

# OHIO ASPHALT PAVING CONFERENCE

**38<sup>th</sup> Annual Conference**

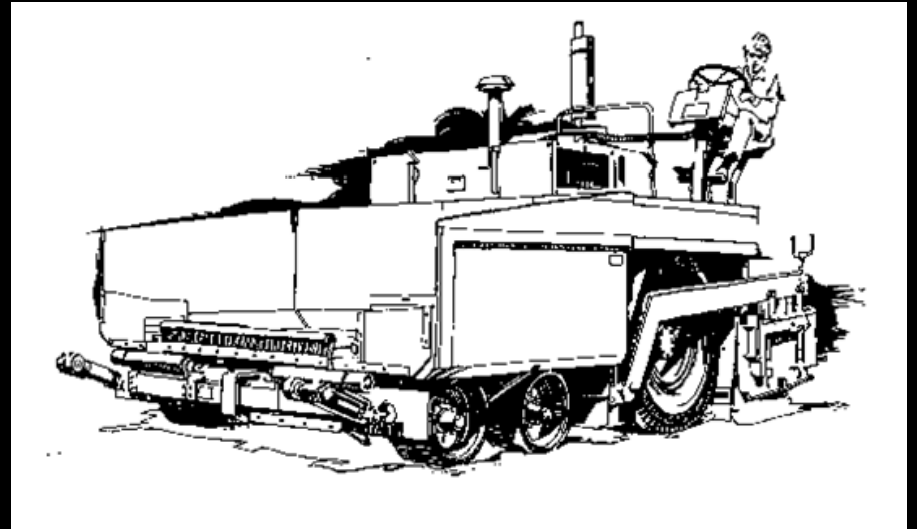
**Wednesday, 2/6/2013**

**Fawcett Center**

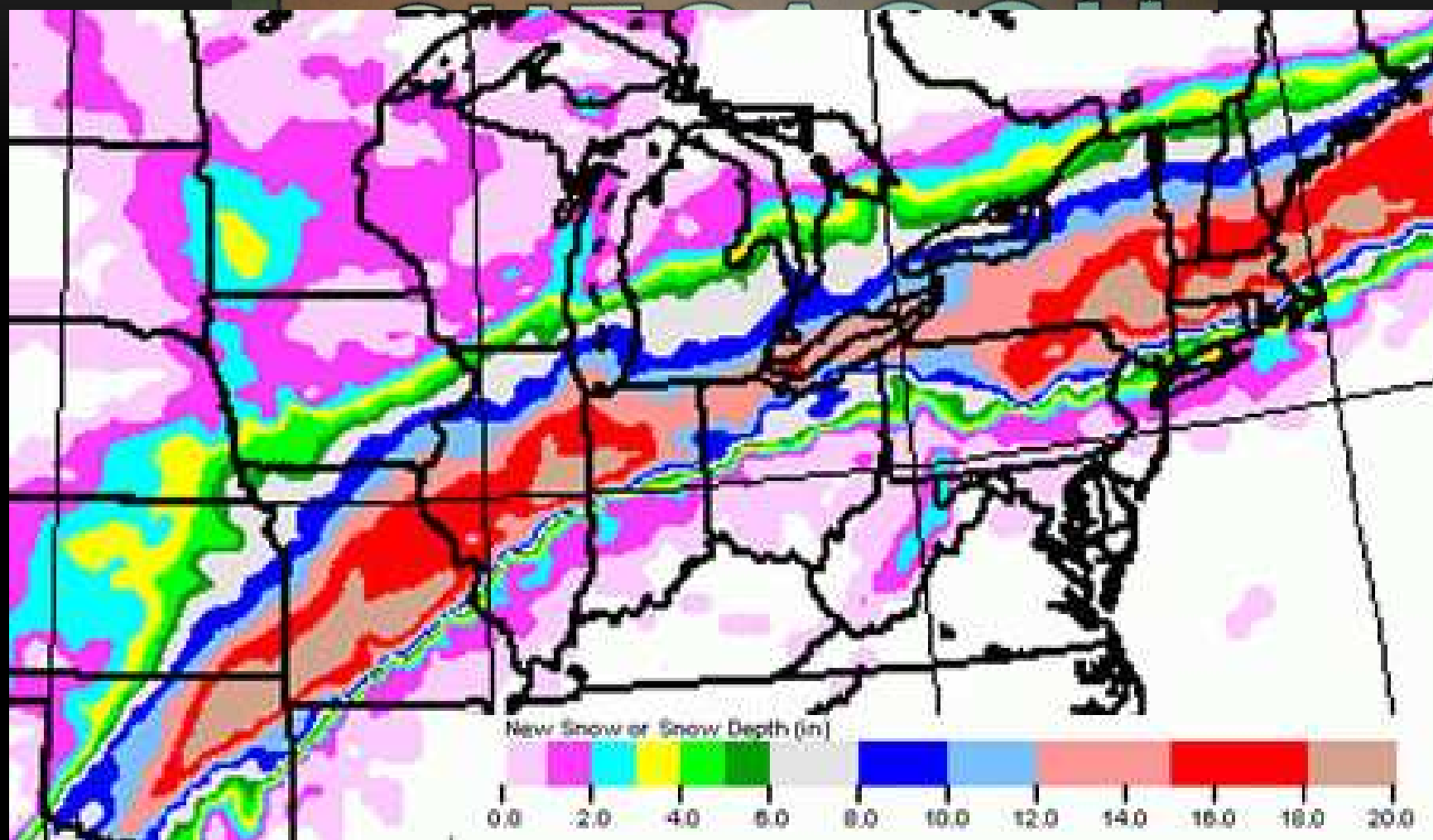
Campus of The Ohio State University

2400 Olentangy River Road

Columbus, Ohio 43210



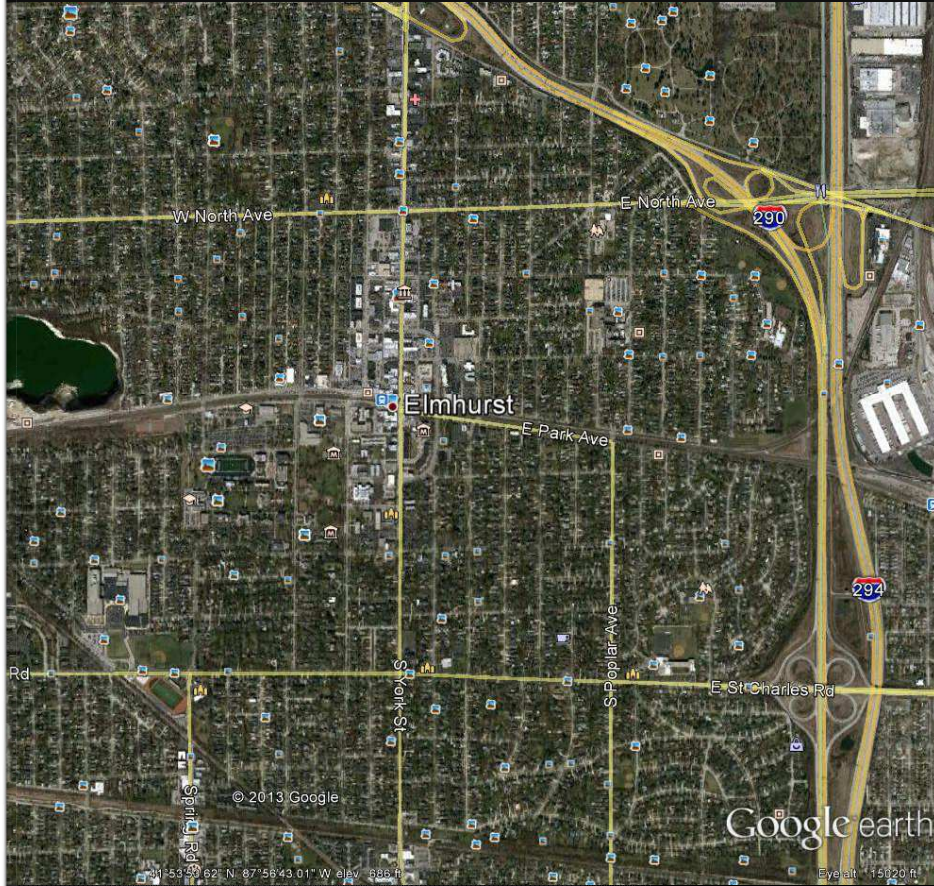
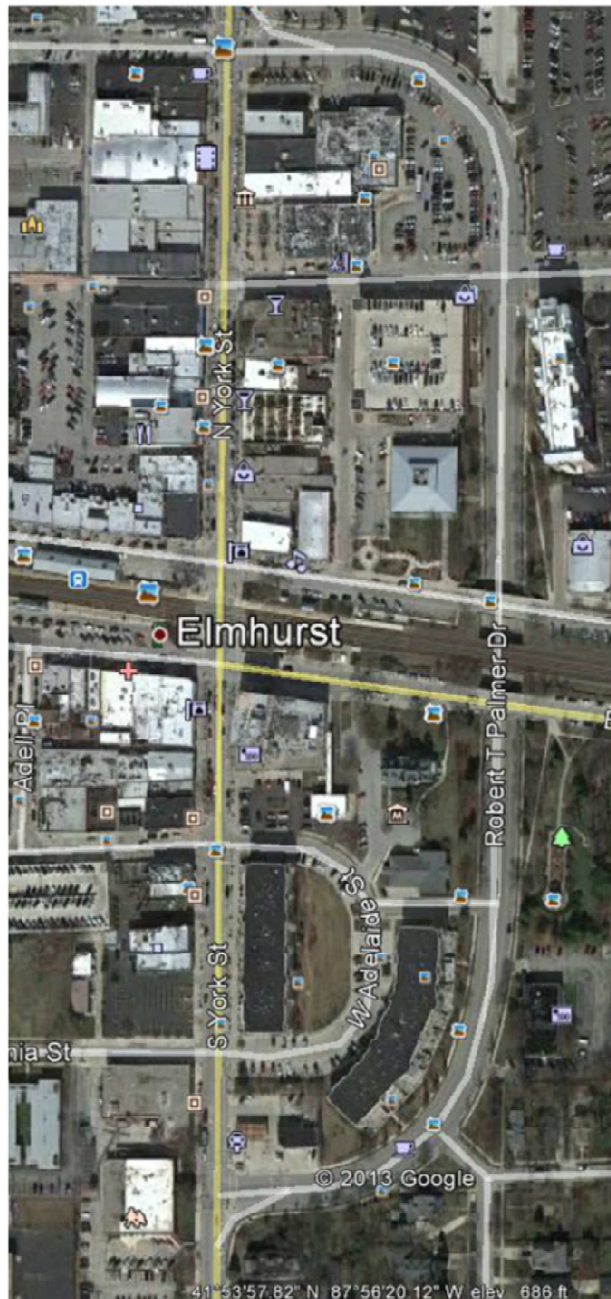
Chicago attracted competing interests  
during the fur-trade era.



