

## Quality Control and Quality Assurance for MTC Distress Data Collection





Roger Smith  
Dept. of Civil Engr. & TTI,  
Texas A&M University






## PCI

- Pavement Condition Index
- Primary measure of condition used in MTC StreetSaver PMP

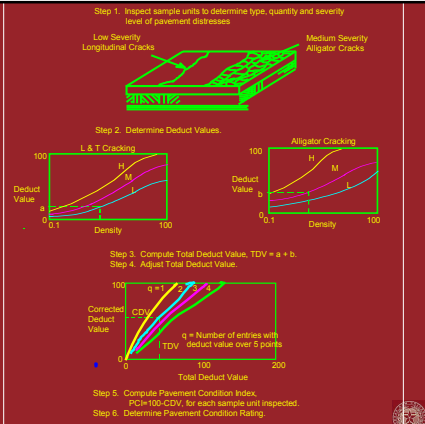



## PCI Scale

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

## PCI Process



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

**Step 2:** Determine Deduct Values.

**Step 3:** Compute Total Deduct Value,  $TDV = a + b$ .



**Step 4:** Adjust Total Deduct Value.

**Step 5:** Compute Pavement Condition Index,  $PCI = 100 - CDV$ , for each sample unit inspected.

**Step 6:** Determine Pavement Condition Rating.

## PCI Concept

- Average rating of the pavement by:
  - A group of maintenance engineers looking at the pavement surface
  - To determine when to intervene to apply needed maintenance and rehabilitation

## Pavement Management is a Decision Making Process

- To find cost-effective treatments
- At designated times
- To provide a desired level of service




## Pavement Management Program or Software (StreetSaver PMP)

- Decision support tool
- Stores data and provides information
- To support in making cost-effective decisions



## Importance of PCI to PMP

- PCI values are:
  - Basis of most management recommendations
- Incorrect PCI values will cause the PMP to
  - Give incorrect recommendations



## Network-Level PMP Elements

- Inventory
- Condition Assessment
- Determination of needed work & funds
- Identification of candidate projects
- Determination of impacts of funding alternatives
- Feedback



## MTC PMP

- PCI is basic measure of condition
- Method to uniformly characterize condition of paved surface
  - Along road/street
  - Over time
  - Among raters

