

## Rehabilitation for Concrete Pavements

[www.AsphaltAlliance.com](http://www.AsphaltAlliance.com)

## Overview

- Effective rehab for PCC
  - Break PCC into small segments
  - Overlay with Hot Mix Asphalt Road-user-friendly
  - Rubblize and pave in off-peak hours
  - High production rates
- Final Product

## What is rubblization?

- **Fracturing:**
  - Eliminates slab action
  - Destroys bond between concrete and steel
- **Rubblized base responds as a tightly keyed, interlocked high-density, unbound layer**
  - Layer cannot crack; already fractured

## Why Rubblize?

- Fracturing PCC to segments less than 9" precludes reflection of:
  - Joints
  - Cracks
  - Faults
- Production Rates up to 1 lane-mile/day

## Purposes for Overlaying PCC Pavements

- Improve ride quality
- Correct surface defects
  - improve surface drainage
  - increase surface friction
- Delay/prevent structural deterioration
- Strengthen pavement structure (rehabilitation)

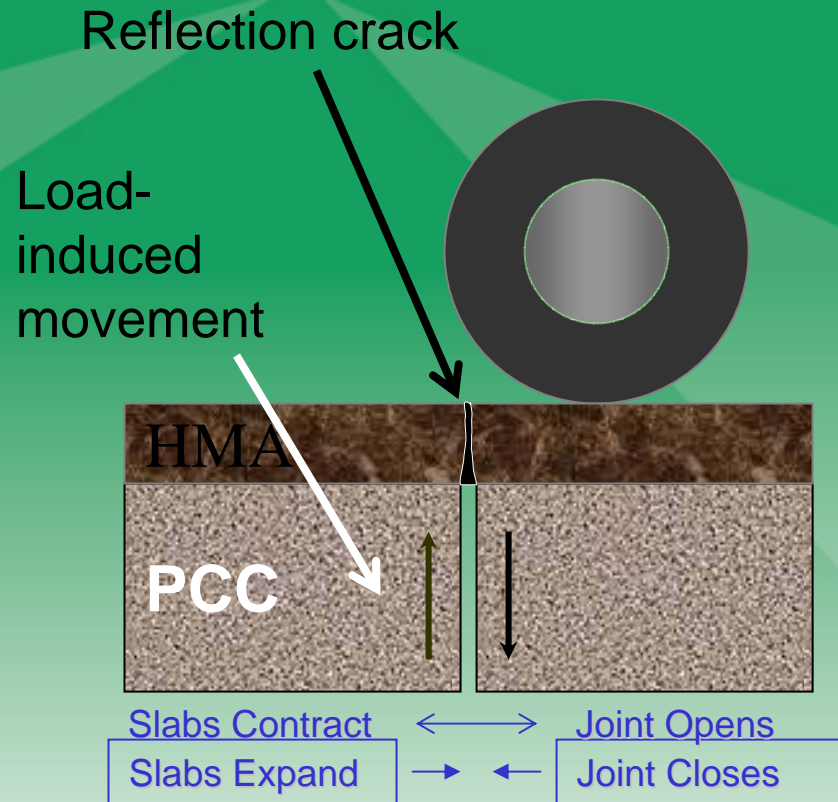
## Pavement Rehabilitation Design Factors

- Pavement type
- Condition of existing pavement
  - Drainage
  - Distress
  - Response to load
- Foundation strength/stiffness
  - Subbase
  - Subgrade
- Future traffic loading
- Additional corrections (safety, capacity, etc)