trade between whites and Native Americans during  
Chicago's brief, but colorful, frontier era.



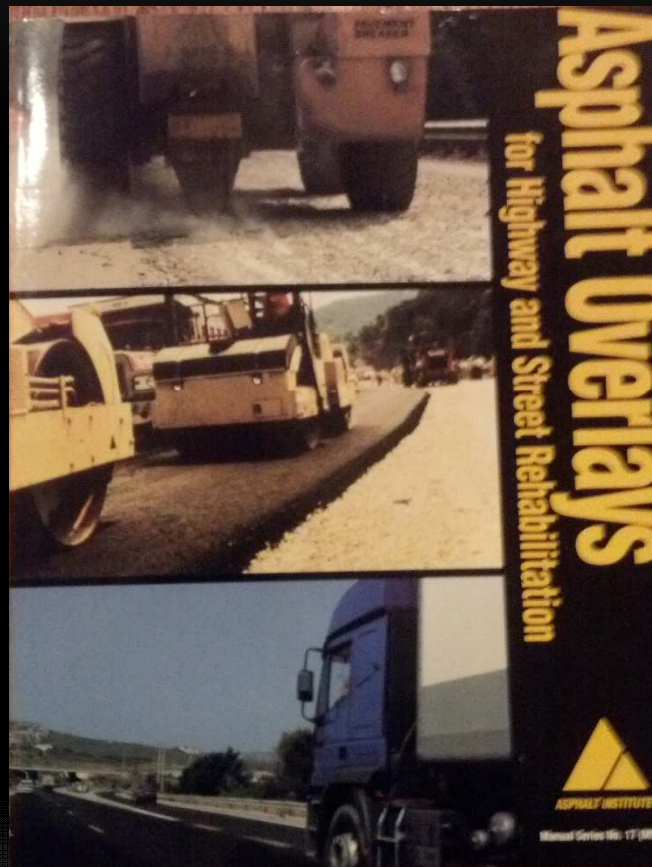
# REGIES FOR LOCAL PCC



Timothy R. Murphy, PE  
President

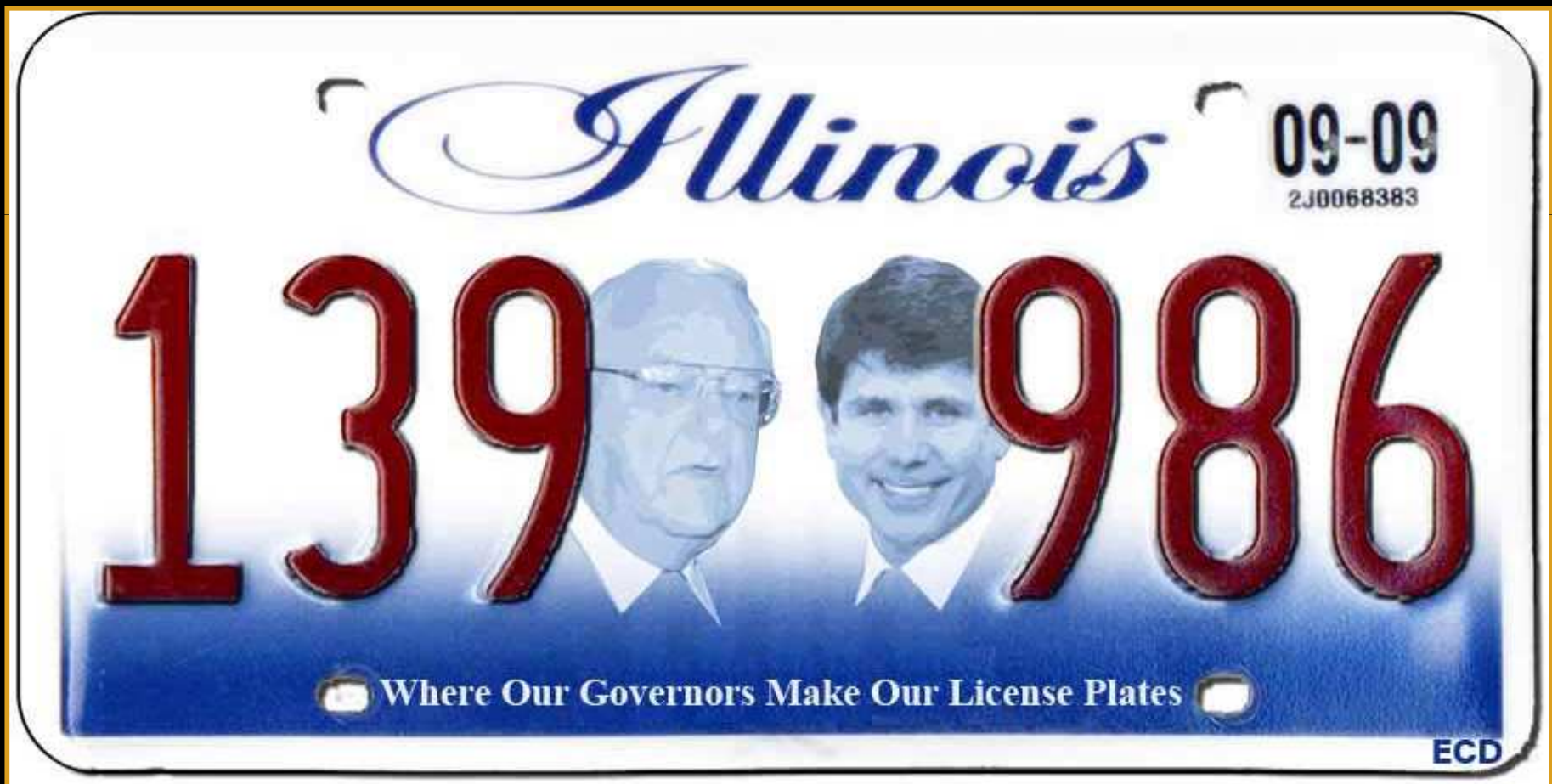
Murphy Pavement Technology, Inc.

# ASPHALT OVERLAYS (MS-17)





THESE 2 ARE NOT WHO I WORK FOR  
ANYMORE...



