PERFORMANCE OF LOUISIANA'S CHIP SEAL AND MICRO-SURFACING PROJECTS

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- Background
  - Chip Seals
  - Micro-Surfacing
- Objective
- Scope
- Research
- Summary and Conclusions

Chip Seals

- What is a Chip Seal?
  - Single layer of asphalt binder covered by embedded aggregate one rock thick.
- Dates back to the 1920's.
  - Used primarily as wearing course for low volume roads.
- Evolved into maintenance treatments for low and high volume roadways.
- Popularity is a result of low initial cost in comparison to thin asphalt overlays.

Chip Seals

- NCHRP Synthesis 35-02, Chip Seal Best Practices.
  - States and municipalities reporting excellent chip seal programs.
    - Use Chips Seals as preventative maintenance.
      - Apply to roads before distress levels are classified as moderate.
      - Chip Seals scheduled every 5 years with life expectancy of chip seals being 6 years.


HYPAC

Micro-Surfacing

- What is Micro-Surfacing?
  - Type of Slurry Seal
  - Mixture of dense-graded aggregate, asphalt emulsion, water, and mineral fillers.
- Applied with specialized paver which carries and mixes all components.
- Surface is initially dark brown and then changes to black.
- Cures in 1 hour.

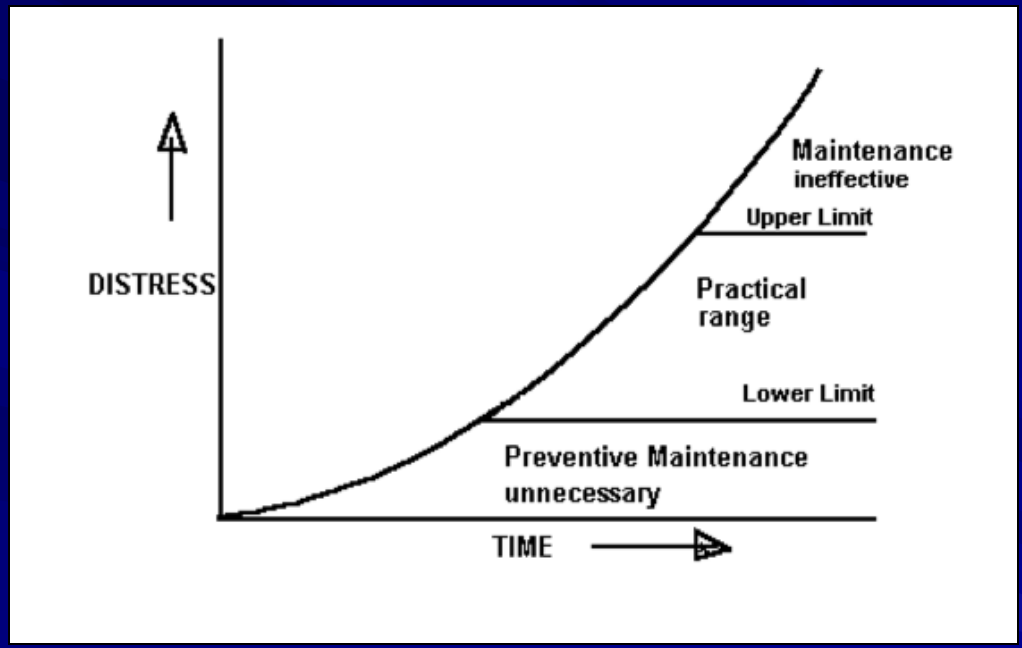
Micro-surfacing

- Chip seals and micro-surfacing are two of the commonly used techniques to preserve or extend pavement life.
- These techniques can be classified according to their purpose or function as either corrective or preventive.
- Should only be considered for structurally sound pavements.

Critical Decisions for Pavement Preservation

- Timing of application
- Selection of an appropriate technique

Time of Application



Effectiveness of Maintenance Operations

Which Application?

- Chip Seal
  - Seal Surface
  - Seal low intensity fatigue and block cracking
  - Restore Surface Friction
- Micro-Surfacing
  - For Asphalt Pavements
    - Rut Filling
    - Texturing/Sealing
  - For Concrete Pavements
    - Texturing

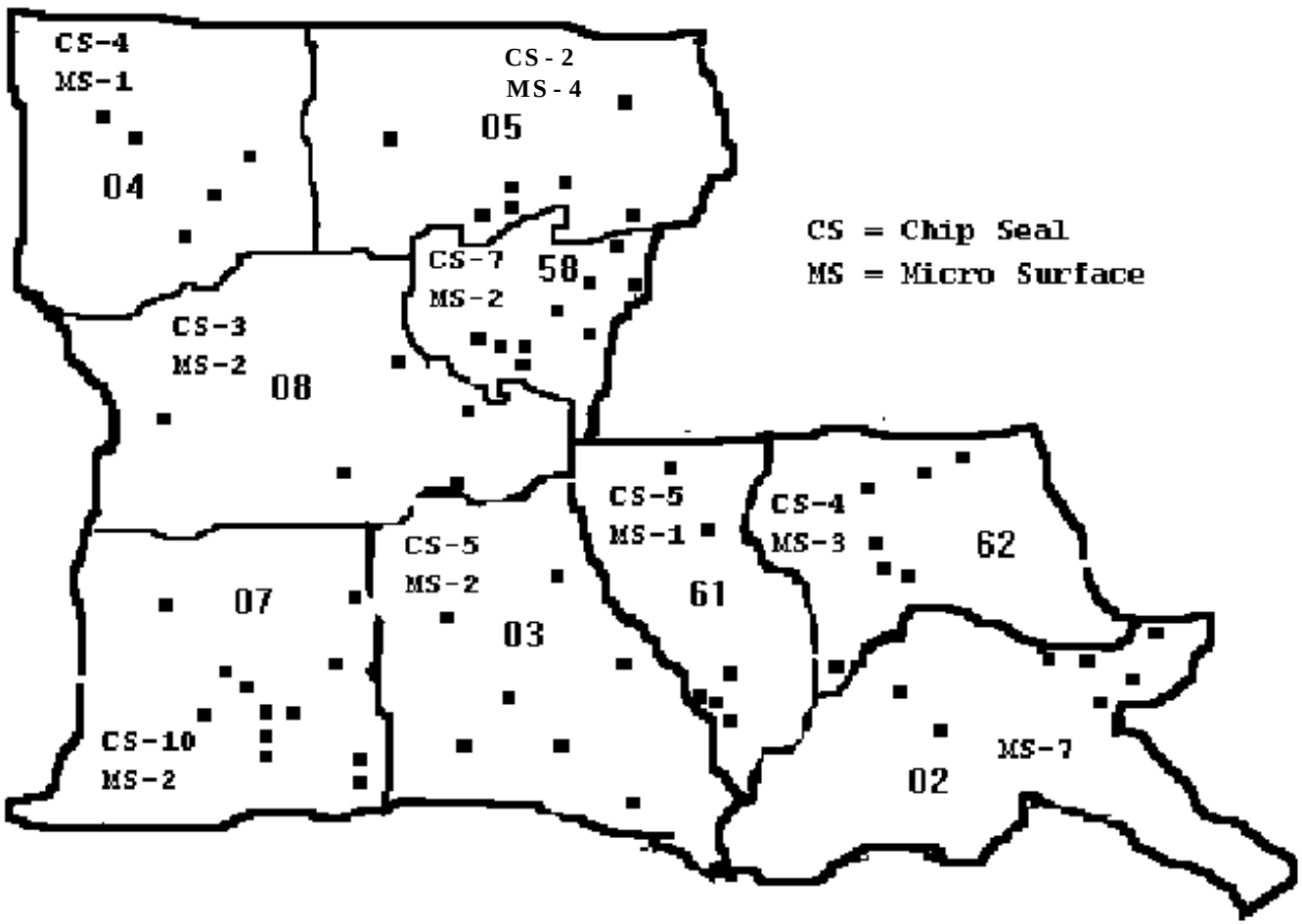
- **Objective**
  - **Evaluate the effectiveness of LADOTD's chip seal and micro-surfacing program in terms of their performance and cost.**

