Preserving Concrete Pavement

Larry Scofield
IGGA and ACPA

NATIONAL PAVEMENT PRESERVATION CONFERENCE
nppc23
IMPACTS AND BENEFITS FROM PAVEMENT PRESERVATION

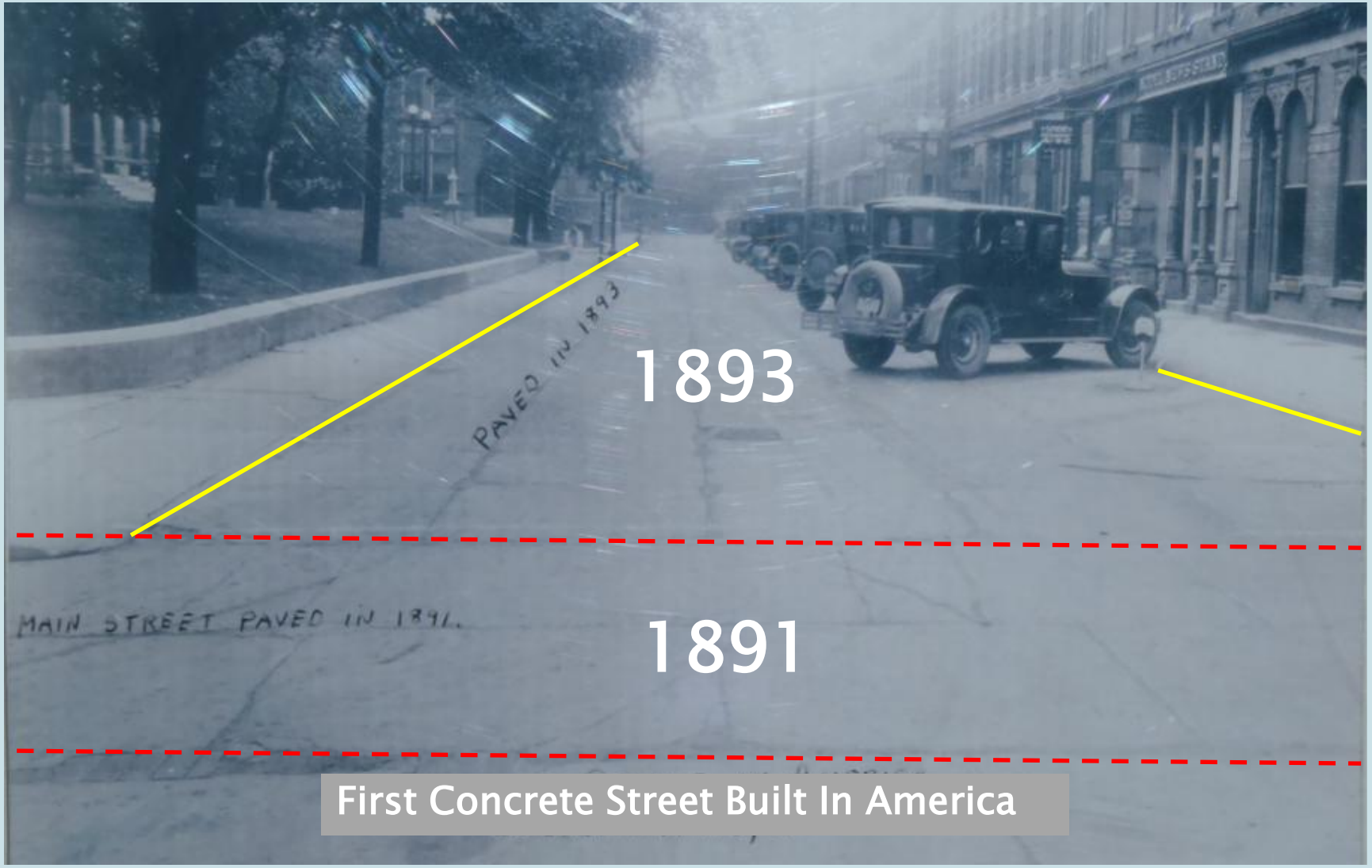
ncpp National Center for Pavement Preservation
MICHIGAN STATE UNIVERSITY