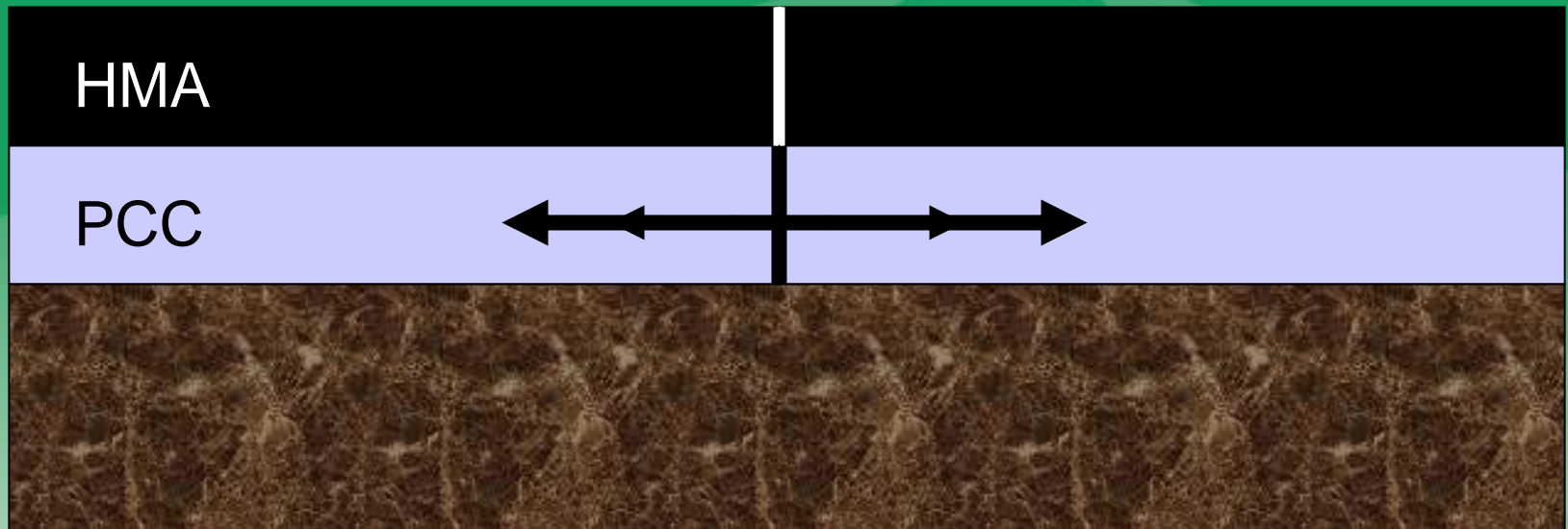
# Rubblization

## Reflection Cracking

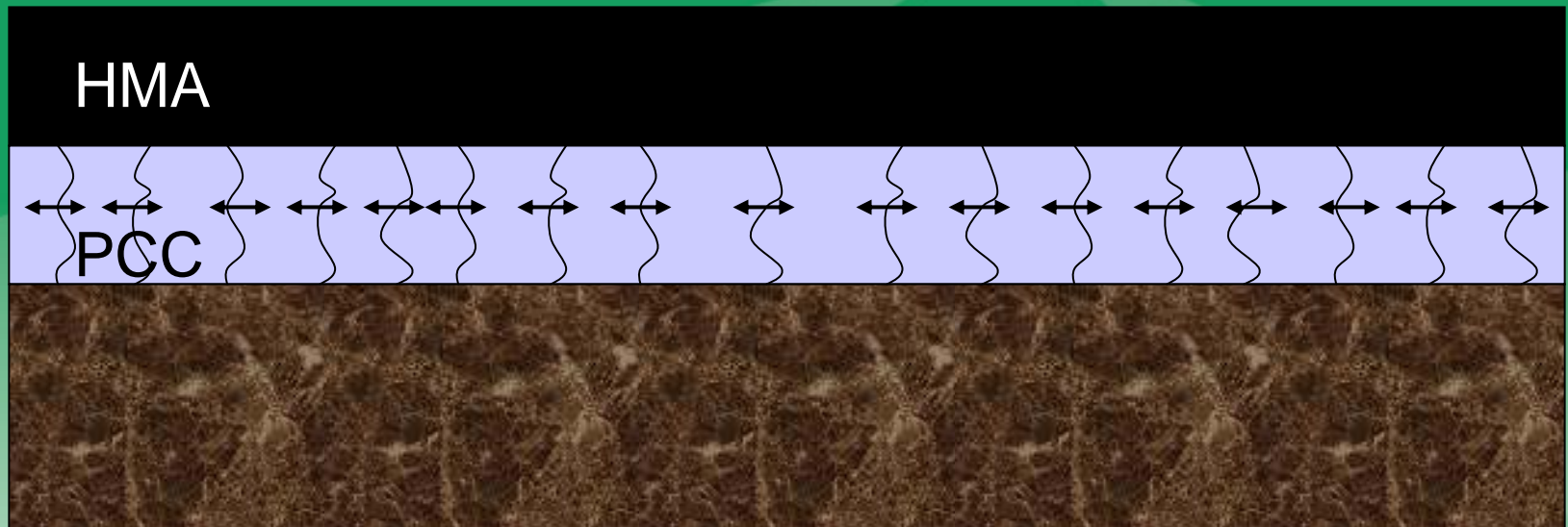
- By far, the biggest problem in HMA overlays of PCC pavement
- Caused by movement at PCC joints and cracks