- **Scope**
  - **Limited to the evaluation of performance relative to age and traffic factors and not factors associated with materials and/or construction.**

Project Factorial

- Single layer Chip Seals
  - 40 projects
  - Constructed 1995 – 1997
- Micro-Surfacing
  - 24 projects
  - Constructed 1995 – 1997

General Location of Preventive Maintenance Projects



Pavement Evaluation Process

- Ride each entire project.
  - Rate roughness
- Select a representative test section from each project.
  - 500 to 700 foot test section
- Survey same section every 12 – 24 months.
- Conduct a minimum of four surveys.

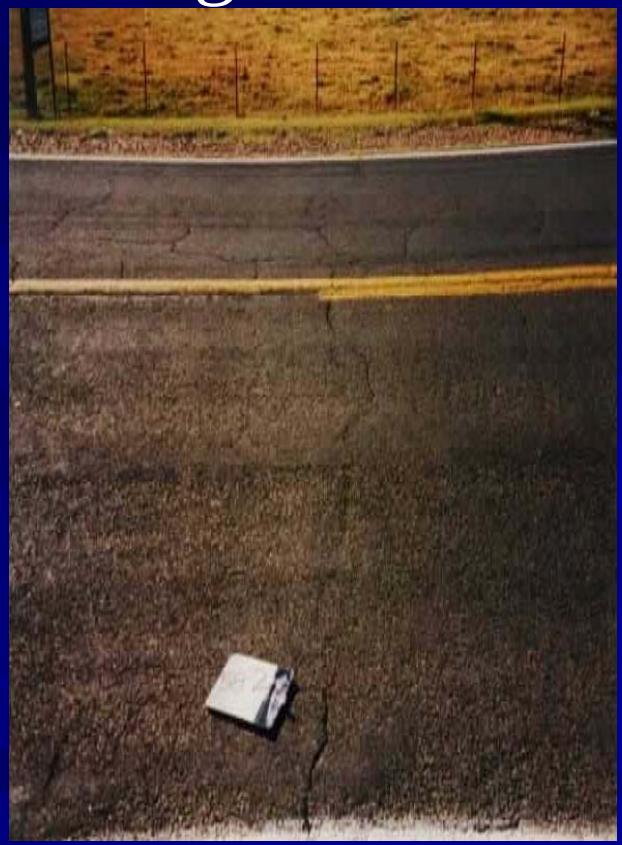
Test Section Evaluation

- Conduct a walking survey.
- Rate Severity and Extent of Pavement Distresses.
- Photograph each test section.

Rating Distresses:

Rating Distresses: Cracking

Alligator



Longitudinal/Transverse

Edge (Widening)

Rating Distresses:

Patch/ Pothole

Aggregate Loss

Field Evaluation Rating Procedure

- Subjectively rate each distress in terms of :
  - Severity
    - Degree of deterioration
  - Extent
    - Frequency of occurrence
- Assign weight to each pavement distress
- Record the rating on the rating form

PAVEMENT CONDITION RATING FORM

Project No: 424-08-0023 District:02 Name: Overpass - Jct LA 3199

Project Begin: US 90 @ the Overpass @ LA 308; thence North to

Project End: its intersection with LA 3199

Route: US 90 Seal Type: MicroSurface Project Length: 3.60

Date Constructed: 2/97(75) Date Surveyed: 4.15.03 Surveyed By: SCS

Test Section Begin: Sheriff's Bldg Test Section End: Insp Lane: NB SB EB WB

Distress Type	Weight Factor	Severity Level				Extent Level				Deduct Points
		None	Low	Med	High	None	Occ	Freq	Ext	
Long/Trans Cracking	20	None	<1/4	1/4	>1/4	None	<10%L	10-30	>30%L	
		0.1	0.2	0.6	1.0	0.1	0.4	0.8	1.0	
Alligator Cracking	15	None	<1/8"	1/8"	>1/8"	None	<10%A	10-30	>30%A	
		0.1	0.2	0.6	1.0	0.1	0.4	0.8	1.0	
Edge Cracking	10	None	<1'	1-2'	>2'	None	<10%	10-30	>30%	
		0.1	0.2	0.6	1.0	0.1	0.4	0.8	1.0	
Patch/Pothole	10	None	Small	Med	Large	None	<5/1K'	5-10	>10	
		0.1	0.6	0.8	1.0	0.1	0.6	0.8	1.0	
Rutting	10	<1/4"	1/4-1/2	1/2-1"	>1"					
		0.1	0.3	0.7	1.0					
Aggregate Loss	10	None	Slight	Mod	Severe	None	<10%A	10-30	>30%A	
		0.1	0.3	0.6	1.0	0.1	0.5	0.8	1.0	
Bleeding	10	None	Slight	Mod	Severe	None	<10%A	10-30	>30%A	
		0.1	0.6	0.8	1.0	0.1	0.6	0.8	1.0	
Roughness	15		Good	Fair	Poor					
			0.2	0.6	1.0					