AASHTO TSP2 PAVEMENT PRESERVATION

ROCKY MOUNTAIN WEST PAVEMENT PRESERVATION PARTNERSHIP
SOUTHEAST PAVEMENT PRESERVATION PARTNERSHIP
MIDWESTERN PAVEMENT PRESERVATION PARTNERSHIP
NORTHEAST PAVEMENT PRESERVATION PARTNERSHIP

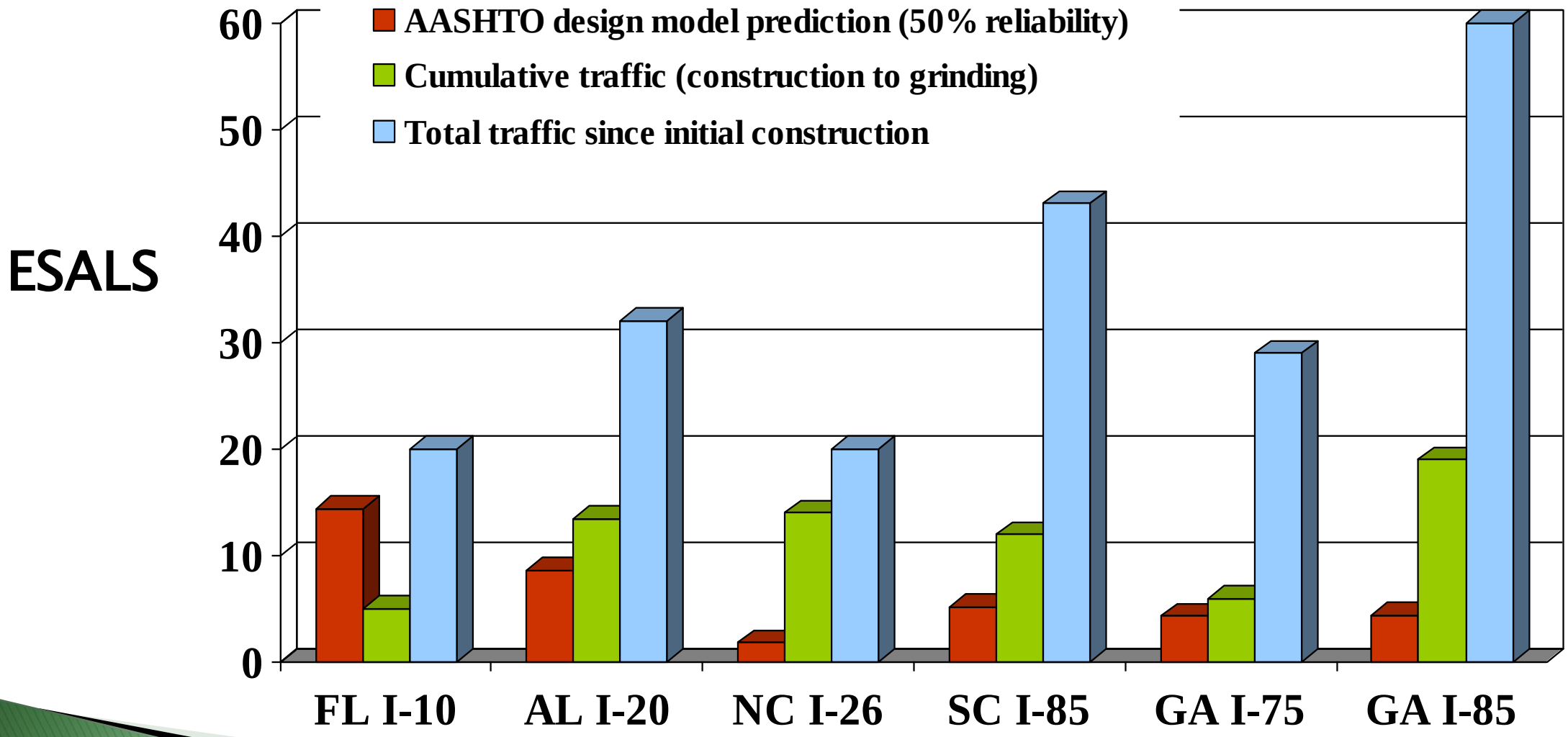
Why Concrete Pavement Preservation