Larger Pieces = Larger Movement = Cracking



**Smaller Pieces = Smaller Movement = No Cracking**



## Benefits

- Time savings
  - Choose work hours
  - High production rates
- Economic Savings
  - Reduce user delay costs
  - Reduce construction costs

## Benefits (continued)

- Environmentally friendly
  - Reduce landfill
  - Reduce fuel consumption/air pollution
- Smoothness
  - Eliminate reflection cracking/faulting

## Construction Procedure

- Install/replace existing edge drainage system as required
- Remove existing overlay (if present)
- Remove existing HMA patches, replace with aggregate base as required
- Fracture the concrete pavement
- Roll
- Place HMA overlay (multiple lifts)

## Resonant Pavement Breaker



# Rubblization



**Multi-Head Breaker (MHB)**

# Rubblization

## Rolling



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## Particle Size



- PCC fractured into 9 in.-minus pieces
- Most pieces are 1- 4 in. diameter
- Aggregate interlock maintained beneath surface
- Rolling knits together surface particles

## When to Rubblize

- ☐ Patching  $\geq 10\%$ .
- ☐ Severe D-cracking.
- ☐ Severe ASR or ACR cracking.
- ☐ Dowel bar locking
- ☐ Severe joint deterioration
- ☐ Persistent faulting.

## Precaution

- Weak soils may make construction difficult.
- Option 1
  - Adjust breaking pattern (12 - 18") in soft areas.
  - Use normal seating rolling.
  - Resume smaller pattern after weak area.

## Precaution

- Option 2
  - Cease rubblization
  - Define weak area
  - Remove/replace problem material
  - Resume normal operations when past weak area
- Perform a good soils evaluation prior to construction

## How Effective is Rubblization?

- Witczak and Rada, 1992
  - "Rubblization . . . is the preferred rehabilitation method for all types of PCC pavements."
- Thompson, 1999
  - Rubblization is a "viable and cost-effective rehabilitation option."