Deduct Points = Distress Weight Factor X Severity Weight Factor x Extent Weight Factor

Total Deduct Points(TDP) =

Pavement Condition Rating, PCI = (100 - TDP) =

PCI Computation

- Compute deduct points for each distress (Wt Factor) x (Severity Factor) x (Extent Factor)
  - Maximum Deduct Factors
    - Cracking – 45 Points
    - Patch/Potholes – 10 Points
    - Rutting – 10 Points
    - Aggregate Loss – 10 Points
    - Bleeding – 10 Points
    - Roughness – 15 Points

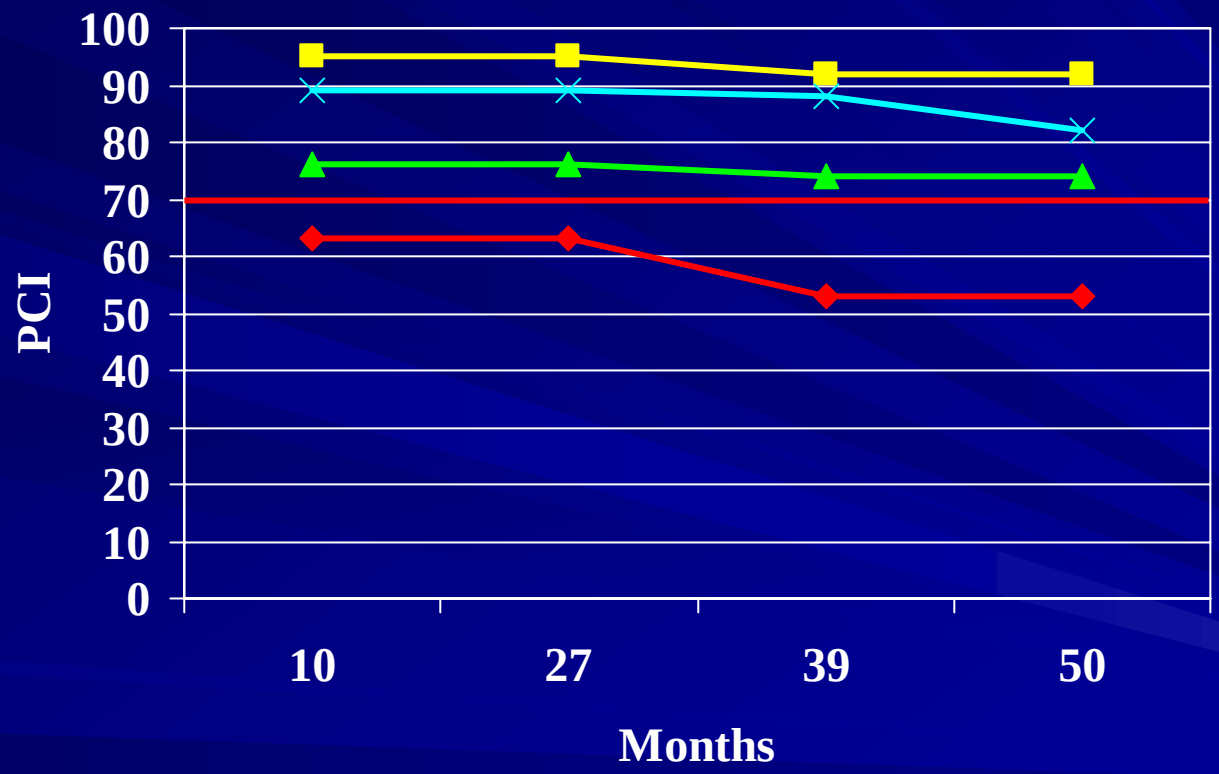
PCI Computation

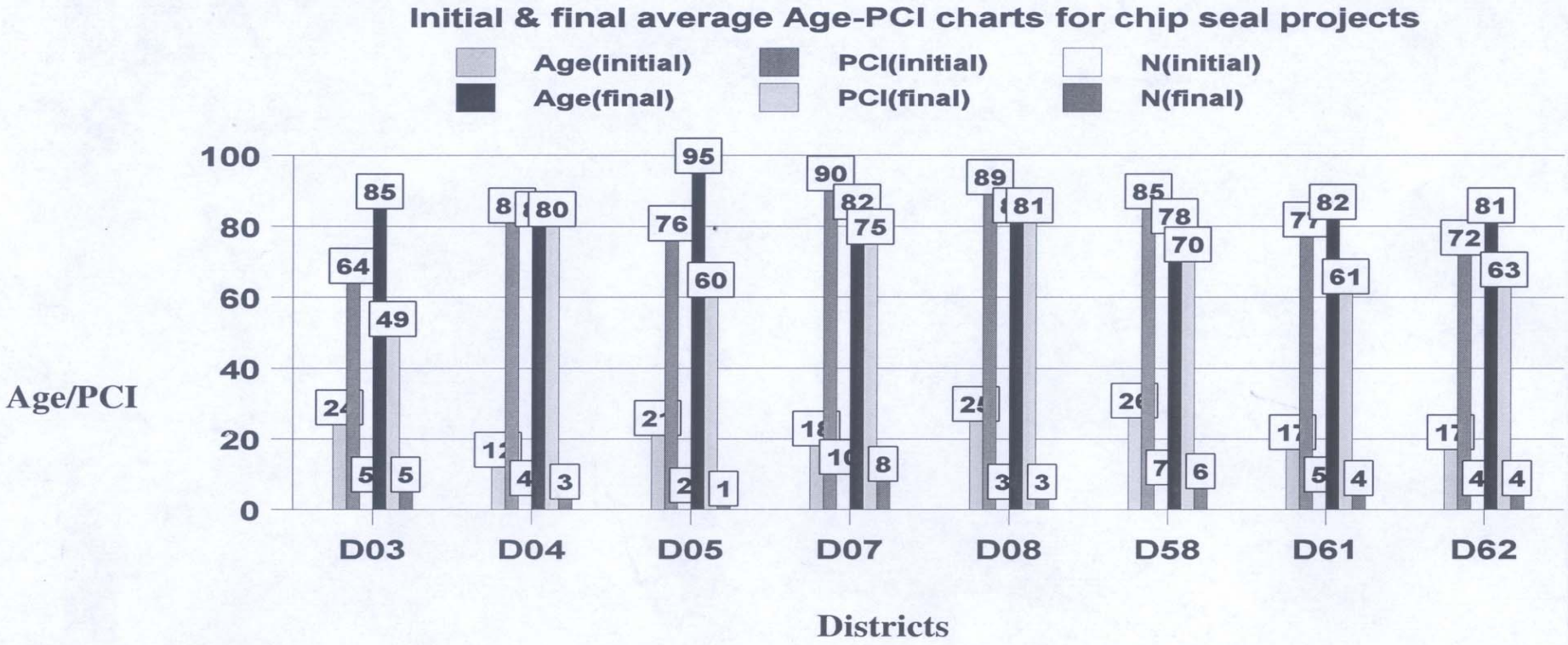
- Determine Total Deduct Points
  - Sum all deduct points for each distress
- Compute the Pavement Condition Index (PCI)
  - PCI = (100 – Total Deduct Points)
    - PCI range from 0 to 100
      - 0 = Poor
      - 100 = Excellent