Bellefontaine, Ohio 1925



2023 = 130th Anniversary

Design Life Vs Actual Performance

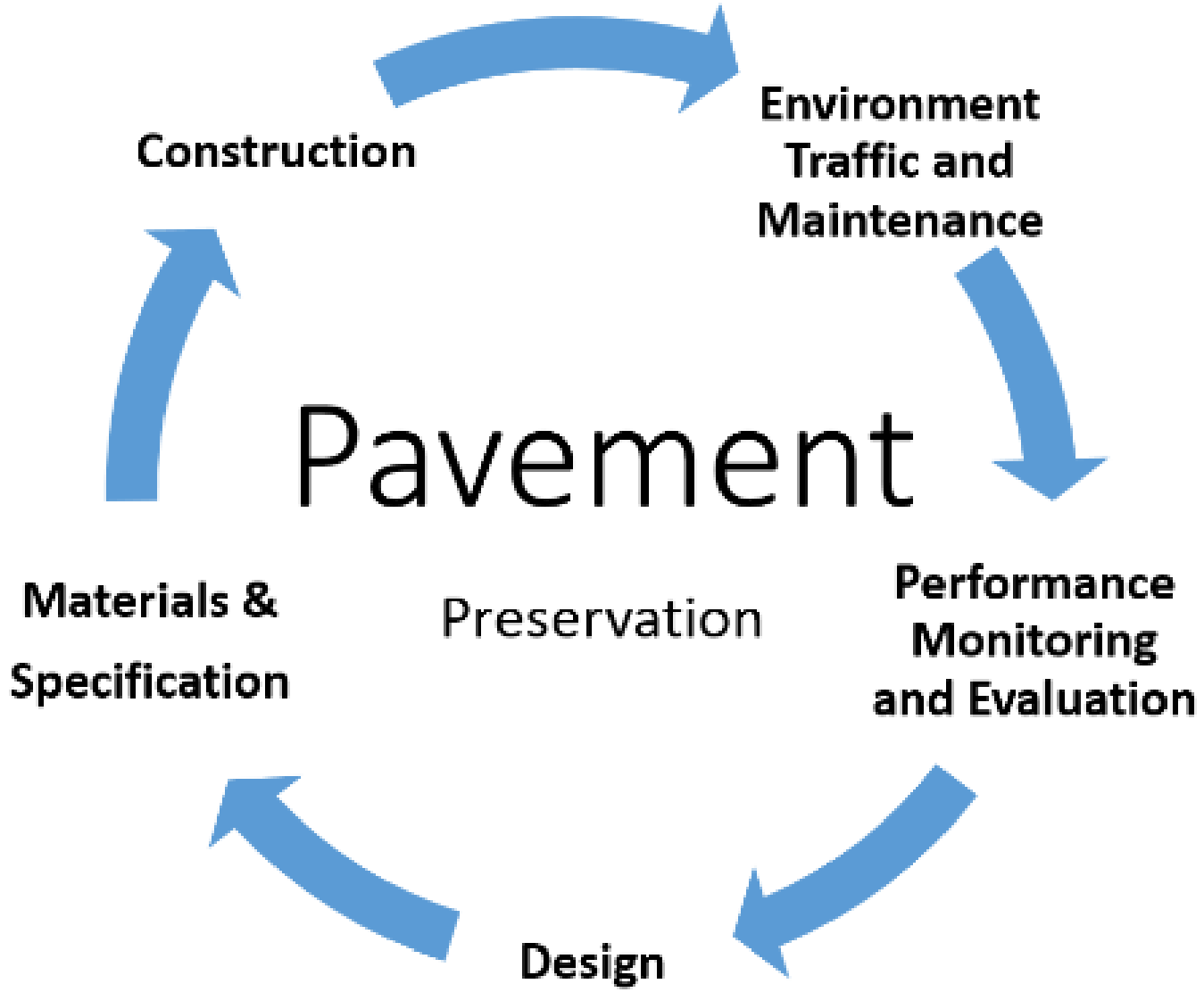


Courtesy Dr. Michael Darter

Things to Remember About PMS and Concrete Pavement Preservation

Photo Courtesy Amarjeet Benipal -- Caltrans

