments

- At designated times

- To provide a desired level of service

StreetSaver® Pavement Management Program or Software

- Decision support tool

- Stores data and provides information

- To support in making cost-effective decisions

PCI Values Used

- To identify level of work needed

- Amount of funding needed

- Project future condition

Importance of PCI to StreetSaver®

- PCI values are:
  - Basis of most management recommendations

- Incorrect PCI values will cause the PMP to
 - Give incorrect recommendations

PCI Values

☒ Based on distress surveys

☒ To determine damage from distress, we must determine distress:
- Type - What is wrong?
- Severity - How bad is it?
- Density - How much is present?

Step 1. Inspect sample units to determine type, quantity and severity level of pavement distresses
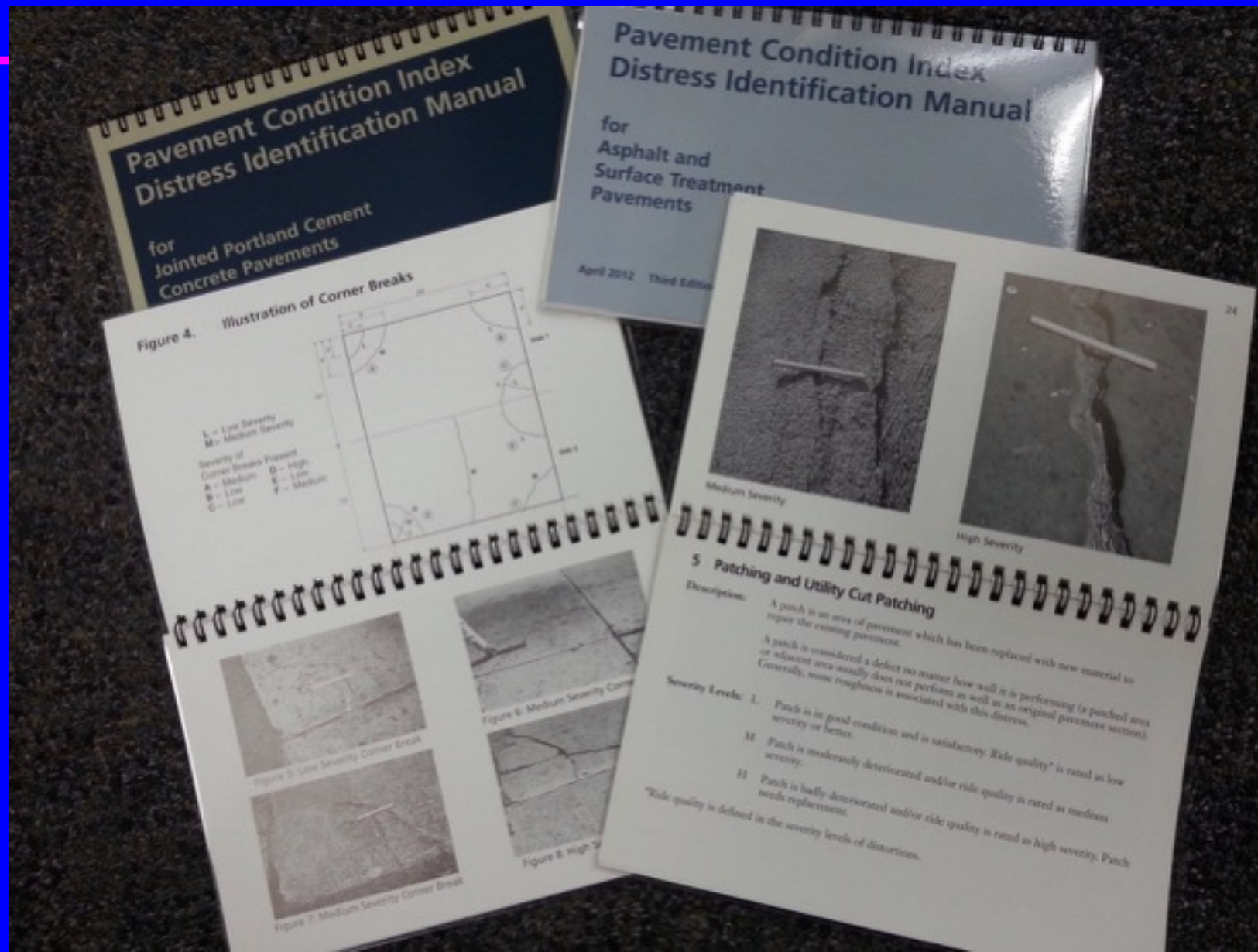