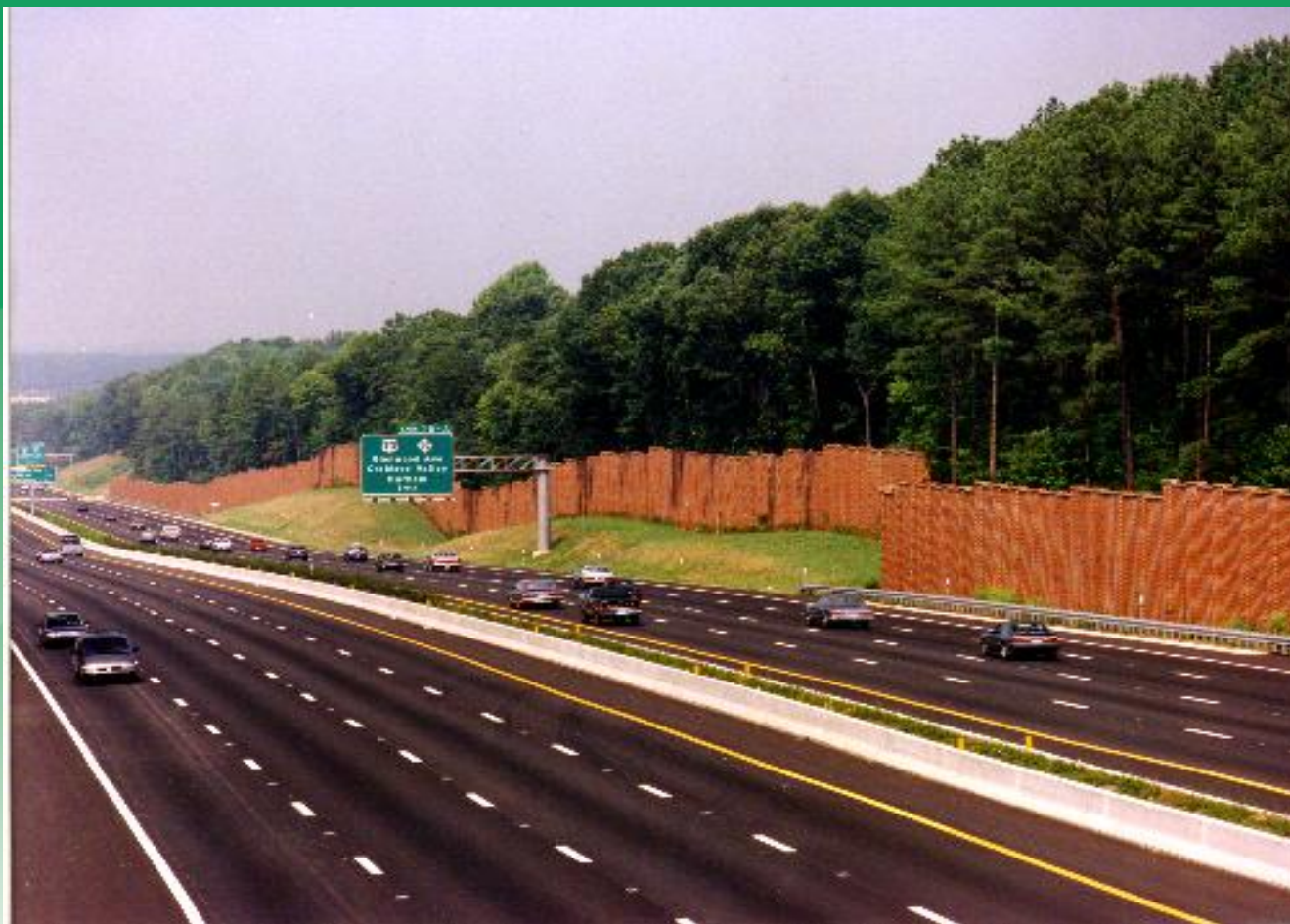
## How Effective is Rubblization?

- 26 States have specifications for Rubblization
- Arkansas
  - 100 miles of rubblization this year
  - 300 miles over a 3-year period

## Projects

- I-440, Raleigh Beltway, North Carolina
  - \$21.5 million contract
  - 3 1/2 mile project
  - AADT = 100,000+
- Awards
  - 1993 Sheldon G. Hayes Award - NAPA
  - 1993 Pinnacle Award - AGC
  - 1995 NQI Achievement