# PASER Concrete Roads Manual



## Rating system

Surface rating	Visible distress*	General condition/ treatment measures
<b>10</b> Excellent	None.	New pavement, no maintenance required.
<b>9</b> Excellent	Traffic wear in wheelpath. Slight map cracking or pop-outs.	Recent concrete overlay or joint rehabilitation. Like new condition, no maintenance required.
<b>8</b> Very Good	Pop-outs, map cracking, or minor surface defects. Slight surface scaling. Partial loss of joint sealant. Isolated meander cracks, tight or well sealed. Isolated cracks at manholes, tight or well sealed.	More surface wear or slight defects. Little or no maintenance required.
<b>7</b> Good	More extensive surface scaling. Some open joints. Isolated transverse or longitudinal cracks, tight or well sealed. Some manhole displacement and cracking. First utility patch, in good condition. First noticeable settlement or heave area.	First sign of transverse cracks (all tight); first utility patch. More extensive surface scaling. Seal open joints and other routine maintenance.
<b>6</b> Good	Moderate scaling in several locations. A few isolated surface spalls. Shallow reinforcement causing cracks. Several corner cracks, tight or well sealed. Open (1/4" wide) longitudinal or transverse joints and more frequent transverse cracks (some open 1/4").	First signs of shallow reinforcement or corner cracking. Needs general joint and crack sealing. Scaled areas could be overlaid.
<b>5</b> Fair	Moderate to severe polishing or scaling over 25% of the surface. High reinforcing steel causing surface spalling. Some joints and cracks have begun spalling. First signs of joint or crack faulting (1/4"). Multiple corner cracks with broken pieces. Moderate settlement or first heave areas. Patching showing distress.	First signs of joint or crack spalling or faulting. Grind to repair surface defects. Some partial depth patching or joint repairs needed.
<b>4</b> Fair	Severe polishing, scaling, map cracking, or spalling over 50% of the area. Joints and cracks show moderate to severe spalling. Pumping and faulting of joints (1/4") with fair ride. Several slabs have multiple transverse or meander cracks with moderate spalling. Spalled area broken into several pieces. Corner cracks with missing pieces or patches. Pavement blowups.	Needs some full depth repairs, grinding, and/or asphalt overlay to correct surface defects.
<b>3</b> Poor	Most joints and cracks are open, with multiple parallel cracks, severe spalling, or faulting. D-cracking is evident. Severe faulting (1") giving poor ride. Extensive patching in fair to poor condition. Many transverse and meander cracks, open and severely spalled.	Needs extensive full depth patching plus some full slab replacement.
<b>2</b> Very Poor	Extensive slab cracking, severely spalled and patched. Joints failed. Patching in very poor condition. Severe and extensive settlements or frost heaves.	Recycle and/or rebuild pavement.
<b>1</b> Failed	Restricted speed. Extensive potholes. Almost total loss of pavement integrity.	Total reconstruction.

\* Individual pavements will not have all of the types of distress listed for any particular rating. They may have only one or two types.

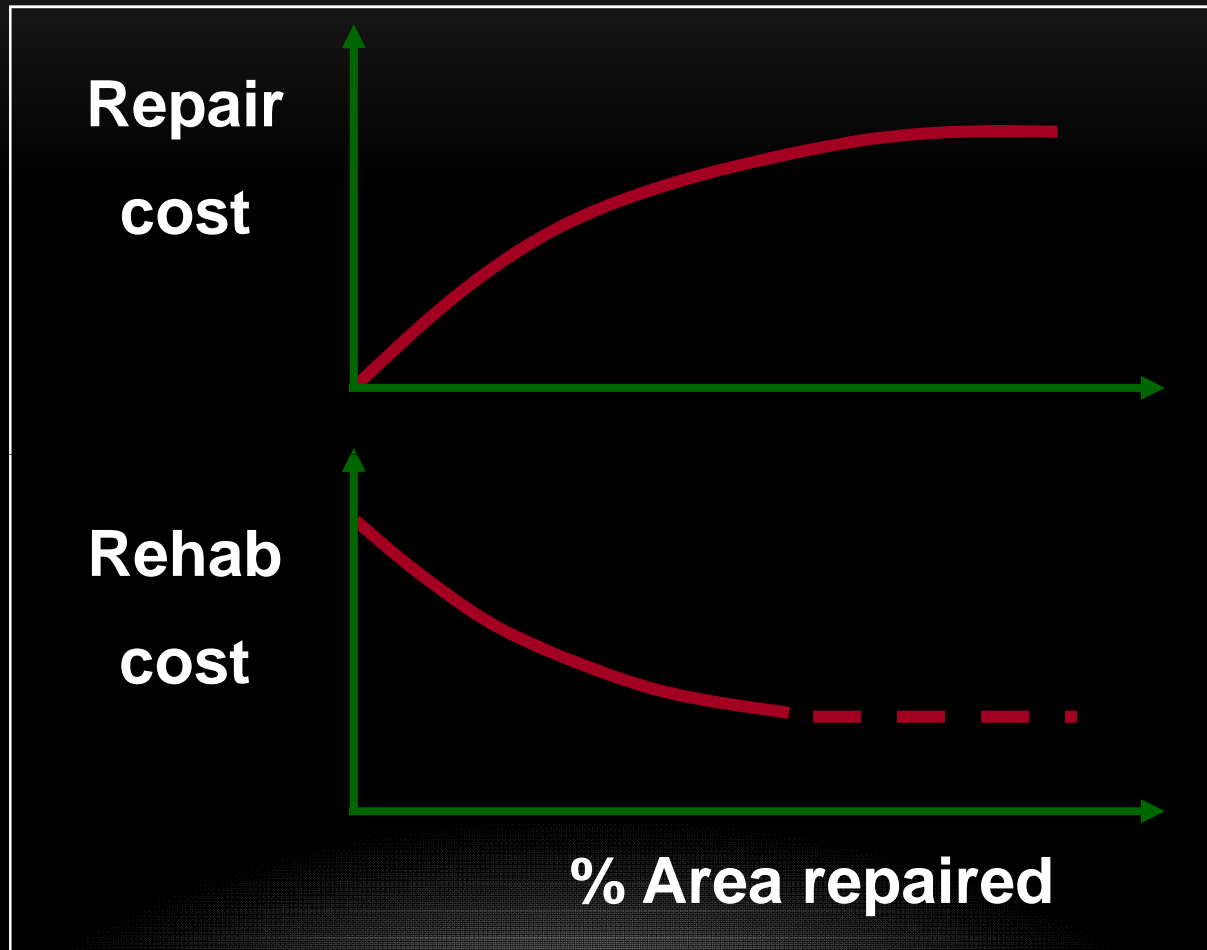
# RESTORATION / REHABILITATION ALTERNATIVES

## Concrete Pavement Restoration (CPR)


- Slab / joint replacement,
- Spall repair,
- Subsurface drainage,
- Diamond grinding,
- Joint sealing.



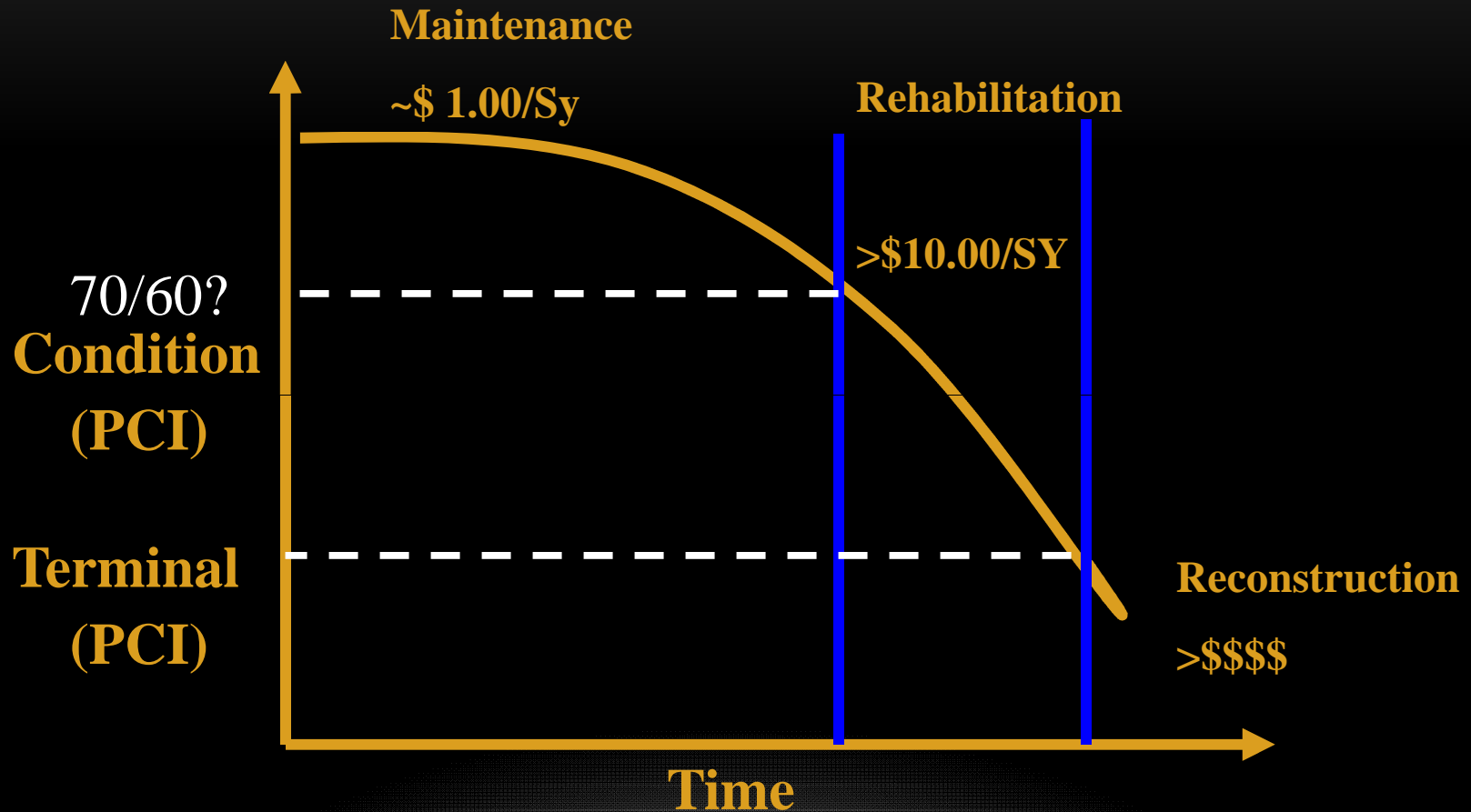
# LOCALIZED REPAIR



# INITIAL AND FUTURE COSTS

- 
1. Straight overlay.
  2. Joint repair and overlay.
  3. Joint repair, level course, and overlay.
  4. Joint repair, crack relief layer, and overlay.
  5. Joint repair, level course, overlay, and saw & seal.
  6. Joint repair, inter-layer, and overlay. (Saw & seal option)
  7. Joint repair, level course, geotextile, and 2.5" thick overlay. (Saw & seal option)
  8. Rubblization.