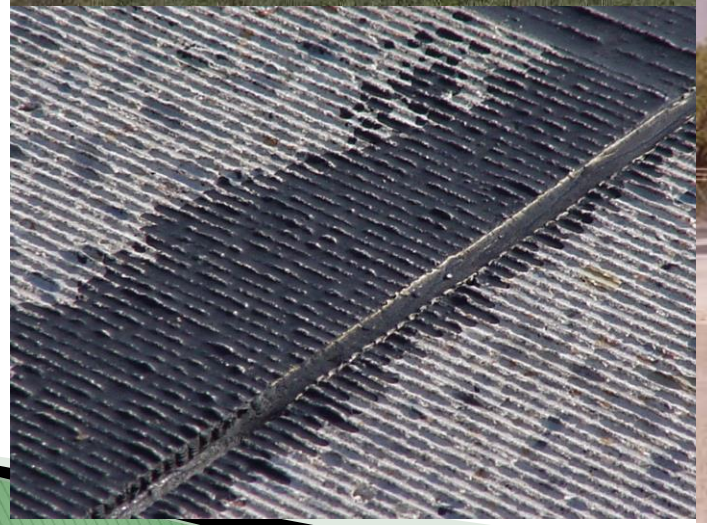
Cradle to Grave Management!



Typical Concrete Preservation Activities

- Diamond Grinding or Diamond Grooving
- Full Depth or Partial Depth Repairs (Gordy Bruhn)
- Dowel Bar Retrofit
- Joint Sealing or Resealing
- Slab Jacking
- Longitudinal Crack Stitching