## I-440, Raleigh Beltway, North Carolina



## I-65, Alabama

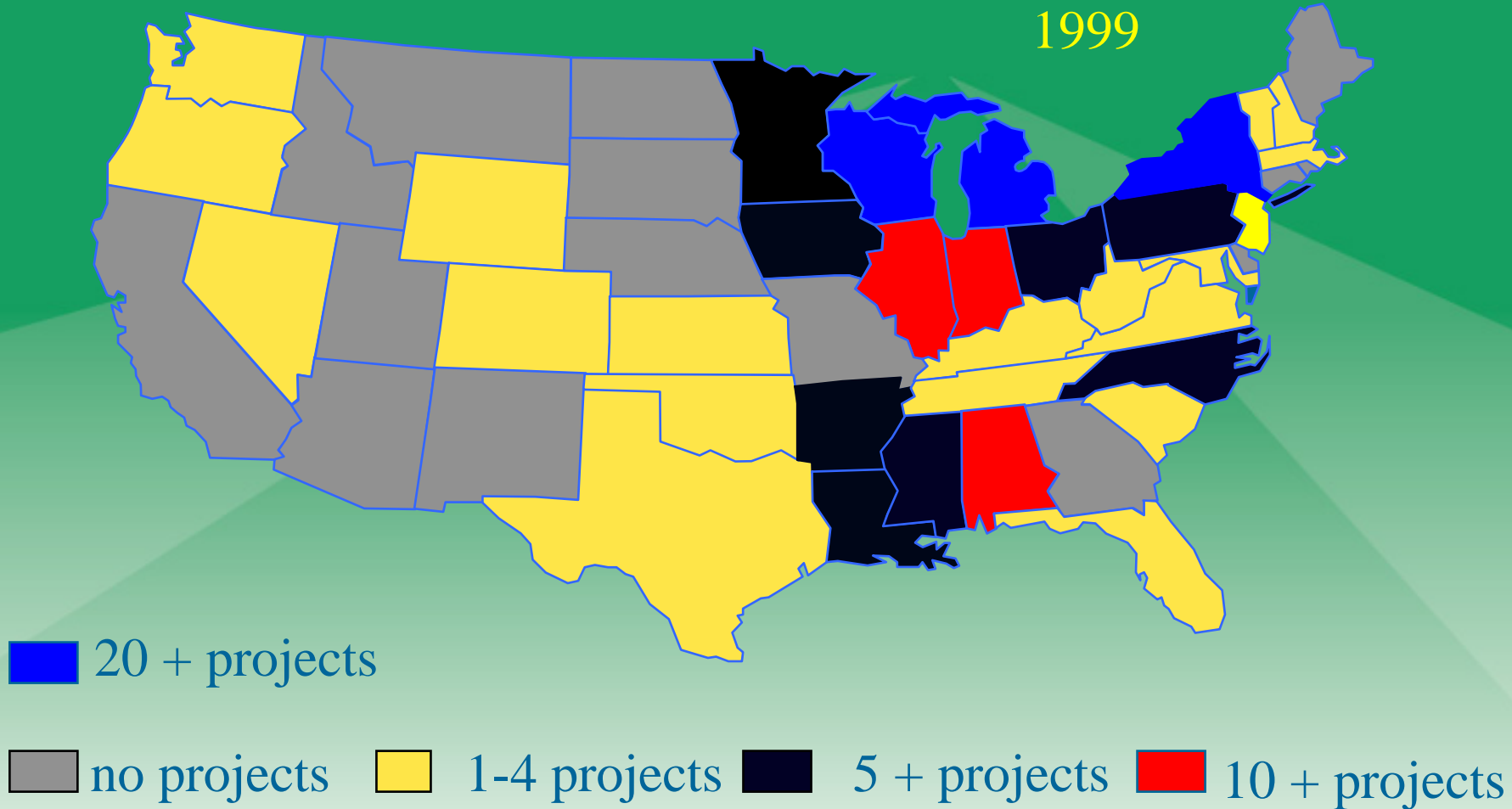
- Rubblize existing concrete pavement
- Widen overall roadway
- Place Permeable Asphalt Treated Base under new lanes
- Overlay with Superpave
- FHWA Showcase October 1997