Generalized PCI Rating Scale

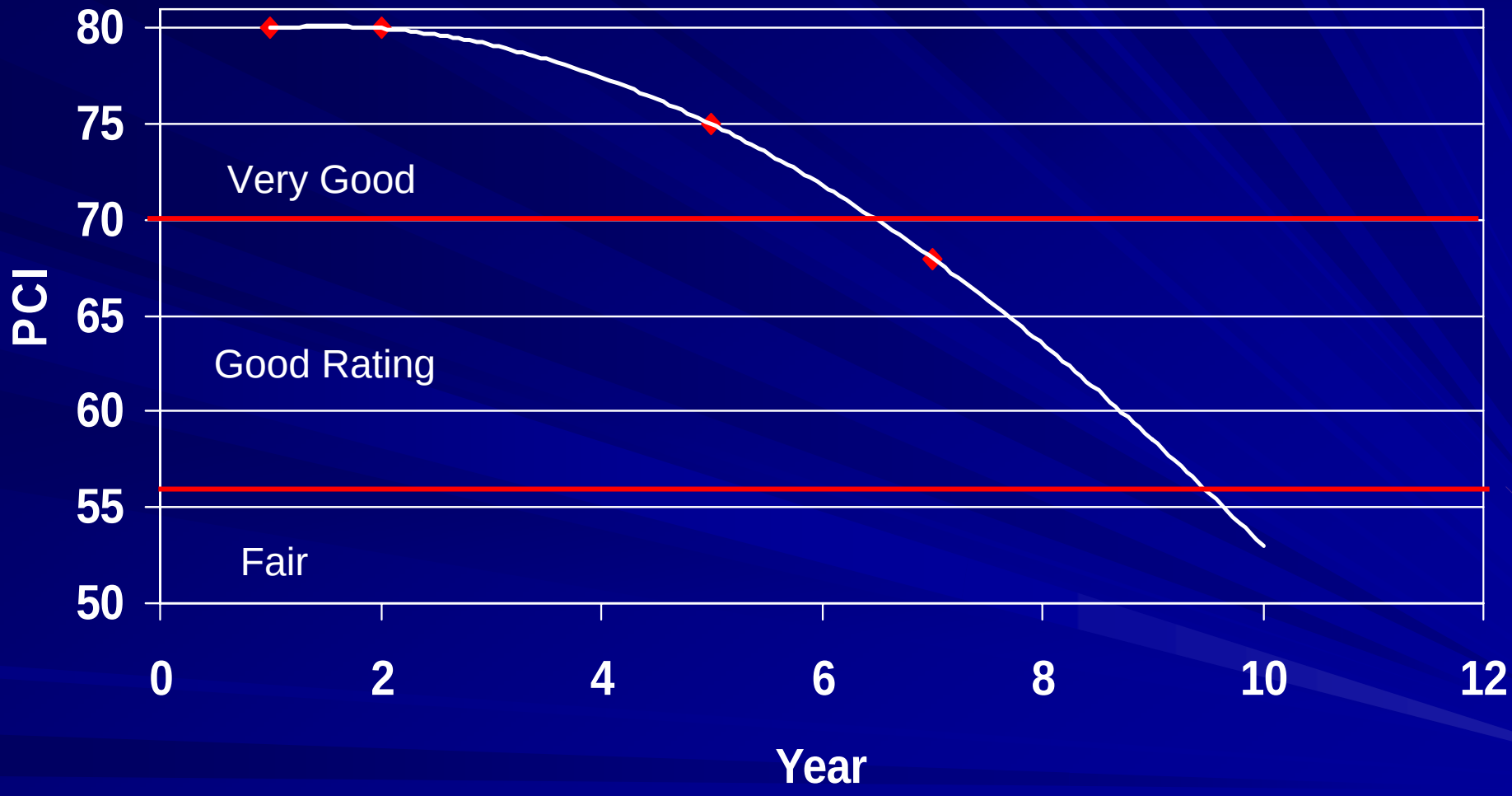
PCI	Rating
86 – 100	Excellent
71 – 85	Very Good
56 – 70	Good
41 – 55	Fair
26 – 40	Poor
11 – 25	Very Poor
0 – 10	Failed