# PAVEMENT LIFE CYCLE THEORY





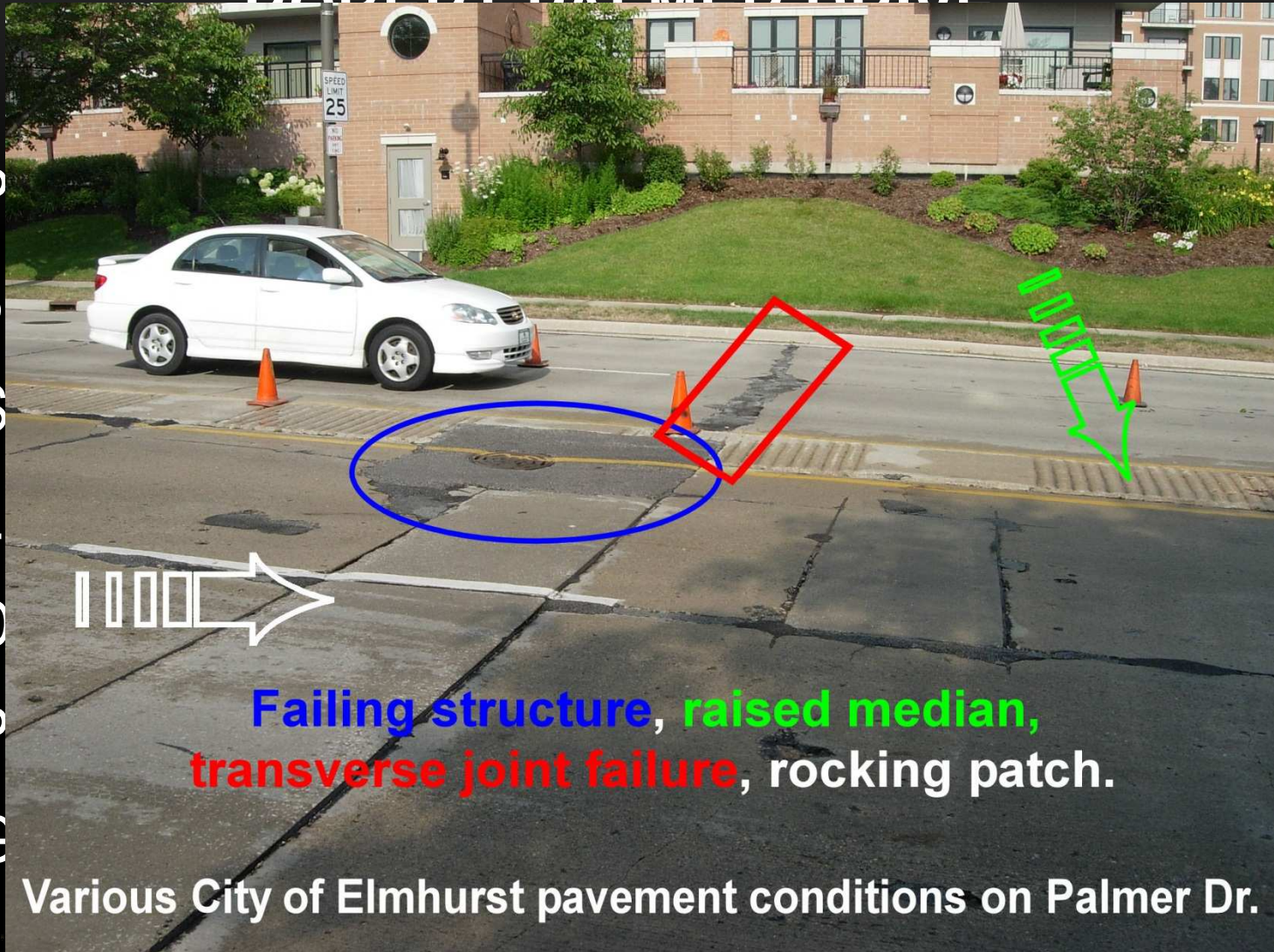
# RESTORATION / REHABILITATION ALTERNATIVES

## HMA Overlays

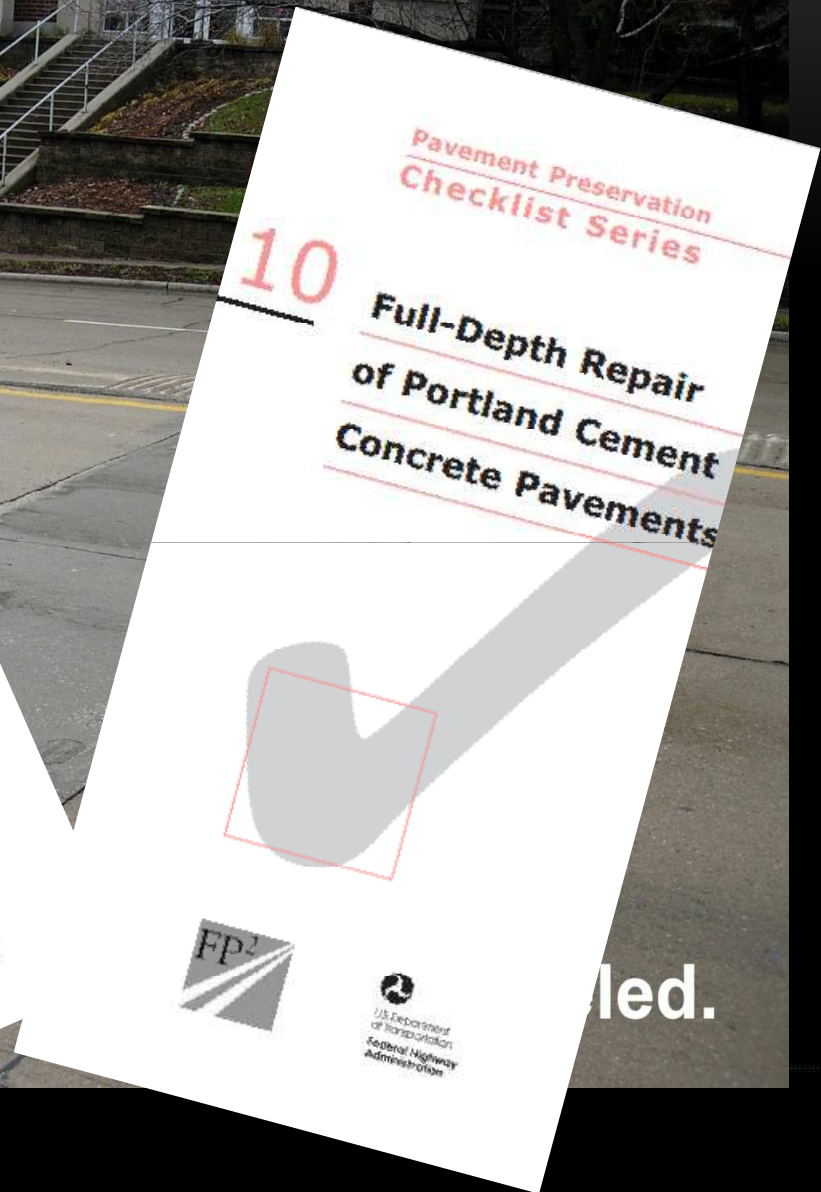
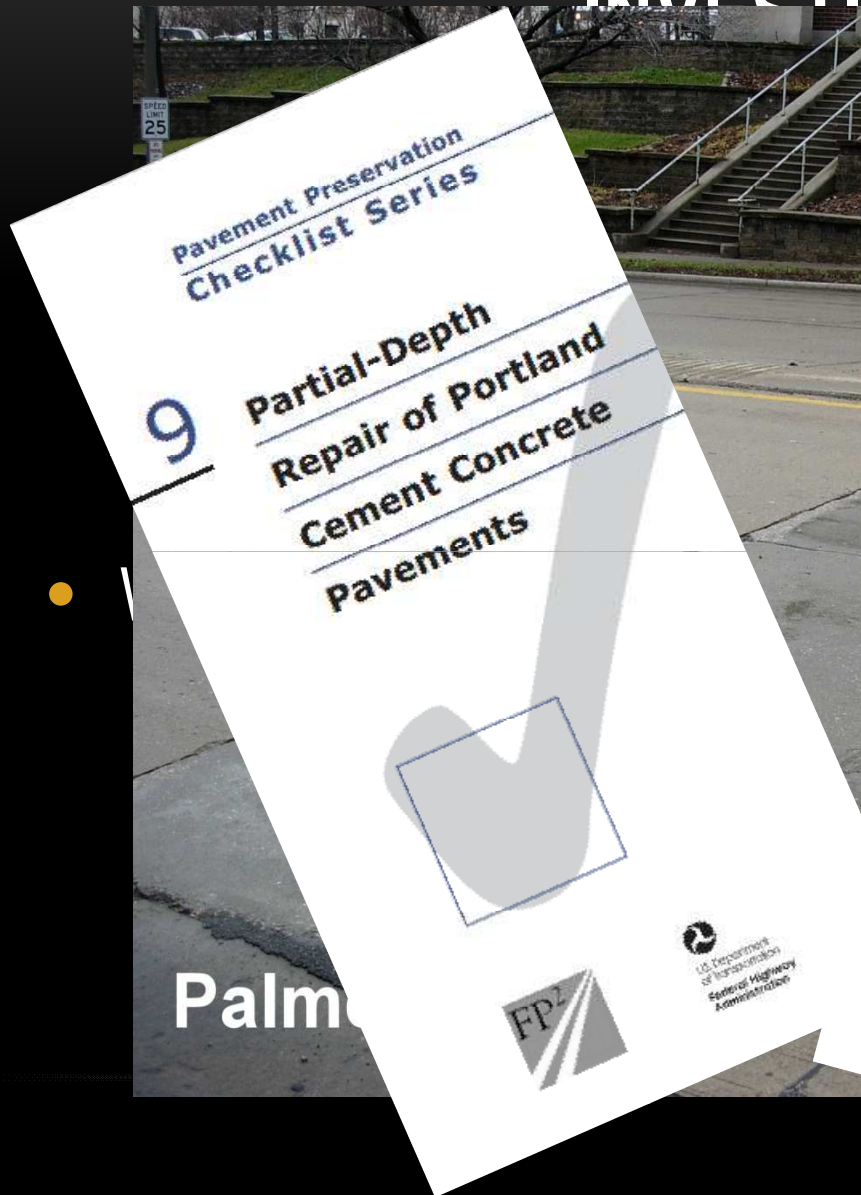
- Over intact PCC pavement
- Over fractured PCC