# Rubblization



## Projects

As of July  
1999



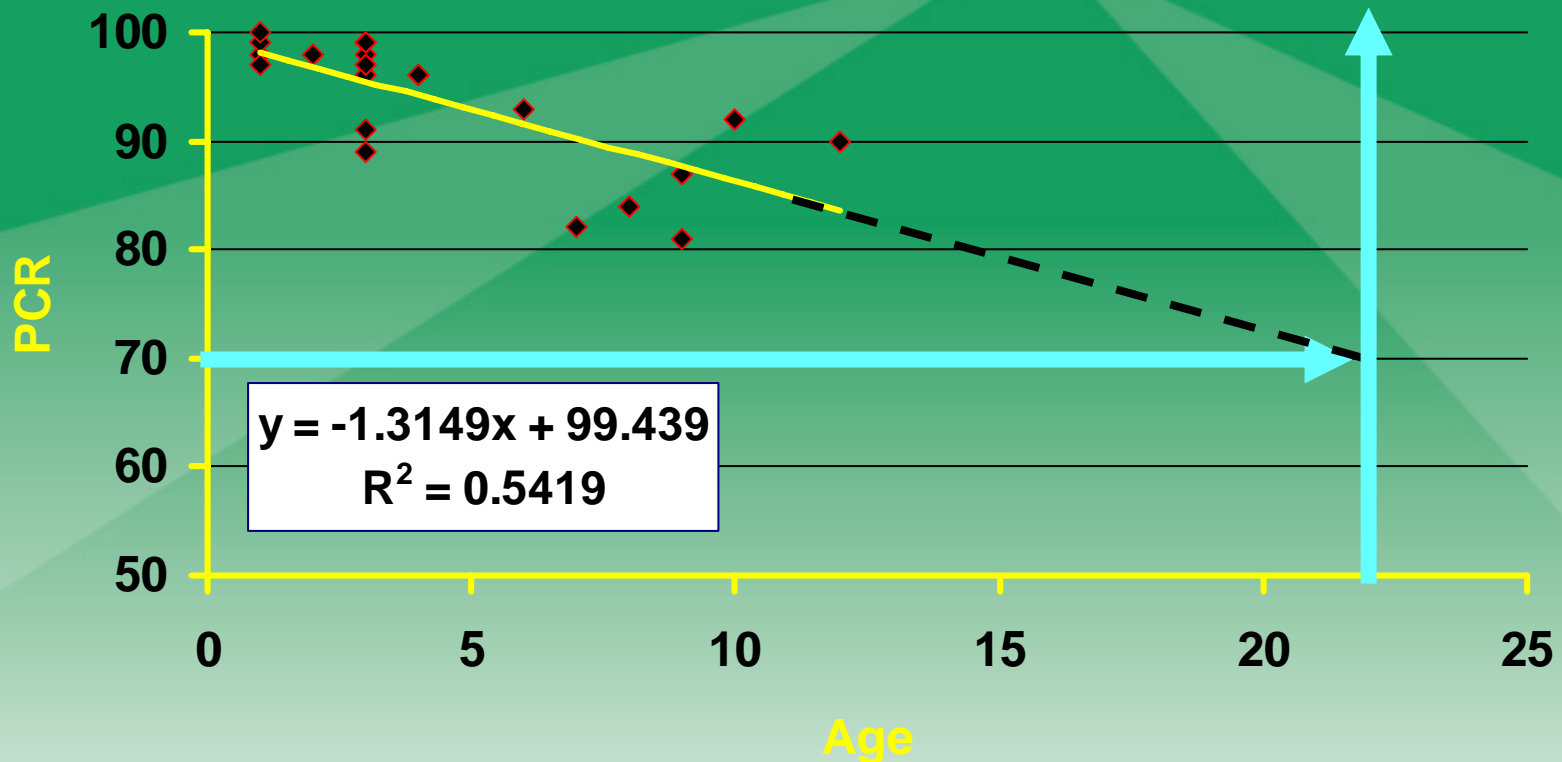
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# Rubblization