Pavement Condition Index –PCI
Chip Seals

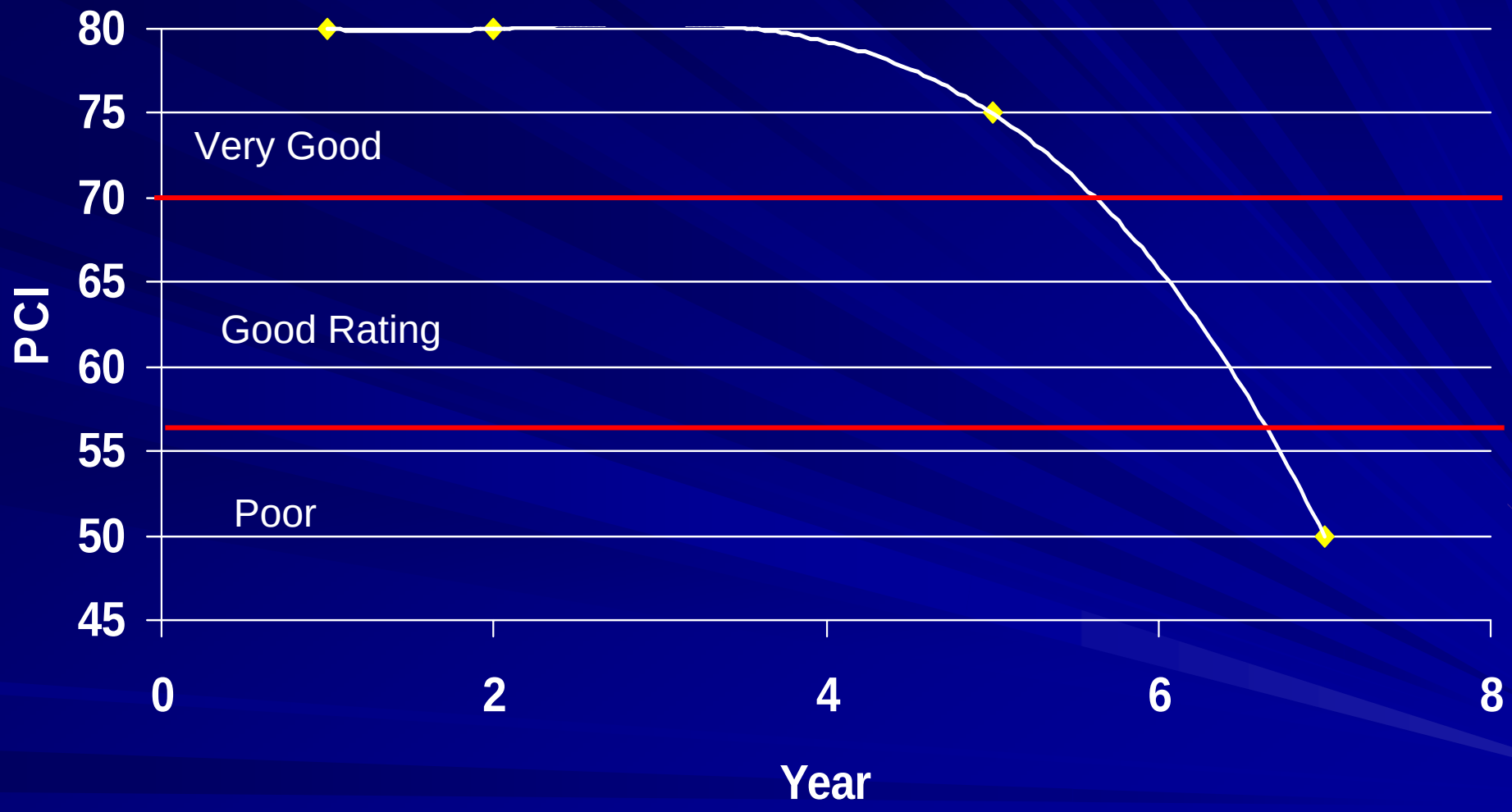



Initial & final average Age-PCI charts for chip seal projects
Age(initial)
Age(final)
PCI(initial)
PCI(final)
N(initial)
N(final)
Age/PCI
100
80
60
40
20
0
D03
D04
D05
D07
D08
D58
D61
D62
Districts