Medium Severity
Alligator Cracks

Low Severity
Longitudinal Cracks
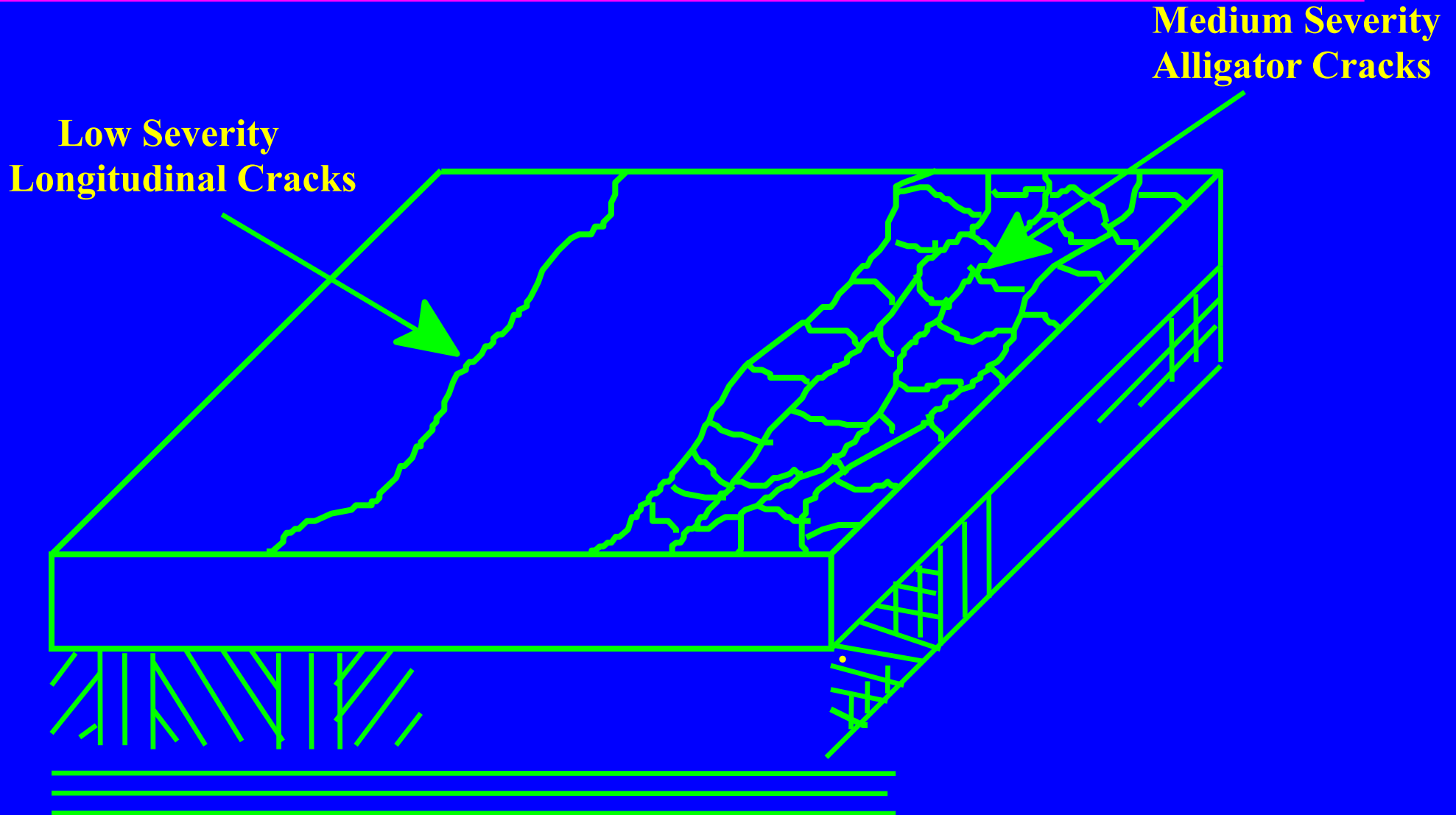
Distress ID Systems in StreetSaver®