## Rubblizing Performance All Data

**PCR = 70 @ 22.4 years**



## Comparisons

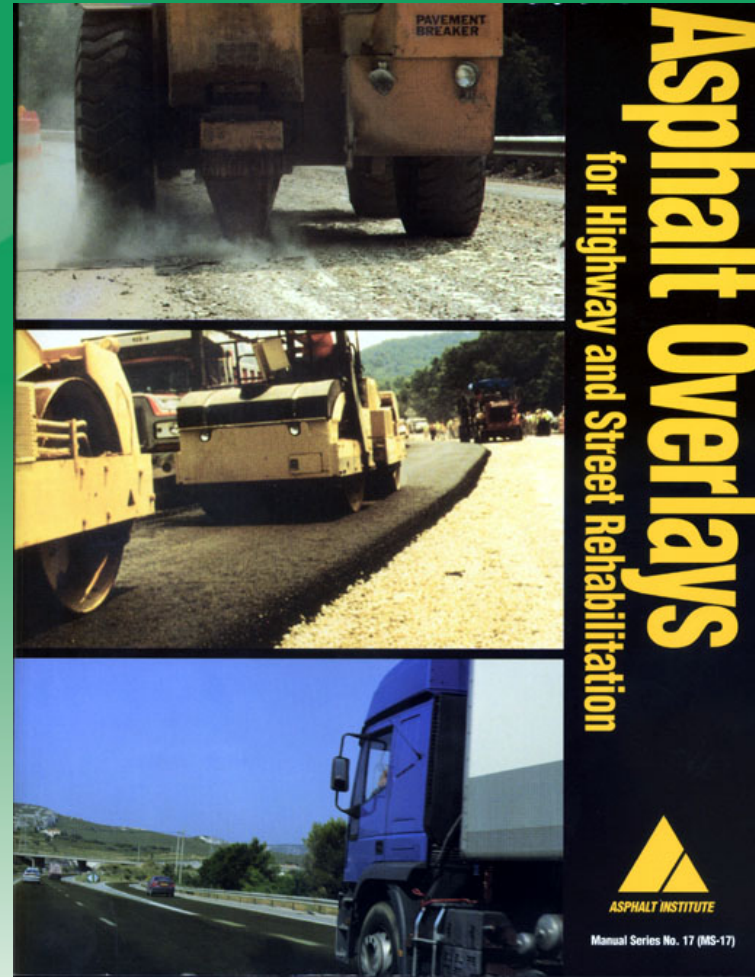
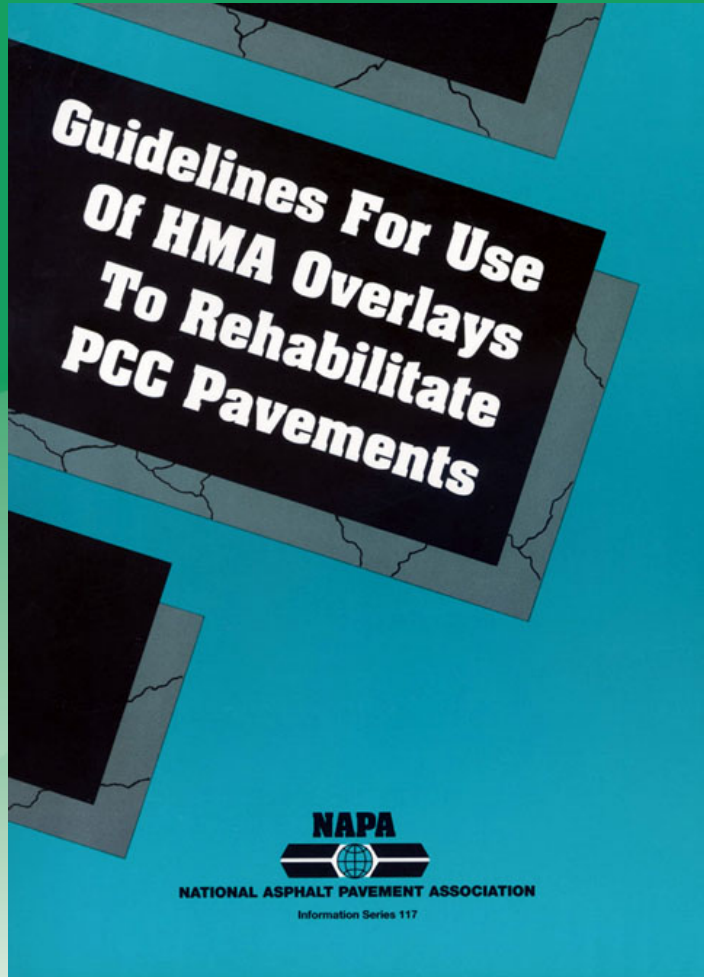
### Alternatives:

- Rubblize PCC, overlay with 10" HMA
- Remove PCC, replace with 12" Fast Track PCC
- Leveling course, 10" Fast Track PCC

## Comparisons

<u>Alternative</u>	<u>Est. Cost</u>
Rubblize, 10" HMA	\$17-23/sy
10" unbonded PCC (Fast Track)	\$26-36/sy
Remove, replace w/12" Fast Track PCC	\$34-46/sy

## References



## Conclusions

- Rubblization is effective. Prevents reflective cracking.
- Rubblization can be done rapidly, minimizing delays.
- Researchers and agencies have concluded that rubblization is technically sound.