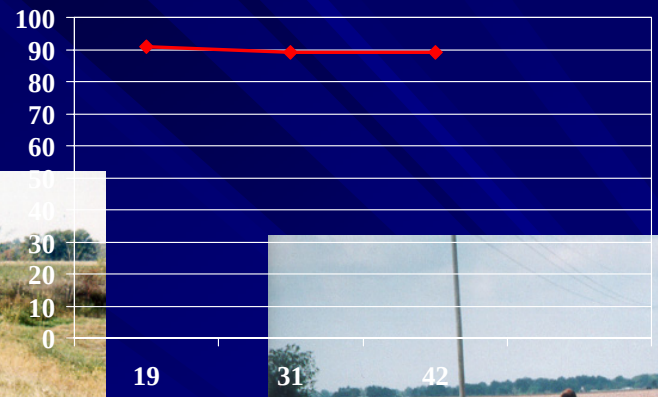
Chip Seal PCI Deterioration Curve



Chip Seal PCI Deterioration Curve



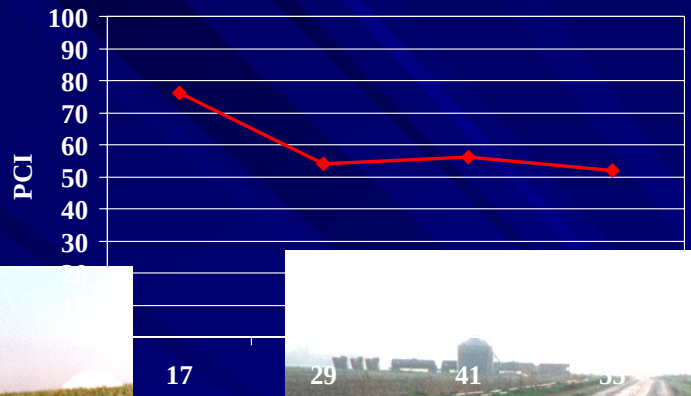
LA 4 Chip Seal



November 1998

February 2001

LA 999 Chip Seal

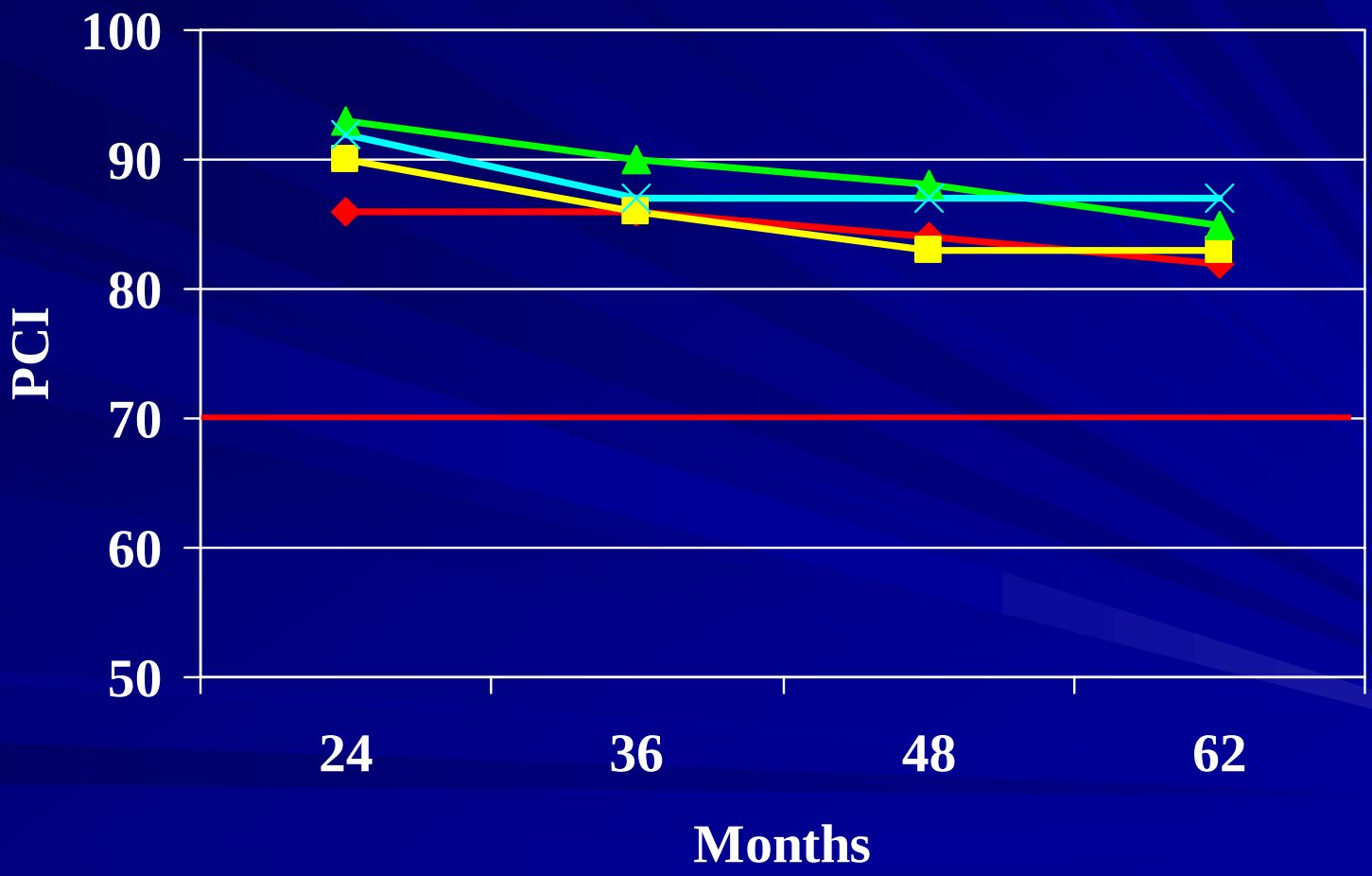