- MTC StreetSaver® Distress ID

- PAVER/ASTM Distress ID

- CRAB recording method

MTC Distress ID Manuals

MTC Pavement Condition Index - PCI

- PCI Calculated automatically in StreetSaver® and used in the program based on:
  - MTC 7 AC and 7 PCC Distress Types
    - » (Soon to be 8 AC & 7 PCC)

MTC Distress Data Entry Screen
Can be Entered by Batch

PAVER Distress ID Manuals

PAVER (ASTM 6433)- PCI

PAVER - PCI Calculated automatically in StreetSaver® and used in the program based on:

- 20 AC and 19 PCC Distress Types

PAVER Distress Entry Screen
Can be Entered by Batch

CRAB Distress Data Recording

- 1/10th mile inspections

- Lane location

- Lane direction

CRAB Distress Entry Screen
Can be Entered by Batch

CRAB Distress Entry Screen

Methods of Distress Collection

- Manual
  - Walking
  - Windshield
- Automated
- Semi-automated
- Hybrid
  - Combinations of the above

Manual Distress Data Collection Method

- Walking distress survey for calculating PCI

- Distress definition/description per:
  - MTC Pavement Condition Index Distress Identification Manuals (AC & PCC)

    - or

  - PAVER Pavement Condition Index Distress Identification Manuals (AC & PCC)

Field Procedure

- Inspect each inspection unit
- Determine:
  - Severity
  - Quantity
- Of each distress type present in inspection unit
- Record this information

Inspection Procedures

- Inspection Team
  - Generally two persons
    - » One identifies distress types, severities, & quantities
    - » One records and watches for traffic
  - More needed for high volume due to safety
  - One person can do it on low volume
    - » Need three hands
- Safety is an issue

Recommended Approach for Network-Level

- MTC recommends 10% of inspection units in each section be inspected for network-level inspections
- Systematic random sampling

Windshield Survey

- Inspector sets in vehicle – conducts survey from vehicle as it travels along street
  - Generally takes less time & effort than walking survey
  - Covers entire street length visible to inspector
- Low severities of most distress types often not visible from a vehicle
- Direction of sun in relation to direction observer views pavement surface has dramatic affect on accurately identifying distress types, severities, and quantities

- Difficult to keep track of all distress type-severity combinations and quantities of each when multiple distress types and severities present
- Tend to pick only most obvious distress type-severity combinations
- Some windshield survey inspectors only use distress quantity categories (less than 5%, 5 to 10%, etc.)

☒Will result in greater error in distress data and PCI values

Management for Supervisors

- Plan work to minimize time lost to travel
- Lay out sections and inspection units
  – Allow changes in field
- Have inspectors mark inspection units
- Mix office/other field work with inspections
- Plan for periodic retraining

Quality Control for Supervisors

- Check data coming in daily - look for problems
  - 1 sq ft block cracking
  - Only medium severity L&T, Alligator, & Patching
- Have teams mark inspection units
  - Reinspect same inspection units
- Supervisor reinspect small percent (2-5%)

Quality Control for Supervisors

- With more than one team
  - Change inspection team members regularly
    - » Don't let divergence develop
  - Have teams reinspect sections inspected by other teams (5%)

Automated

- Machine produces sensors readings
- Readings interpreted by software to give distress types, severities, & quantities
- Few (if any) of current systems fully automated
- Some systems have relatively fully automated components:
  - Rut measurements of length and depth of rutting
  - Crack detection systems to determine length, width, location, and direction of cracks
  - Surface macro-texture