## Total Reconstruction

# ROBERT PALMER DRIVE



# INVESTIGATION



Palm

led.



# INVESTIGATION

Project Analysis, Fix, and Future pcc Pavement Repairs made this project the 'Village of Elmhurst' prototype.



# OPENING UP A TYPICAL PCC JOINT



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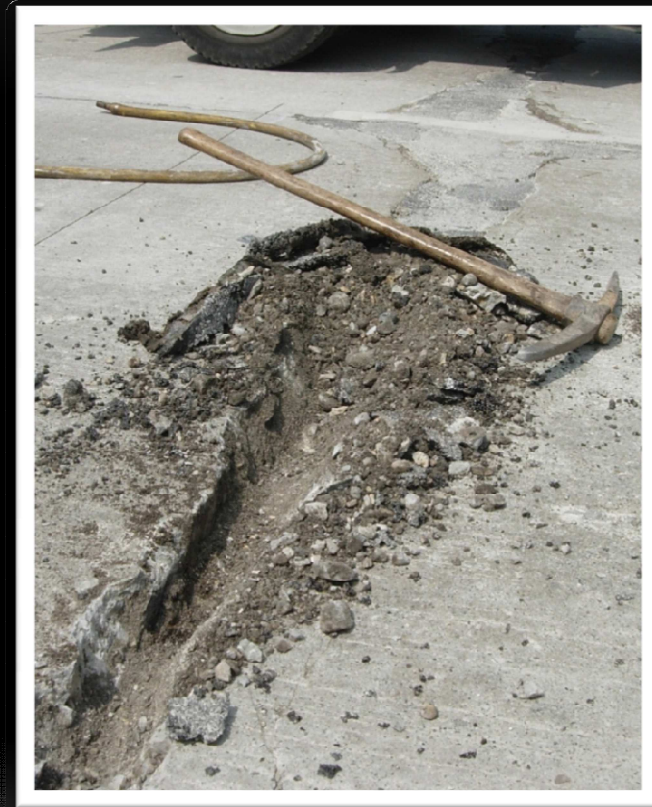
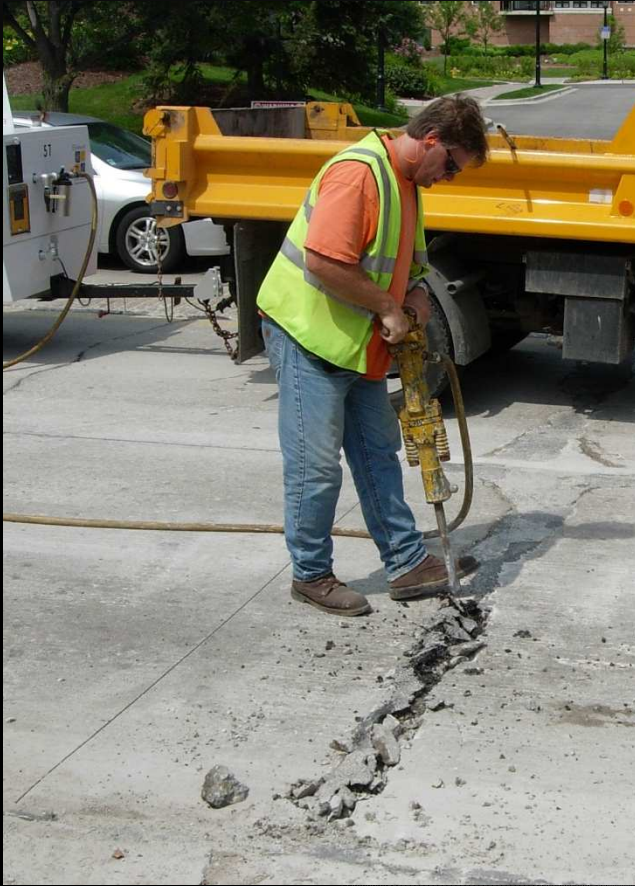




# OPENING UP A TYPICAL PCC JOINT



# CITY EXCAVATION & EVALUATION OF PCC CRACKS





# AREA OF FAILURE WAS WELL DEFINED AND CONFINED



Palmer Dr. excavation and  
evaluation of transverse joints.

# NO AGGREGATE BASE PROBLEMS





# MAJOR INTERSECTION



# WHAT WAS NEEDED ON PALMER DRIVE?

- Waterproofing of the pcc was needed.
- Patching was surface in nature, not full depth.
- Cold milled 'rumble median' and over layed with asphalt.

# WATERPROOFING OF THE PCC WAS NEEDED





# RELAXING AND REALIGNING THE PCC WAS NECESSARY

- 6-ft. wide asphalt patches from curb to curb.





# COLD MILLED PCC PAVEMENT

- Curb reveal.
- Butt joints.
- Spot milling of high points.

# JOINTS

- Important to define working versus non-working joints.
- Summarized quantities for each to make best decision.
- Developed 'global' treatment strategy for each.