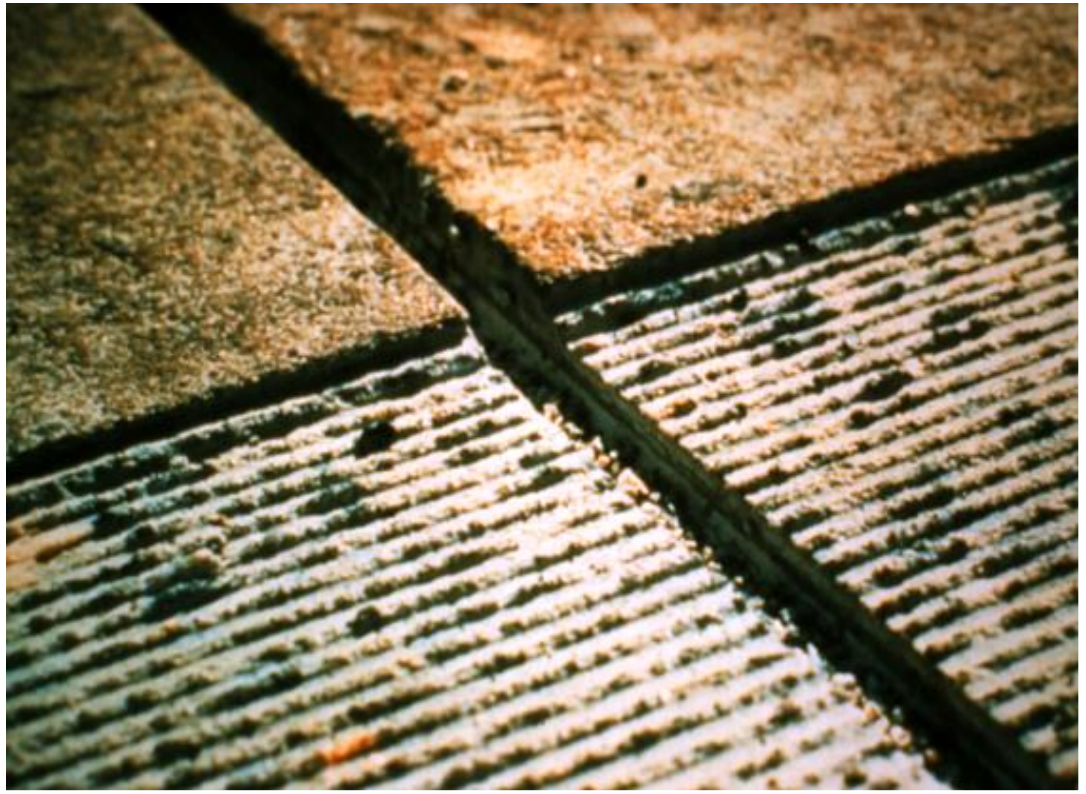
Grinding Concrete



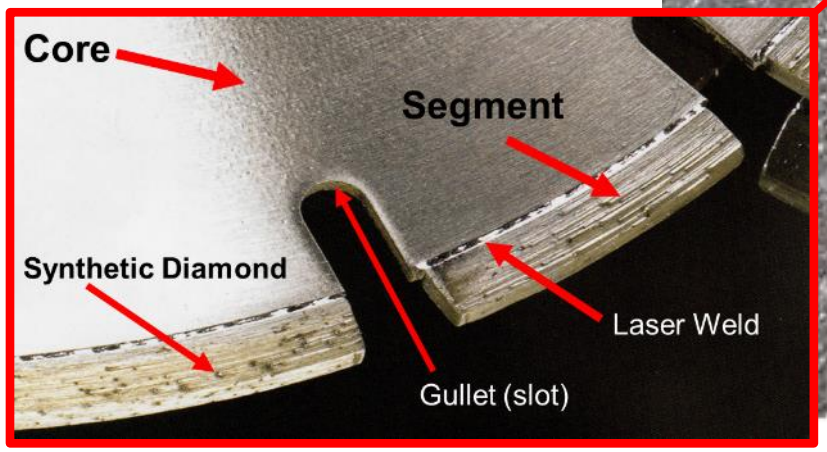
Diamond Grinding

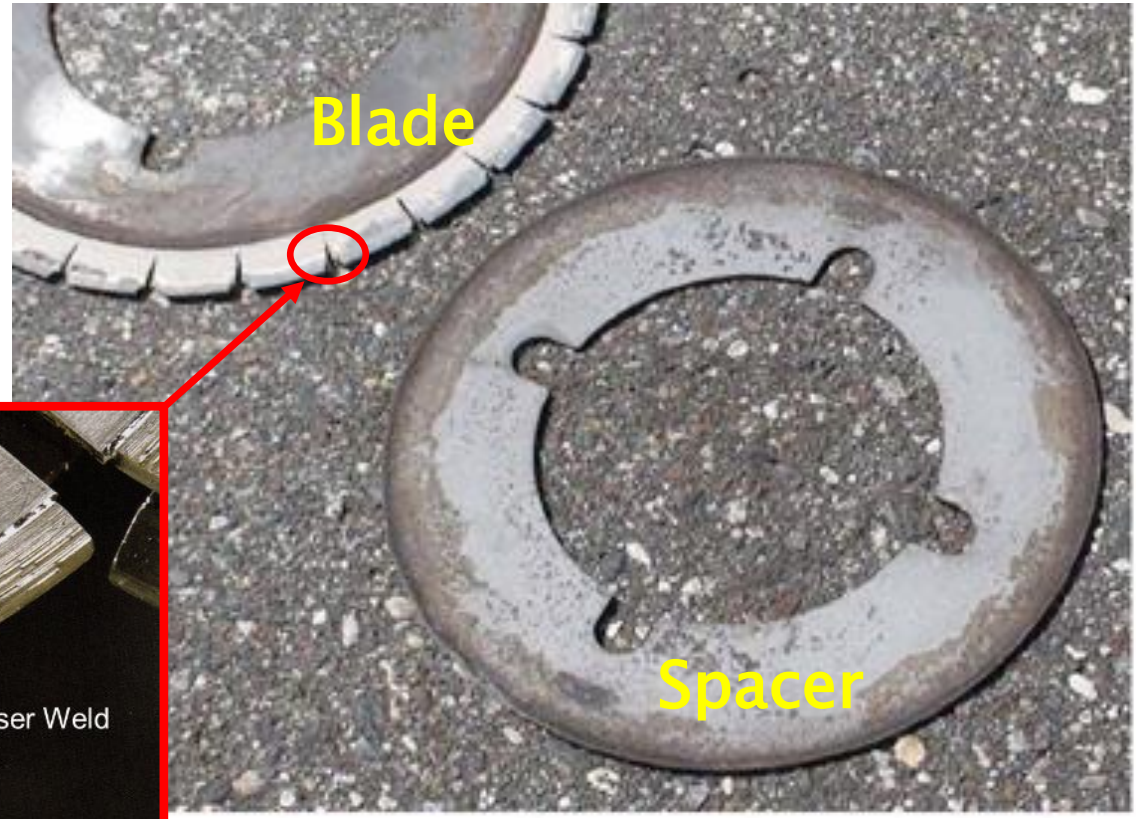