Semi-Automated

- Machine takes sensor readings
- Some readings may be machine interpreted
- Some readings may be partially interpreted by machines and verified manually
- Some readings may require manual interpretation - trained observers view images on computer screens & identify type, severity, and quantity of distress present

Hybrid Systems

- Use automated/semi-automated systems to collect some distress types
  - Cracking
  - Rutting
- Use other approach (typically windshield survey) to collect other distress types
  - Distortions
  - Patching
  - Weathering

The Big Questions

- Does distress data from semi-automated data collection methods match distress data from manual surveys?
  - Generally - No

Comparison of Automated Width vs Normal Manual Width

- Normal manual method
  - Full width by 100'
    - » Or
  - Half width by 100'
  - Typically includes parking area
- Automated method
  - 12' by multiples of ~200' (Driving lane)

Automated
~ 12'
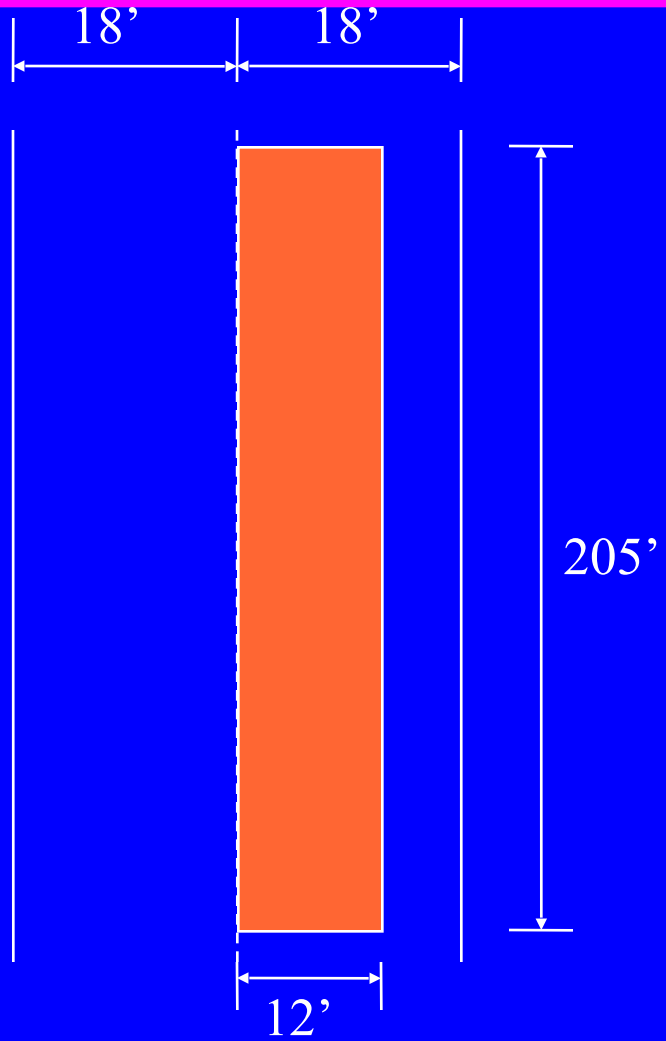
Walking
Full Width

18' 18'

18' 18'

205'

100'

12'