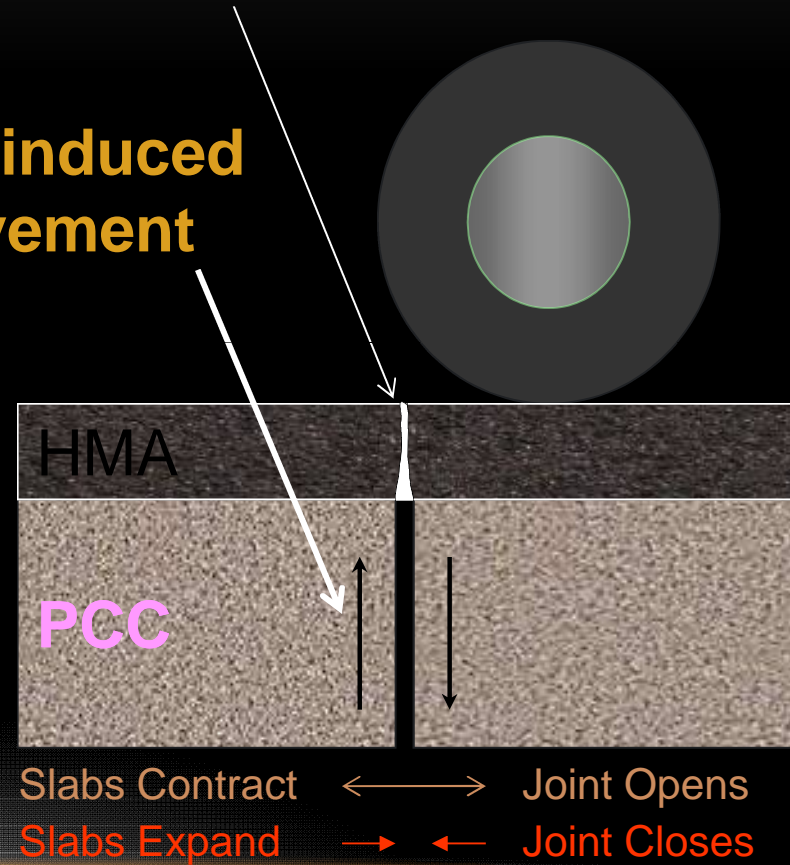
# THE MAJORITY OF SIDE STREETS AND THEIR CONDITION



# REFLECTION CRACKING

## Reflection crack

## Load-induced movement





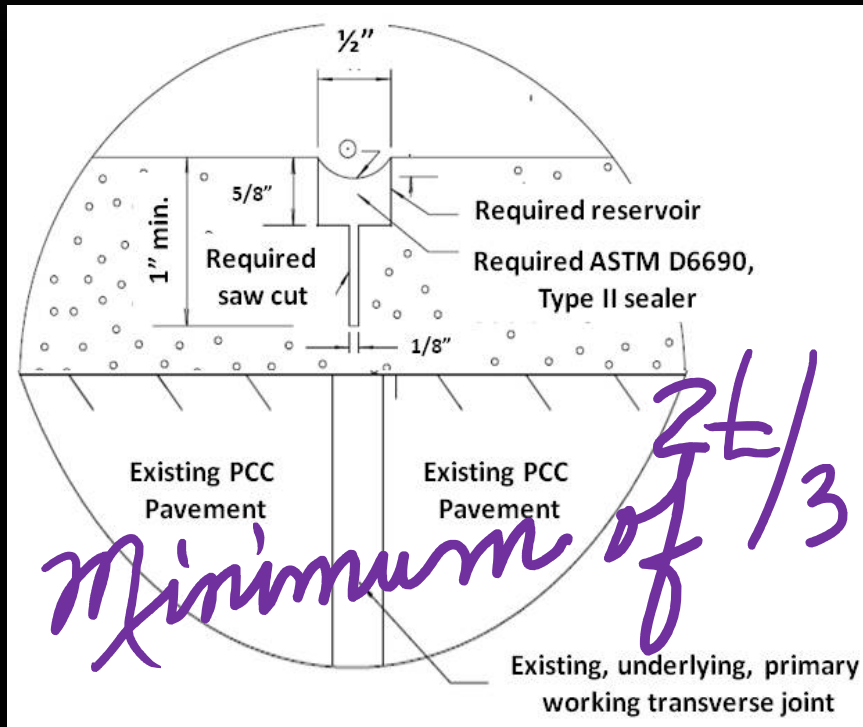
# HMA OVERLAYS ON INTACT STRUCTURALLY SOUND PCC PAVEMENTS

- Even with good load transfer, joints will eventually reflect from thermal movement
- Saw-cut and sealing over joints controls reflection cracking
  - ✓ Provides maintainable joint
  - ✓ Reduces spalling

# SAW-CUT AND SEAL PROCEDURE (REF AI'S MS-17)

- Repair existing PCC, clean and fill joints
- Locate and reference existing joints
- Place and compact HMA
- Saw-cut overlay directly above referenced joints the following day
- Clean and dry saw-cut
- Apply sealant

# SAW AND SEAL (ASPHALT INSTITUTE MS-17)



## Saw-Cut Dimensions

<i>Metric</i>		
PCC Slab Length (meters)	Width (mm)	Depth (mm)
≤ 15	12.5	16
15.5 - 19	16	16
19 - 23	19	16
23 - 26.5	22	19
26.5 - 30.5	25	22

<i>English</i>		
PCC Slab Length (feet)	Width (in.)	Depth (in.)
≤ 50	0.5	0.625
51 - 62	0.625	0.625
63 - 75	0.75	0.625
76 - 87	0.875	0.75
88 - 100	1	0.875



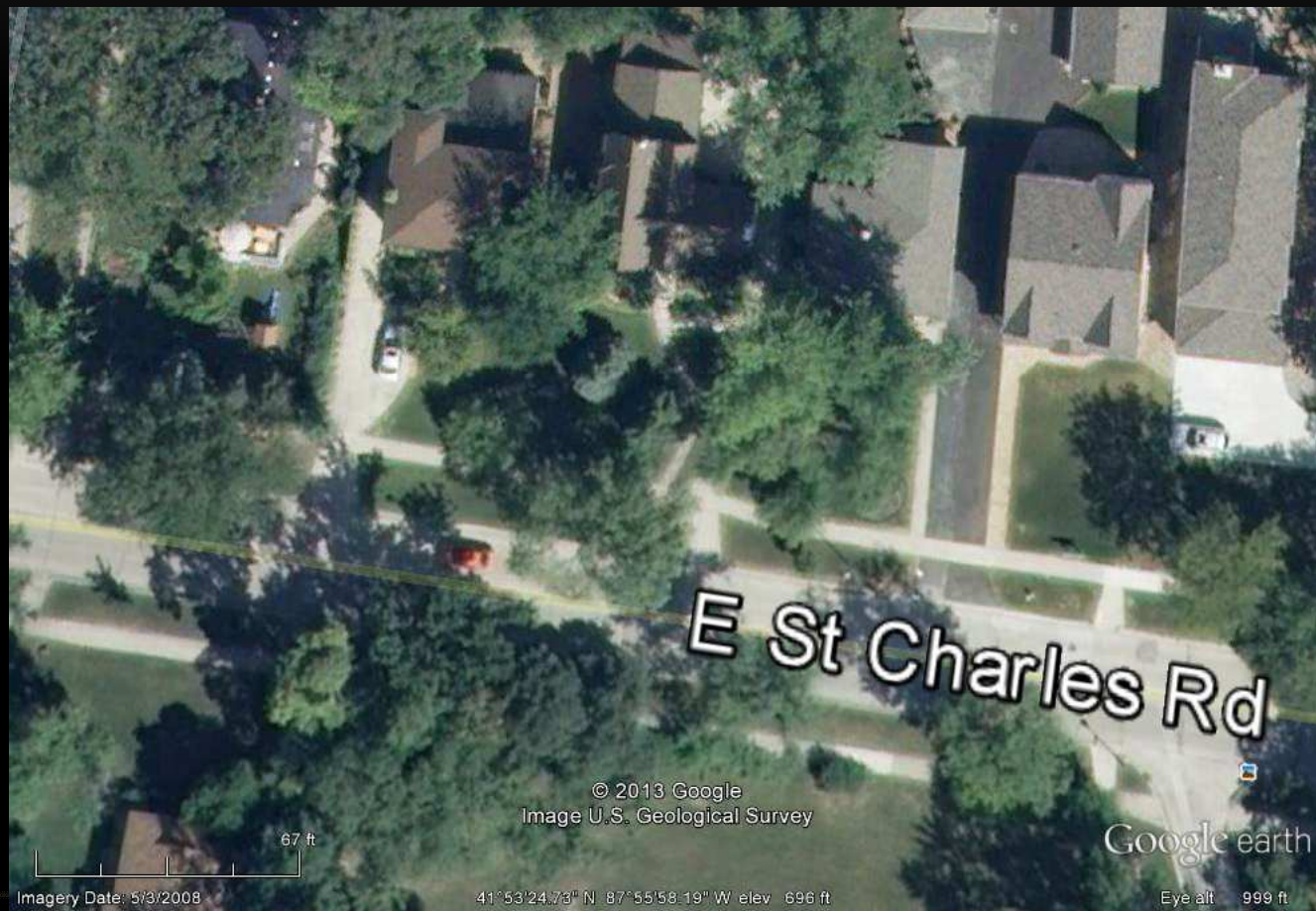
# THE MAJORITY OF SIDE STREETS AND THEIR CONDITION



# ASPHALT NEEDS

- $\frac{3}{4}$ " highly polymerized sand mix to level.
- 2" asphalt surface course overlay.
  - Similar to 448, Type 1.
  - Known as N50, IL-9.5 mm @ 4% Voids.
  - Utilized friction coarse aggregate.
- Saw and seal at 'well defined' transverse joints only.