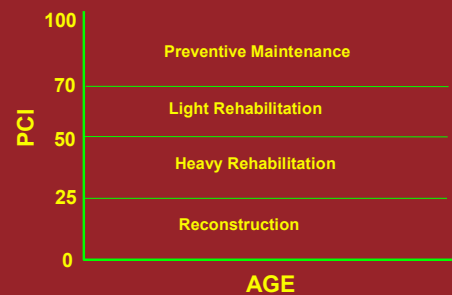


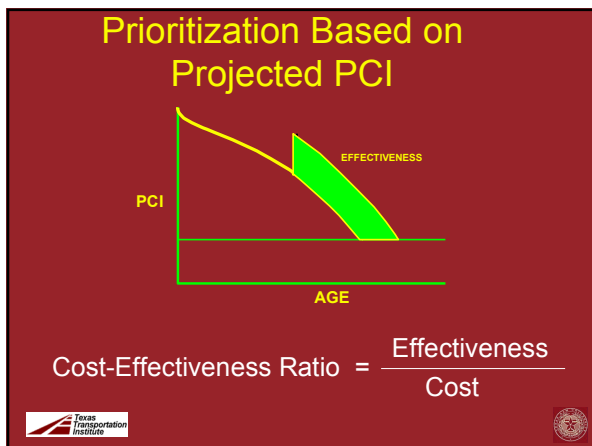
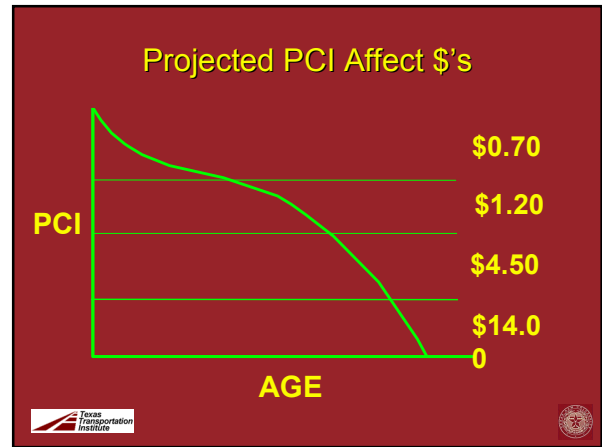
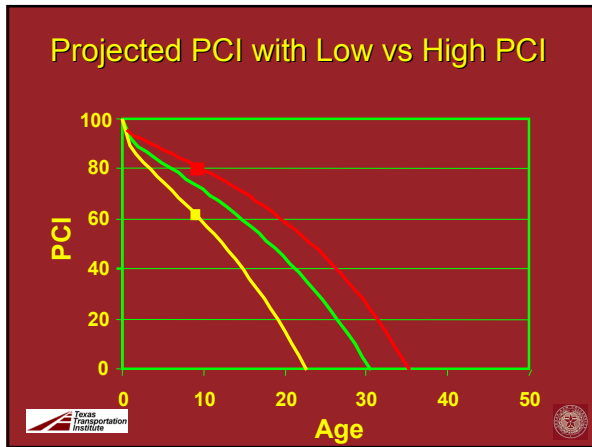
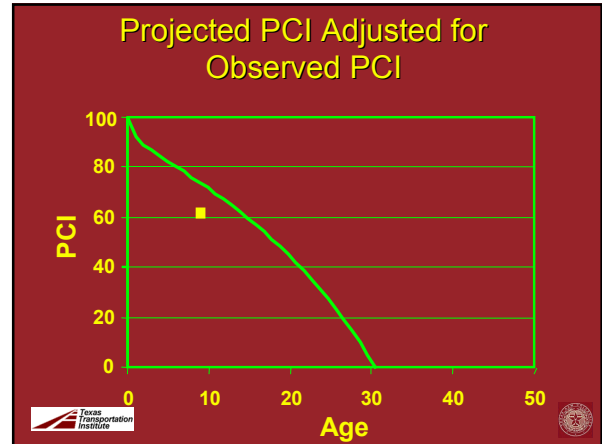
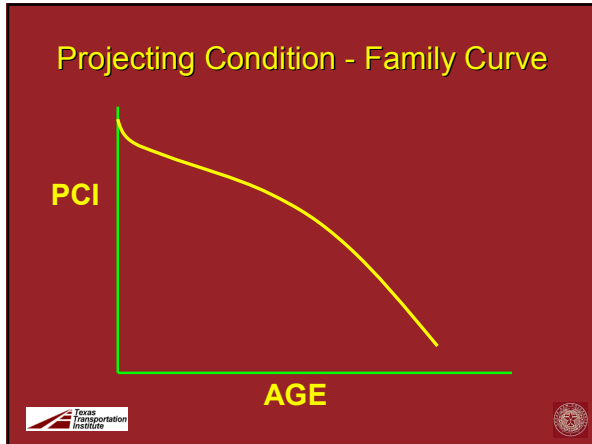
## PCI Values Used

- To identify level of work needed
- Amount of funding needed
- Project future condition



## PCI Value Affects Treatment





- ### PCI Values
- Drive most recommendations from MTC PMP
  - Incorrect values produce incorrect recommendations
- Texas Transportation Institute

## QA / QC

- PCI data drives recommendations from MTC StreetSaver software
- Incorrect values produce incorrect recommendations
  - GIGO
- Managing agency responsible for ensuring data is correct



## QA / QC

- Quality Control
  - Processes used by group completing inspections to ensure quality inspection data
- Quality Assurance
  - Processes used by owner agency to assure quality inspection data
- Both important



## Terminology

- Accuracy
  - What you report is what is present
  - Reported alligator cracking is alligator cracking as defined in MTC Distress ID Manual
- Precision
  - Repeated inspections give you the “same” value



## Terminology

- Resolution
  - The level of determination
  - Low severity cracking is identified



## Manual Inspections



- Accuracy, Precision, & Resolution Function of:
  - Training of those making observations
  - Dedication of those making observations
  - Pavement surface & weather conditions at time of inspection
  - Quality control practiced by responsible managers



## Semi-Automated Inspections

- Accuracy, Precision, & Resolution Function of:
  - Equipment
  - Interpretation
  - Software & training of interpreters
  - Placement during repeat runs
  - Pavement surface & weather conditions at time of inspection
  - Quality control practiced



## How Good is Good Enough?

- What are we looking for?
- Network-level data that gives correct network-level information
- Budget needs
  - ~ +/- 20% of 20 year budget needs
- Network PCI
  - ~ +/- 4 PCI Points
- Individual section PCI
  - ~90% +/- 10 PCI Points



## Where Do These Come From

- Budget needs
  - ~ +/- 20% of 20 year budget needs
  - 2005 MTC Study
- Network PCI
  - ~ +/- 4 PCI Points
  - 2005 MTC Study
- Individual section PCI
  - ~90% +/- 10 PCI Points
  - RES – Standard deviation from reinspection of same inspection unit ~3.7 PCI Points