36'
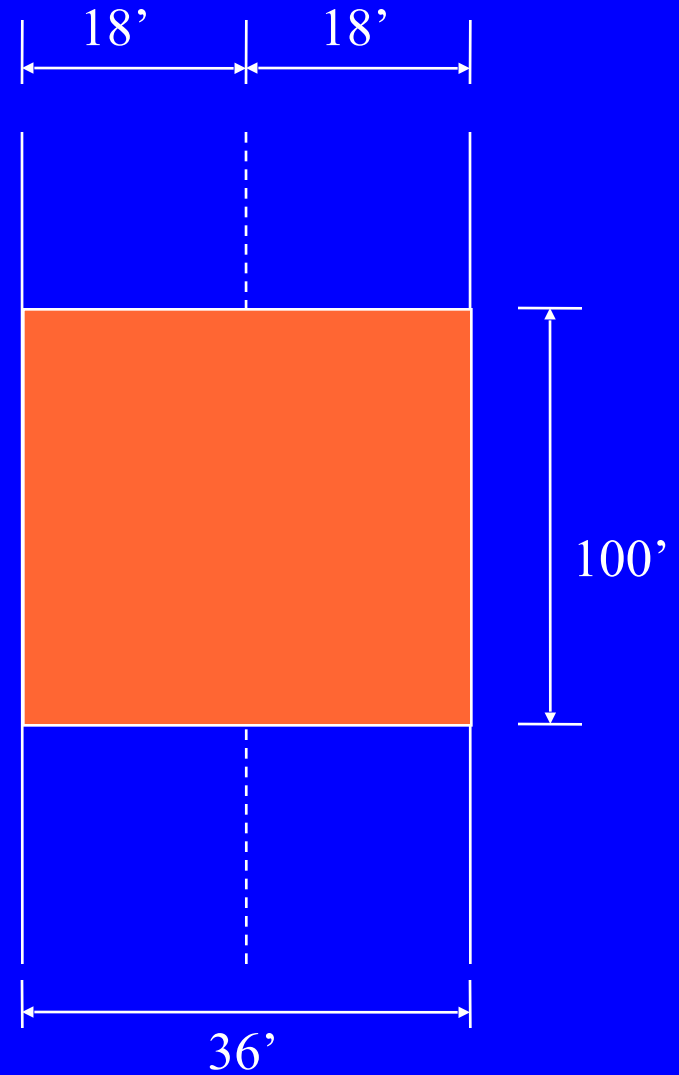
Common Semi-Automated Issues

- Weathering & patching difficult to determine manually – even with windshield or semi-automated
- Distortions (especially those along edge) may be missed

The Big Questions

- Is there an adjustment factor that can be applied?
  - Generally - No

- The distress differences (and PCI values) caused by location depend on the differences in the distress types, severities, and densities between the driving lanes and parking lanes/shoulders

The Big Questions

- Can distress data and PCI values calculated from semi-automated distress surveys be used effectively in StreetSaver® and other PMP's

- Yes, but some adjustments may be needed

Semi-Automated Collection of Distress Data

- ☑ Decreases safety issues

- ☑ Decreases traffic interruptions

- ☑ Uses contract funds instead of staff resources

- ☑ Will be somewhat different than manual data

Contracting for Distress Data Collection

- Define distress ID methodology to be used and precision and accuracy needed
- Require Data Quality Control Plan
- Establish Data Quality Assurance Plan

- MTC has plans that agencies can end can use in developing their contract plans at: http:// www.mtcpms.org/support/consultants.html

MTC Data Quality Management Plan

- Includes Pre-qualification & Rater Certification for distress identification using the MTC distress definitions

- **Pre-qualification - **Ensures that contracting agencies are capable of collecting distress data that is reasonably close to what would be collected by an "expert" rater

- **Rater Certification Program - **Under the P-TAP, even if a firm has pre-qualified, all of the firm's raters must The exam is scheduled on **November 19 & 20, 2014**

Data Quality Control Plan

- Each firm required to provide Quality Control Plan that includes
  - Qualifications of each rater
  - Description of their data verification processes including what checks will be made and actions to be taken when issues arise

MTC Data Quality Acceptance Plan

- ☒ **1) Administer Rater Certification Program**
  Pre-qualification of the contractor does not ensure that all raters are capable of rating with the desired level of accuracy.
- ☒ **2) Conduct Audits of Contractors' Quality Control Plans**
  - MTC reviews quality control plans and approves prior to commencement of work
  - CSUC conducts audits of the QCP results to ensure that the data collection contractors are meeting the requirements established in their plans.
- ☒ **3) Verify Data Collected by Contractors**
  - CSUC conducts full audits of the data collected from selected projects when issues are encountered
  - CSUC spot checks data collected by contractors from selected projects