# 2008





# 2011



# TRANSVERSE IS TYPICAL, LONGITUDINAL SOMETIMES

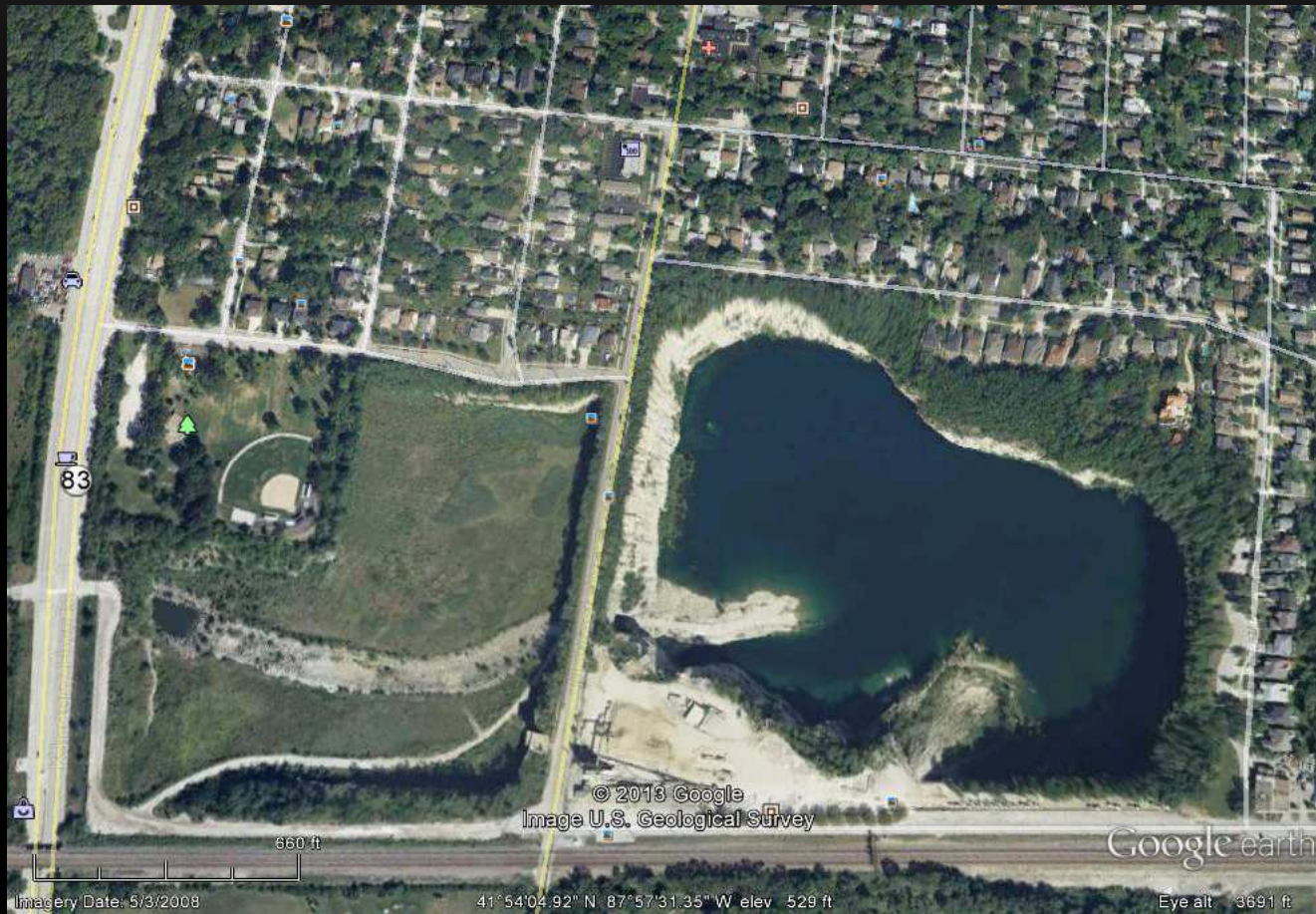




# TRANSVERSE IS TYPICAL, LONGITUDINAL SOMETIMES









© 2013 Google  
Image U.S. Geological Survey

Google earth

Imagery Date: 5/3/2008  
34 ft

41°54'03.73" N 87°57'33.21" W elev 694 ft

Eye alt 795 ft







**NOV 2005**



**Composite pavement,  
8" pcc overlaid with 3" HMA**

**MAY 2008**







05/18/2005



# MINNEAPOLIS, MN [10-Y/O PROJECT]



Composite pavement saw & sealed  
with no reflective cracks

# WHAT'S THE ANTICIPATED COST

- Anticipate \$1.25 - \$1.50 / lin. ft.
- Redeploy MFT / Federal Funding \$ (versus maintenance budget).
- Increase pavement life due to:
  - Improved ride quality
  - Elimination of incompressible materials and water.

# HMA OVERLAYS ON INTACT STRUCTURALLY SOUND PCC PAVEMENTS

Inter-layers such as:

- SAMI's,
- Fabrics,
- HMA crack relief layer,
- 4.75 mm (#4)

delay reflection cracking and their effectiveness depends on treatment, timing, climate, conditions, etc.



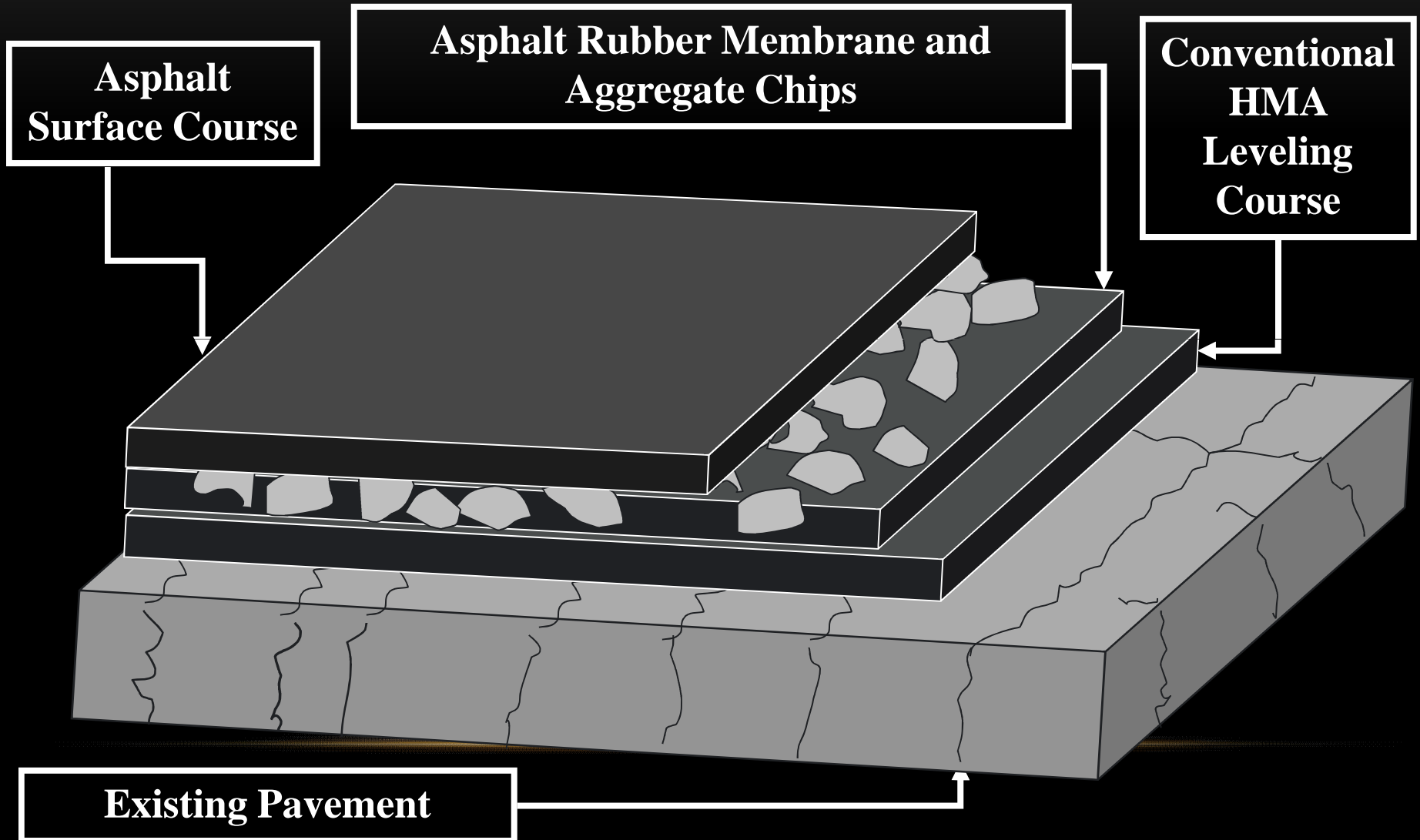
# HOW ABOUT A COMBO SOLUTION?