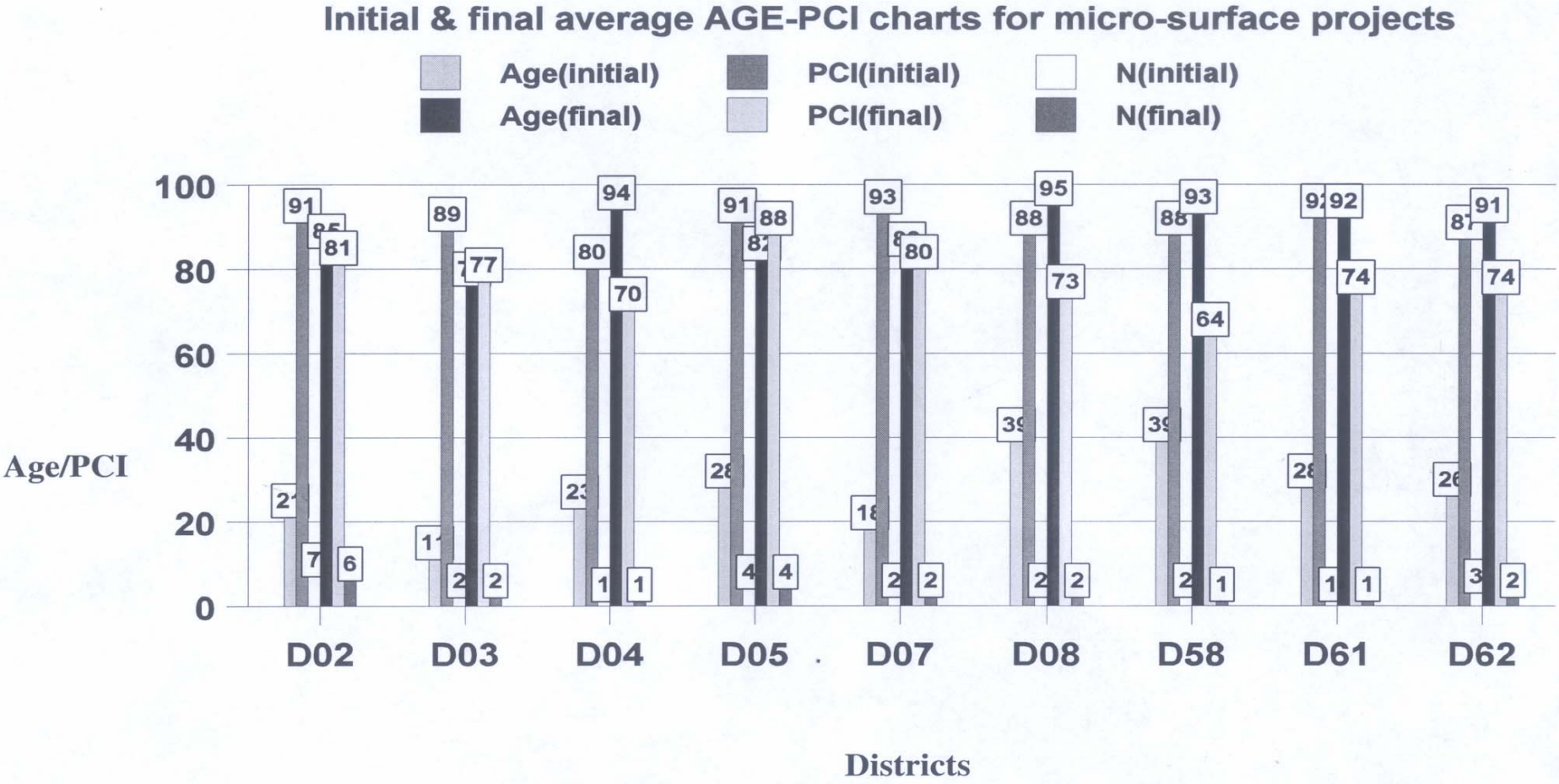
December 1998

February 2001

Pavement Condition Index –PCI

Micro Surfacing

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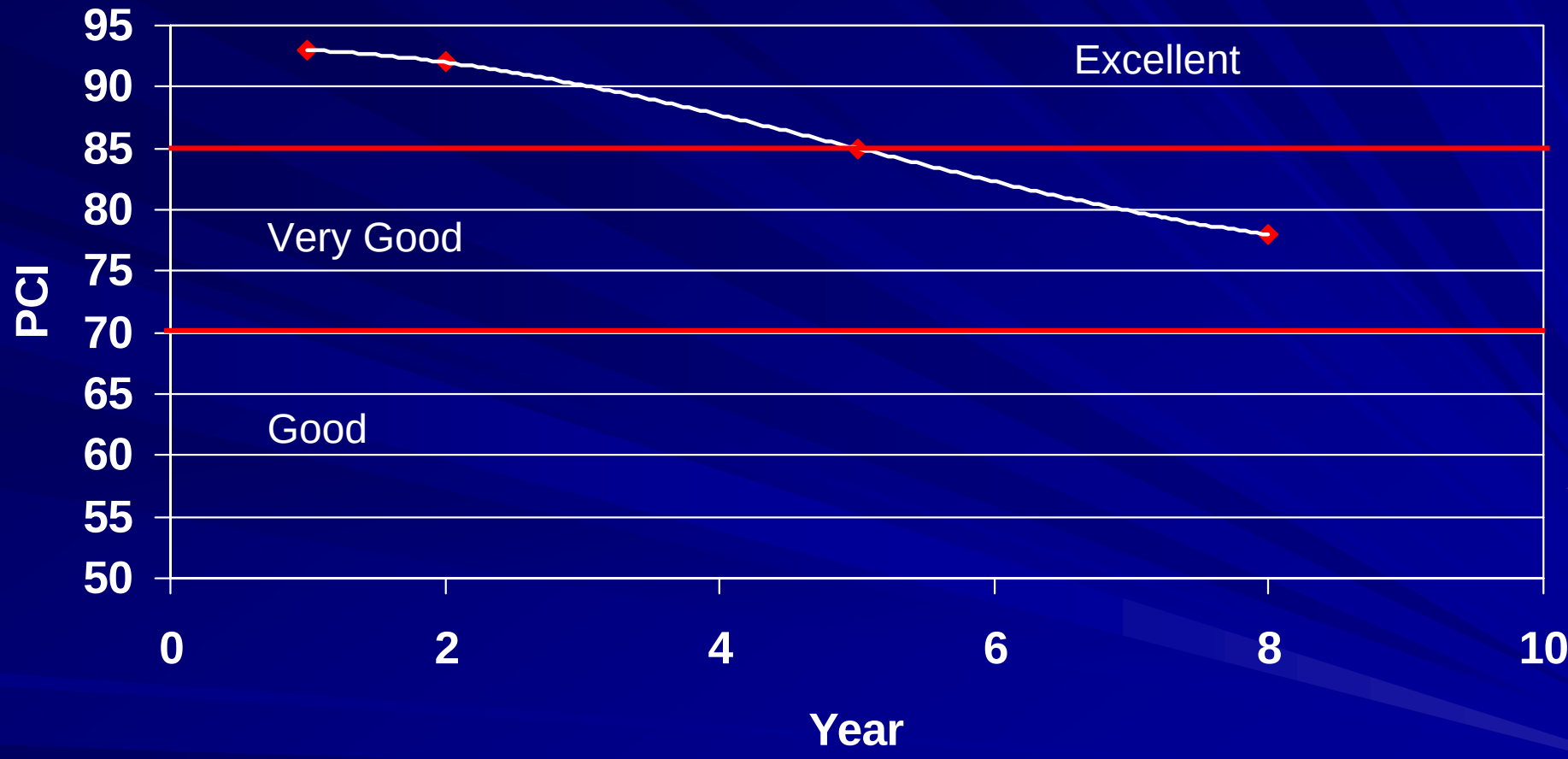
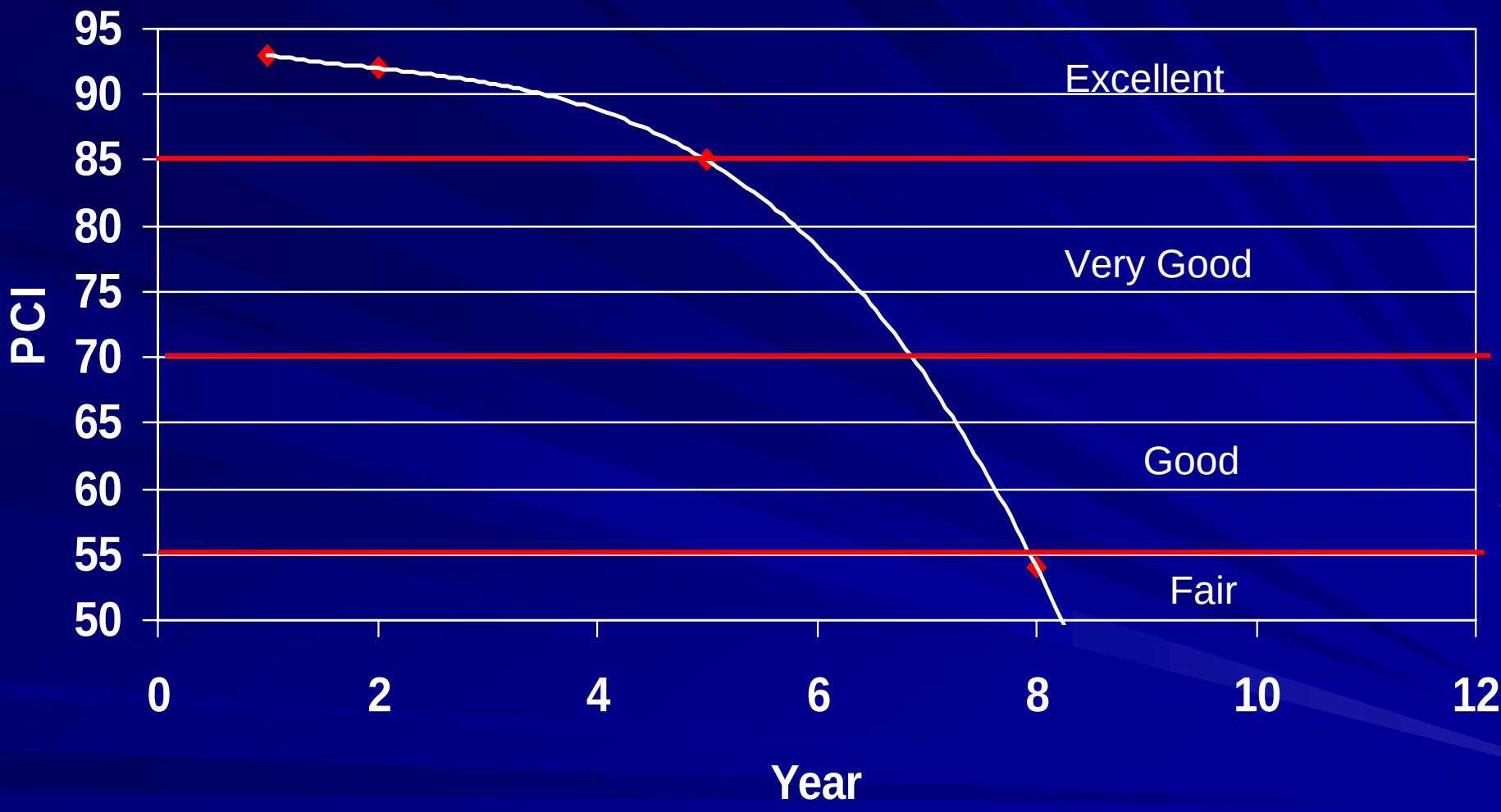
Districts