MTC Maintains List of Consultants that have experience with StreetSaver®

AMS Consulting LLC*
5627 Stoneridge Dr, Suite 320
Pleasanton, CA 94588
925.225.9922

ASCG Inc.
6501 Americas Parkway, Suite 400
Albuquerque, NM 87110
505.247.0294

Adhara Systems*
1735 N. First St. Suite 200
San Jose, CA 95112
408.441.0340

Aslab Pty Ltd
P.O. Box 1061
Bibra Lake DC,
Western Australia 6965
+61-08-9434-2540

Bureau Veritas
6150 Stoneridge Mall Road, Suite 370
Pleasanton, CA 94588
925.468.7413

CSG Consultants, Inc.
1660 South Amphlett Blvd., Suite 330
San Mateo, CA 94402
650.522.2525

California Engineering Company, Inc
1110 Civic Center Blvd, Ste 404
Yuba City, CA 95993
530-751-0452 x111

Coastland Civil Engineering, Inc.
1400 Neotomas Avenue
Santa Rosa, CA 95405
707.571.8005

Capitol Asset & Pavement Services*
P.O.Box 7840
Salem, OR 97303
503.689.1330

Farallon Geographics Inc.
609 Mission St, 2nd Floor
San Francisco, CA 94105
415.227.1140

Freiburger Engineering
P.O. Box O
Twin Falls, ID 83303
208.732.5972

Fugro Consultants
8613 Cross Park Drive
Austin, TX 78754
512-977-1800

GeoData Analytics, LLC
2510 Tassajara Avenue
El Cerrito, CA 94530
510.234.9485

Harris & Associates*
120 Mason Circle
Concord, CA 94520-1272
925.827.4900

IMS
116 N. Roosevelt, Suite 131
Chandler, AZ 85226
480.839.4347

Kleinfelder Inc.
8 Pasteur, Suite 190
Irvine, CA 92618
949.727.4466

MACTEC Engr. and Consultants, Inc.
961 Matley Lane, Suite 110
Reno, NV 89502
775.329.6123

Nichols Consulting Engineers*
501 Canal Blvd, Suite I
Point Richmond, CA 94804
510.215.3620

Northwest Management System
3302 N. 7th Street
Tacoma, WA 98406
253.219.8904

Norris Repke Inc
400 N. Tustin Ave., Suite 230
Santa Ana, CA 92705
714.973.2263

Pavement Engineering Inc. *
3820 Cypress Drive, Suite 3
Petaluma, CA 94954
707.769.5330

PENCO Engineering
One Technology Park, Bldg J-725
Irvine, CA 92618
949.753.8111

RKA Civil Engineers Inc.
398 S. Lemon Creek Dr, Suite E
Walnut, CA 91789-2649
909.594.9702

Fugro-Roadware Group Inc
147 E. River Road
Paris, Ontario N3L 3T6
Canada
+1 519 442 2264

STANTEC Consulting Engineers
8211 S 48th Street
Phoenix, AZ 85041
602.438.2200

i-TEN Associates, Inc.
5 Eton Court
Berkeley, CA 94705
510.654.3263

Applied Pavement Technology
115 W. Main St, Suite 400
Urbana, IL 61801
217.398.3977

Associated Engineering Consultants *
20179 Charlanned Drive
Redding, CA 96002
530.226.1616

AECOM
2101 Webster Street, Ste. 1900
Oakland, CA 94612
510.622.6627

BKF Engineers
1646 N. California Boulevard, Suite 400
Walnut Creek, CA 94596
925.940.2207

The Barnhardt Group, LLC
1001 Bayhill Drive, Suite 200
San Bruno, CA 94066
650.922.0469

DNMZ Consulting Engineers
P.O. Box 411818
Craighall, 2024
South Africa
+27-11-789-9512

Pavement Services, Inc
3835 NE Tillamook Street
Portland, OR 97086
503-235-0377

JG3 Consulting, LLC*
P. O. Box 2377
Heath, OH 43056
800-638-8040

Quality Engineering Solutions*
405 Water Street
Conneaut Lake, PA 16316
814-382-0373