# INTERLAYERS

- Stress Absorbing Membrane Interlayers (SAMI's)
- Fabrics/Geotextiles
  - Localized
  - Global
- Asphalt interlayer

# 3-LAYER SAMI





# GEOTEXTILE APPLICATION

- Easier to install
- Best on leveling course
- At least 2.5 in. HMA cover and watch traffic volume and motion



**Interlayer Stress Absorbing Composite ISAC®**



# CRACK RELIEF LAYER SYSTEM



Typically asphalt; from 1" to 1/2" top size with no fines.  
May be aggregate base.  
Both require > 20% Voids. (Think OGFC or Porous Asphalt



# ASPHALT INTERLAYER



# MIX GRADATION

Sieve	Percent Passing
9.5 mm (3/8 in.)	100
4.75 mm (No. 4)	90 - 100
2.36 mm (No. 8)	70 - 90
1.18 mm (No. 16)	50 - 65
600 $\mu\text{m}$ (No. 30)	35 - 55
300 $\mu\text{m}$ (No. 50)	15 - 30
150 $\mu\text{m}$ (No. 100)	10 - 18
75 $\mu\text{m}$ (No. 200)	7 - 9

AC Content

7% to 9%





# DO NOT USE VIBRATORY ROLLERS



# FRACTURED PCC SLABS

## Fractured Slab Technology

- Rubblization
- Crack / Break and Seat

**Alternatives to total reconstruction**



# Resonant Pavement Breaker



## Roll shattered PCC



## Result

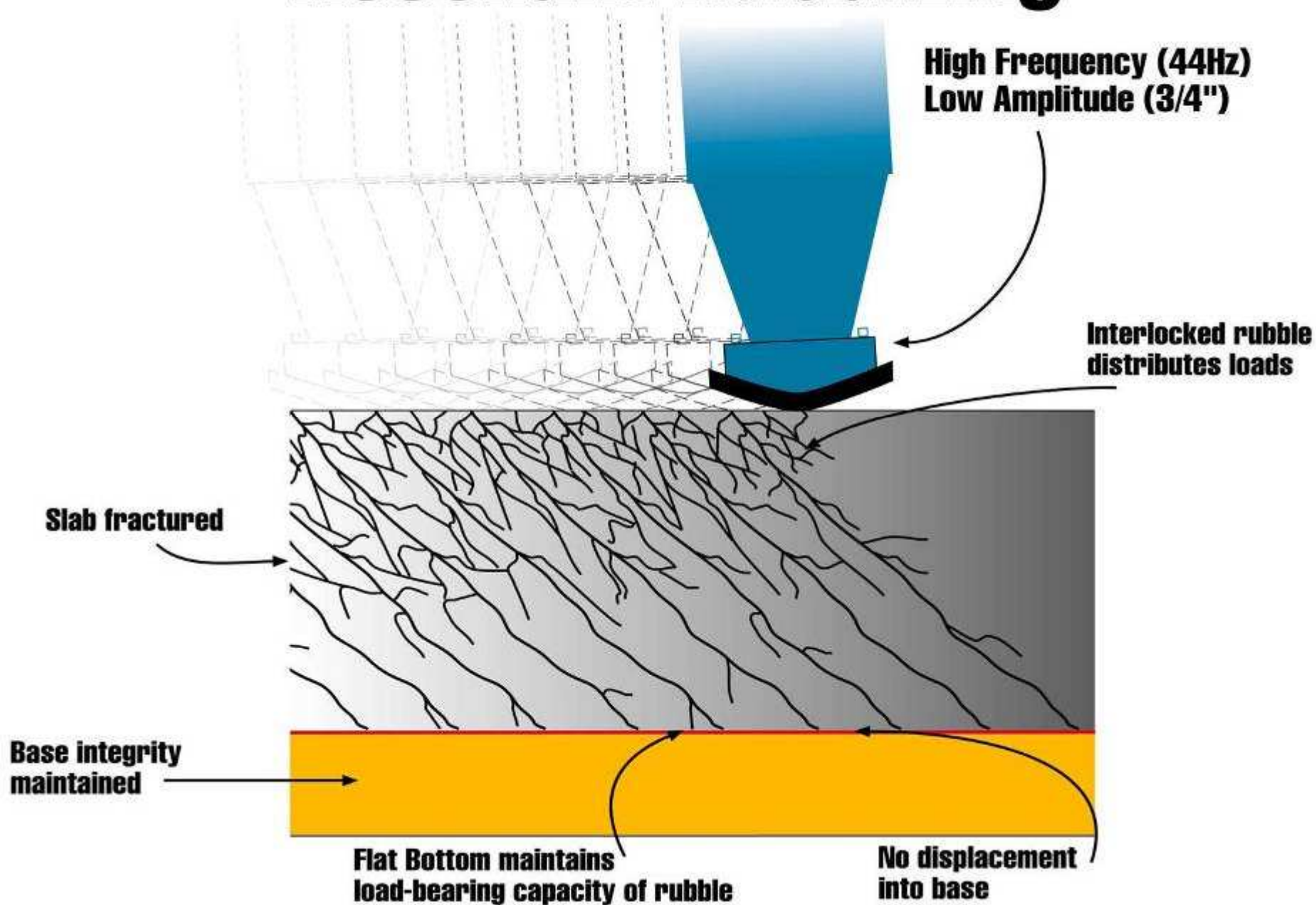


## Resonant Pavement Breaker

- Low amplitude,  $\frac{3}{4}$  inch
- High Frequency, 44 HTZ
- Single Breaking Shoe
- 9-12" per pass on free edge



# Resonant Rubblizing



# RUBBLIZED PCC



- 6 in. or minus pieces
- Most are 1-3 in. diameter
- Aggregate interlock
- Rolling
  - ✓ Resizes
  - ✓ Knits together surface particles



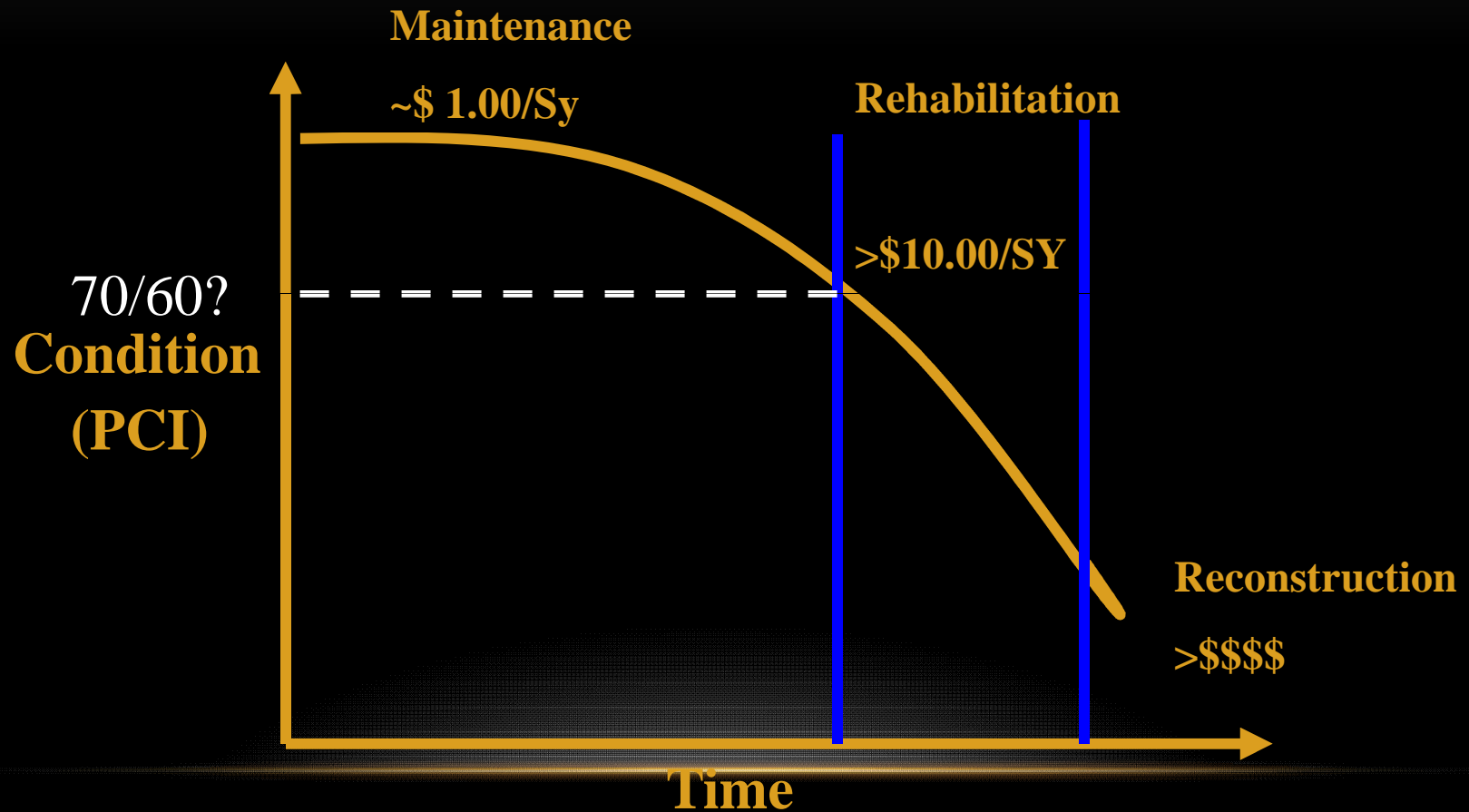
# RUBBLIZED PCC @ JOINT

**Remove excess joint Sealer**





# PAVEMENT LIFE CYCLE THEORY




# COST ANALYSIS FROM AI – MS-17

Repair / Replacement Activity	Unit Cost
PCC Patching	\$75 / sy
Saw & Seal	\$1.50 lin. ft.
Asphalt Base	\$1.50 / sy / in.
Asphalt Surface	\$1.75 / sy / in.
Rubblize	\$1.50 / sy

**COST OF PCC PATCHING  
PRIOR TO ASPHALT OVERLAY VERSUS  
FRACTURED SLAB REHABILITATION**

**BREAK EVEN ~13% PATCHING**

# INITIAL AND FUTURE COSTS

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# QUESTIONS?



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