- Improves Friction
- Reduces Noise

- Removes Faulting
- Improves Ride

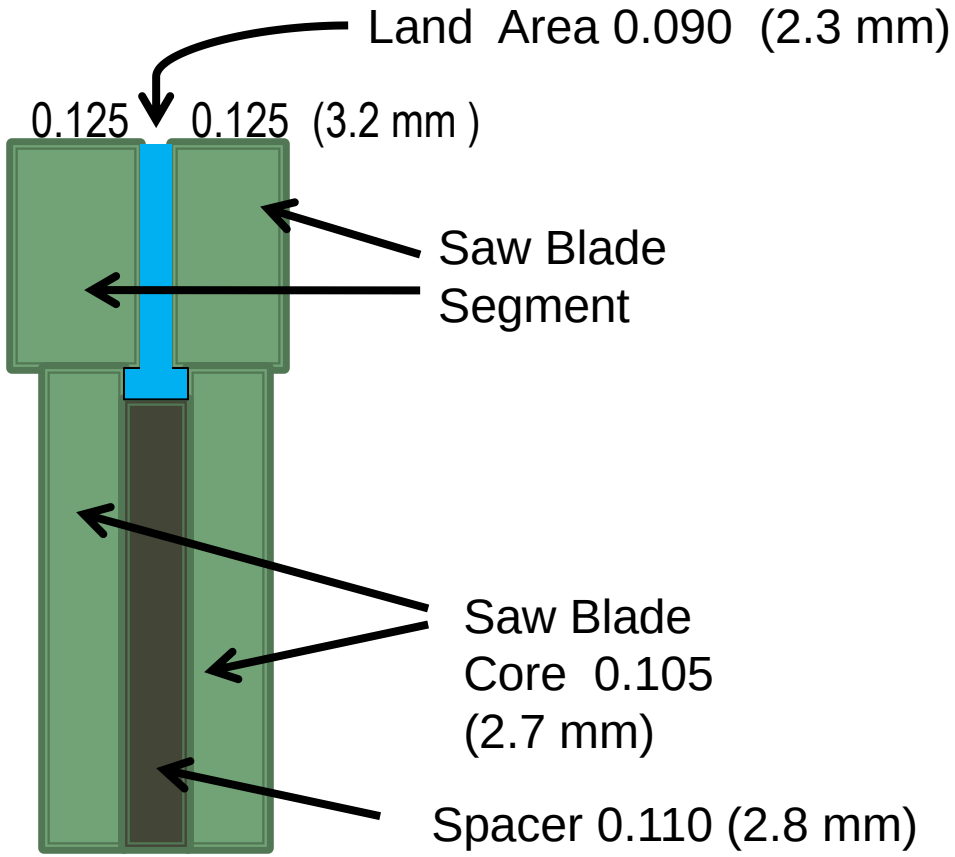


It all Starts with Blades and Spacers



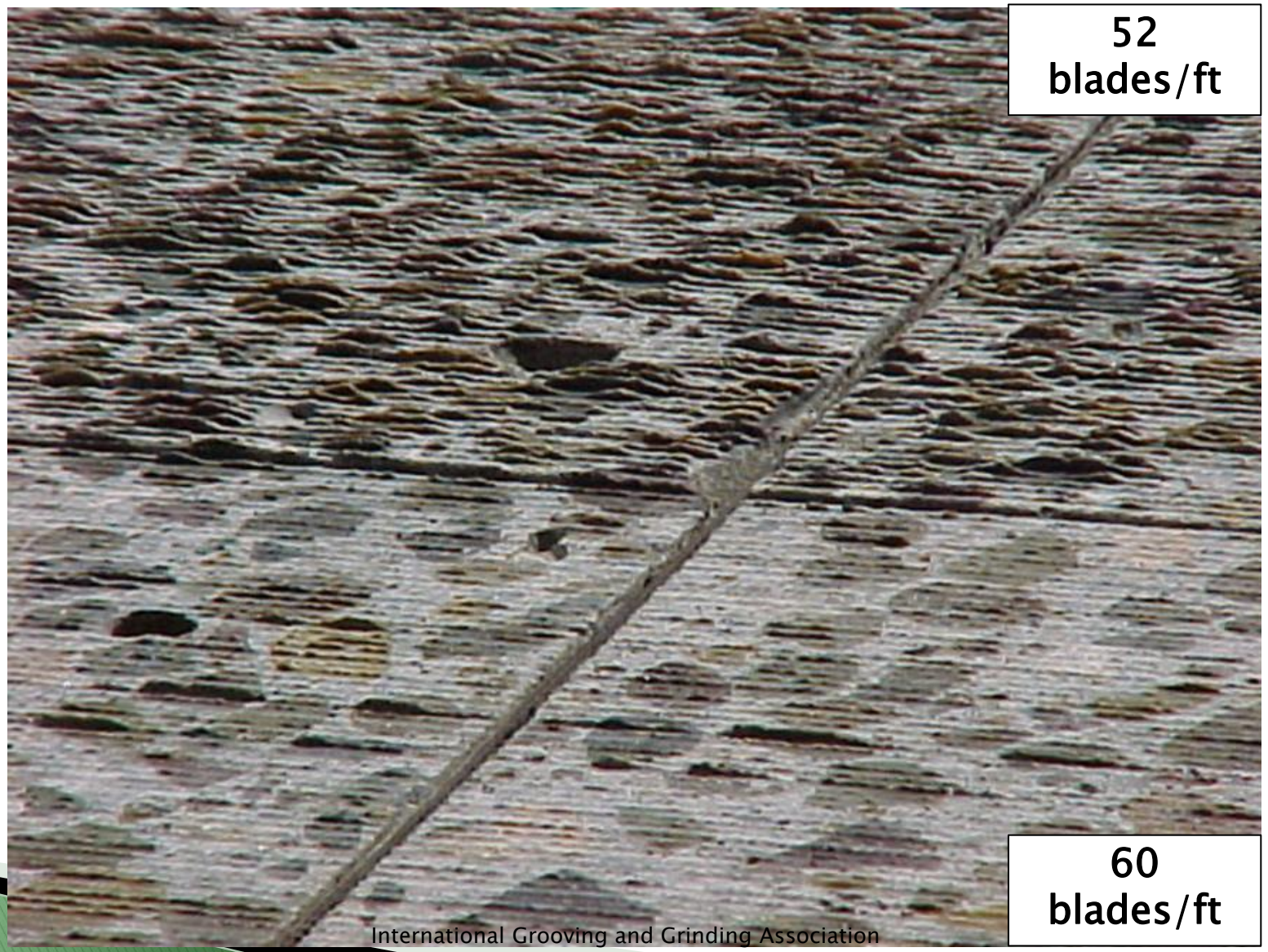