Consultant List

- *http://www.mtcpms.org/support/consultants.html*
- These consultants are licensed to use StreetSaver®. Consultants with an * passed pre-qualification tests in 2012.
- Highlighted consultants are currently under contract with MTC as qualified PTAP consultants

QA/QC Is Worth the Effort

- You wouldn't let contractors construct pavements without conducting QA/QC

- You shouldn't purchase distress or other condition data without a QA/QC program

- Avoid "garbage in > garbage out"

Concluding Remarks

- Distress data from semi-Automated distress data collection will be somewhat different from that based on manual surveys
- However, PCI values from semi-automated pavement distress data can be used for network-level analysis when collected properly
- Adjustments in decision trees, etc. may be needed to use it effectively

Concluding Remarks

- Manual inspections are still more common than semi-automated

- Recommend not to switch back and forth between manual and semi-automated distress data collection

- Can use semi-automated distress data collection on high volume streets (Arterials?) but manual on others, etc. as long as consistent

On-line Distress Training

Self-Paced Online Courses:

- Pavement Condition Assessment:
    - MTC's 7- Distress protocol (will be modified)
    - ASTM D6433 (full Paver distresses)
- More info:

    www.mtcpms.org/products

Rater Certification Program
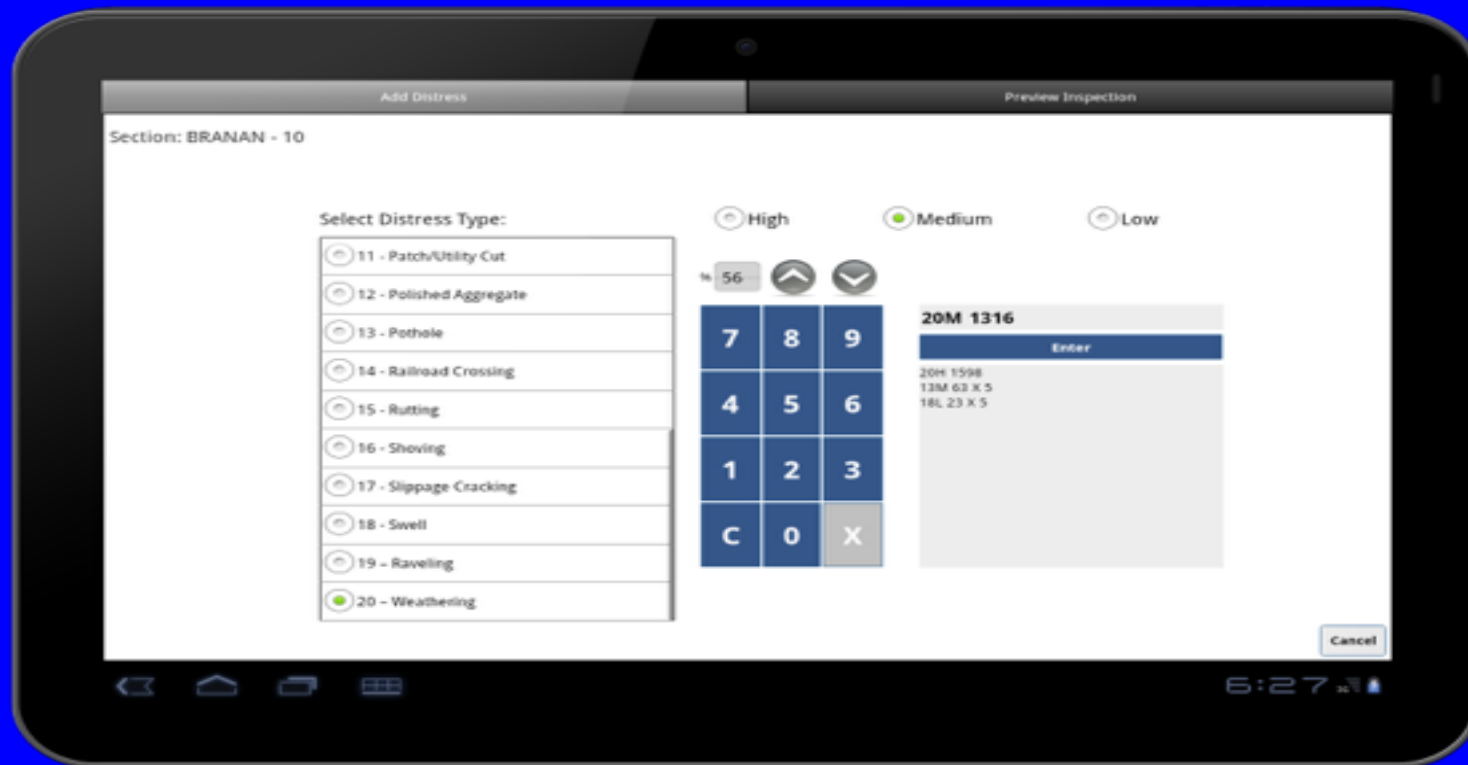
Part of MTC Data Quality Management Plan:

- Must attend a distress survey class or
- Online pavement condition assessment class
- Pass a 8-hour field test
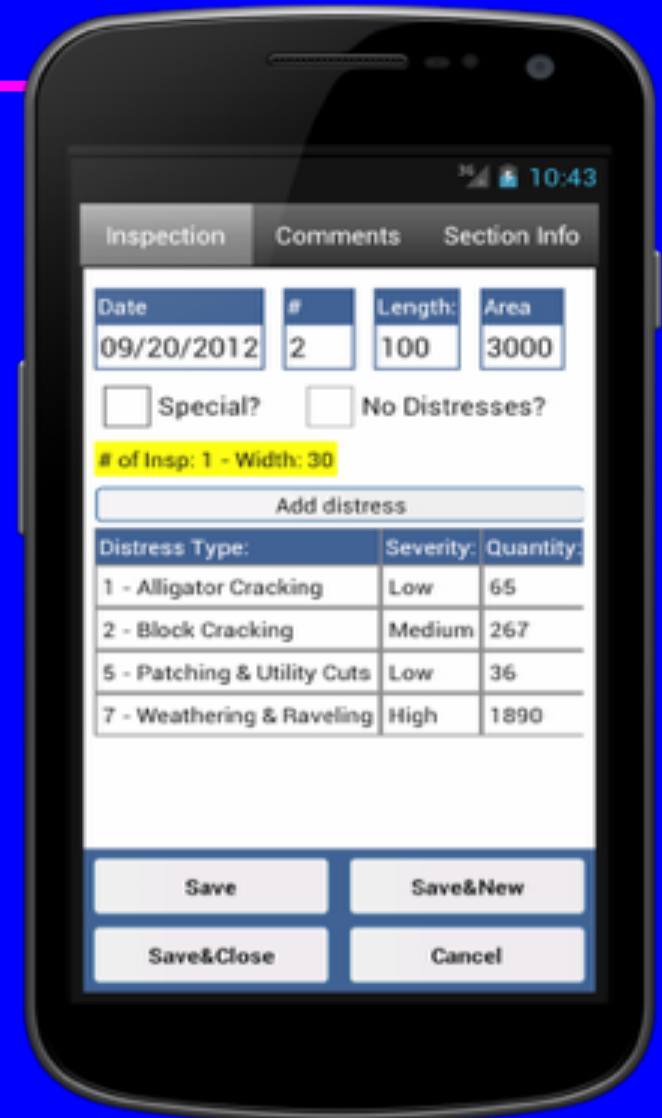- Pass an online knowledge test
- Certification good for 2 years

www.mtcpms.org/support/QualityMgtProgram.html

Next Field Test: November 19 & 20, 2014

Mobile Rater – Android Tablet

Mobile Rater – Android Smart Phone

MobileRater Features

- Instant PCI calculation
- Record multiple distresses at once
- Inspection error checking
- Choice of inspection areas – entire network or zones
- Secure and easy one-click transfer of data to online server
- Fully compatible with StreetSaver® Online version

Questions?