## MTC Contractor Qualifying Criteria

- Three criteria:
  1. At least 40% of sections within +/- 5 PCI points of "Ground Truth"
  2. No more than 15% of sections > 15 PCI points of "Ground Truth"
  3. At least 90% of PCI values from repeat inspections within +/- 7 PCI points of mean value for that site



## Management for Inspection 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 Inspection Supervisors

- Check data coming in daily
  - Look for data problems
- Have teams mark inspection units
- Supervisor reinspect small percent
- Teams reinspect small percent
- Reinspect same inspection units



## Quality Control for Inspection 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%)



### Inspection Supervisor Office Checks

- Check data coming in daily - look for problems in inspection unit data
  - 1 sq ft block cracking
  - 100 % block cracking & L&T cracking
  - Small areas of weathering & raveling
  - Only medium severity L&T, Alligator cracking, & Patching
- Differences between PCI values from prior inspections



### Inspection Supervisor Field Checks

- With more than one team
  - Teams reinspect sections of other teams (~5%)
  - Within 1-2 weeks
  - Reinspect same inspection units
- Supervisor
  - Reinspect 2 - 5 % of sections inspected by teams



### Expect Inspector Fatigue

- Distress surveys will become BORING
- Results
  - Only 1M, 4M, 5M & 7L
  - All pavements look alike anyway
  - No one cares about what I report
- Weather can reduce attention
- Prevention
  - Change members of teams
  - Reinforce importance of correct data
  - Check work of teams



### Inspection Supervisor Management

- Require refresher training
- Provide breaks from constant survey duty



### Field Checks (Cont'd)

- $\pm 5$  PCI points desirable
- $\pm 10$  PCI points OK
  - Not distress type, severity, quantity
- $> \pm 15$  PCI points acceptable for small percent



### Field Checks (Cont'd)

- At least 40% of sections within  $\pm 5$  PCI (10) point range
- No more than 15% of sections  $> 15$  PCI (30) point range
- 90% of PCI values from repeat inspections within  $\pm 7$  PCI points
  - Only applied to inspection unit inspected by same inspector



## Quality Control for Contracted Distress ID

- Contract must lay out requirements
- Describe distress types, severities, and measurement requirements
  - MTC Distress ID Manual
- Specify the accuracy required
- Describe when data must be submitted
- Describe how data will be checked
- Require contractor quality control plan



## Quality Control Plan

- Contracting agency should provide agency with quality control plan
  - How they will check data being collected
    - » Reinspection by qualified supervisor
    - » ~2-5%
  - How problems will be defined
    - » At least 40% of sections within +/- 5 PCI points range
    - » No more than 15% of sections > 15 PCI points range



## Quality Control Plan

- Contracting agency should provide agency with quality control plan
  - What they will do when they find a problem
    - » Retraining
    - » Addition monitoring
    - » Reinspection after second occurrence
  - How & when this will be reported to agency
    - » Weekly
  - Other items in agency contract



## Quality Assurance Plan

- What is required
  - What must be collected (MTC Distress ID)
  - Format of required data
  - When data is required (each week)
  - What is acceptable
  - What happens if data is not acceptable
  - Prequalification?



## Quality Assurance Plan (Cont'd)

- How agency will
  - Check data collected by contractor
  - 2-5% of management sections
  - Require inspection units be marked
  - Must be timely
- What happens if data is not OK
  - Required reinspection
- All required to be in request for services & contract



## Semi-Automated Collection of Distress Data

- Decrease safety issues
- Decrease traffic interruptions
- Uses contract funds instead of staff resources
- Will be somewhat different than manual data
  - Inspects limited width
  - Define how data will be provided to allow reinspection for QA



### Pre-Qualifying Data Collection Vendor

- Establish ground truth against which contractors will be evaluated
- At least four sites
  - One in very good condition
  - One in relatively poor condition
  - Two in moderate condition
- Experienced inspection staff conduct inspections
  - At least three "blind" inspections of each site
- PCI and other quantities calculated using MTC StreetSaver PMP
- Determine "Ground Truth PCI" for each site as the mean value from multiple inspections



### Evaluate Data Collection Vendor

- Vendor inspects test sections & provides data to agency immediately
- PCI and other quantities calculated using MTC StreetSaver PMP
- PCI values from vendor data compared to "Ground Truth PCI" values
  - At least 40% of sections within +/- 5 PCI points of "Ground Truth"
  - No more than 15% of sections > 15 PCI points of "Ground Truth"
- Agency makes a judgment if contractor data is acceptable



### Quality Control is Worth the Cost

- You wouldn't spend money on construction without quality checks
- Don't spend money on inspection without quality control !!



?