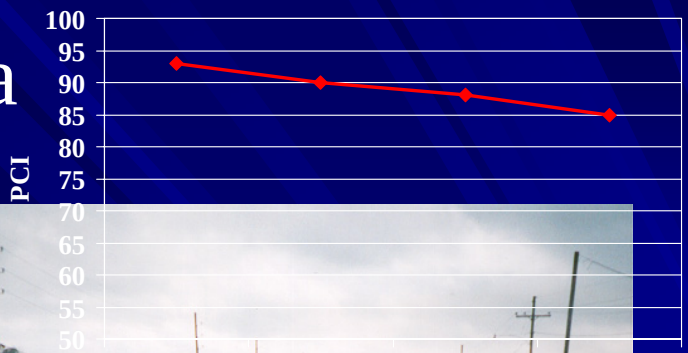
Micro-Surfacing PCI Deterioration Curve



Micro-Surfacing PCI Deterioration Curve



LA 659 Micro Surfacing, Houma



December 1998

February 2001

LA 3188 Micro Surfacing

December 1998

February 2001

Cost Effectiveness

- Expressed as Equivalent Annual Cost (EAC)
  - EAC = $\frac{\text{Unit Cost of Treatment}}{\text{Expected Life of Treatment}}$
  - Unit Cost = Construction Cost plus Maintenance Costs

Cost Effectiveness

- Average Unit Cost of Chip Seal
  - $1.67/sq. yd
- Average Unit Cost of Micro-Surfacing
  - $3.20/sq.yd.
- $EAC_{Chip\ Seal}$ = ($1.67/sq.yd.)/(6years)
  - $0.28/sq.yd./year for average expected life.
  - $0.33/sq.yd./year for preventative maintenance cycle of 5 years.
- $EAC_{Micro\text{-}Surfacing}$ = ($3.20/sq.yd.)/(7years)
  - $0.46/sq.yd./year for expected life.

Summary and Conclusions

- Chip Seals
  - 30 percent of projects have been rehabilitated.
  - Remaining 70 percent have a median PCI of 68 (Good Rating) after 7 years of service.
  - Based on PCI Deterioration Curves
    - 5- 7 year life expectancy
    - 5 year preventative maintenance (PM) cycle
  - Equivalent Annual Cost (EAC)
    - $0.33/sq.yd./year for PM cycle.
    - $0.28/sq.yd./year for average expected life

Summary and Conclusions

- **Micro-Surfacing**
  - 33 percent of the projects have been rehabilitated.
  - Remaining 67 percent have a median PCI of 78 after 8 years of service.
  - Based on PCI Deterioration Curves
    - 7 year life expectancy
  - Equivalent Annual Cost (EAC) of about $0.46/sq.yd./year.

Summary and Conclusions

- Two major distresses affecting performance
  - Cracking
  - Followed by roughness
- Surface treatment techniques considered only for structurally sound pavements.

Summary and Conclusions

- **Timing of application**
  - **Louisiana evaluation shows nothing to refute NCHRP 35-02, Chip Seals Best Practice, findings.**
  - **May be possible to extend preventative maintenance cycle for individual roadways depending on historical data, distress rating and rate of deterioration.**
  - **Principle Investigator, Shashikant Shah, developing guidelines.**

Summary and Conclusions

- Selection of an appropriate technique.
  - Galehouse, L., Moulthrop, J.S., Hicks, R.G.
    - "Place the right treatment, on the right road, at the right time"
  - Abadie, Chris
    - "Place any preventative maintenance treatment, on all roads, at the right time".


Thank You !