Typical Conventional Diamond Grinding Blade Configuration



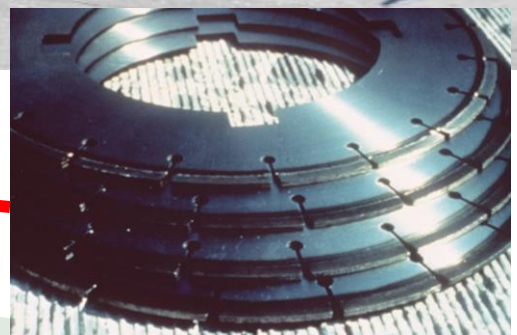
The Spacers Create the Ridges (lands) in the Corduroy Texture

Number of Blades Per Foot Matters!!!!



International Grooving and Grinding Association

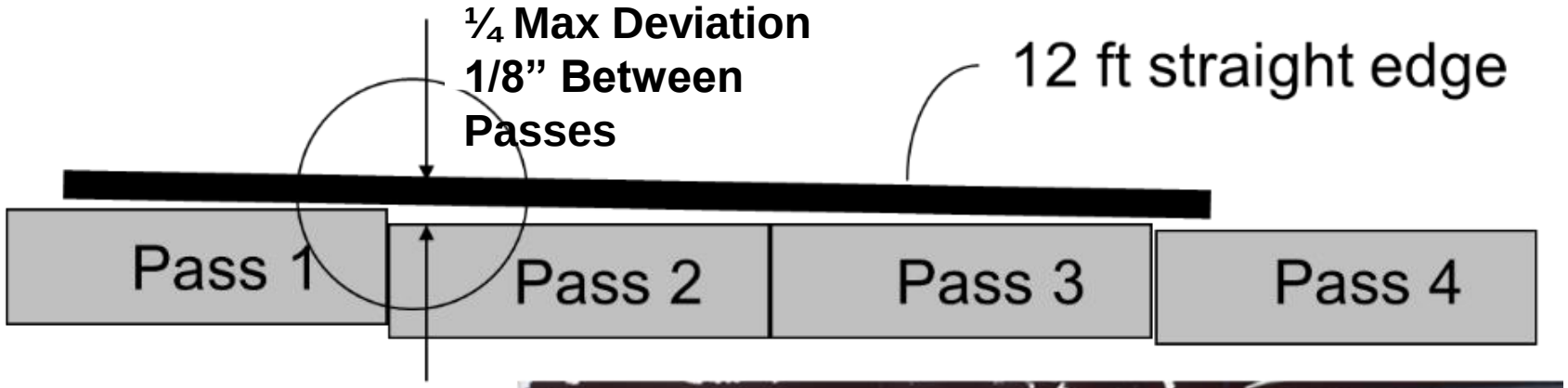
Diamond Grinding Equipment

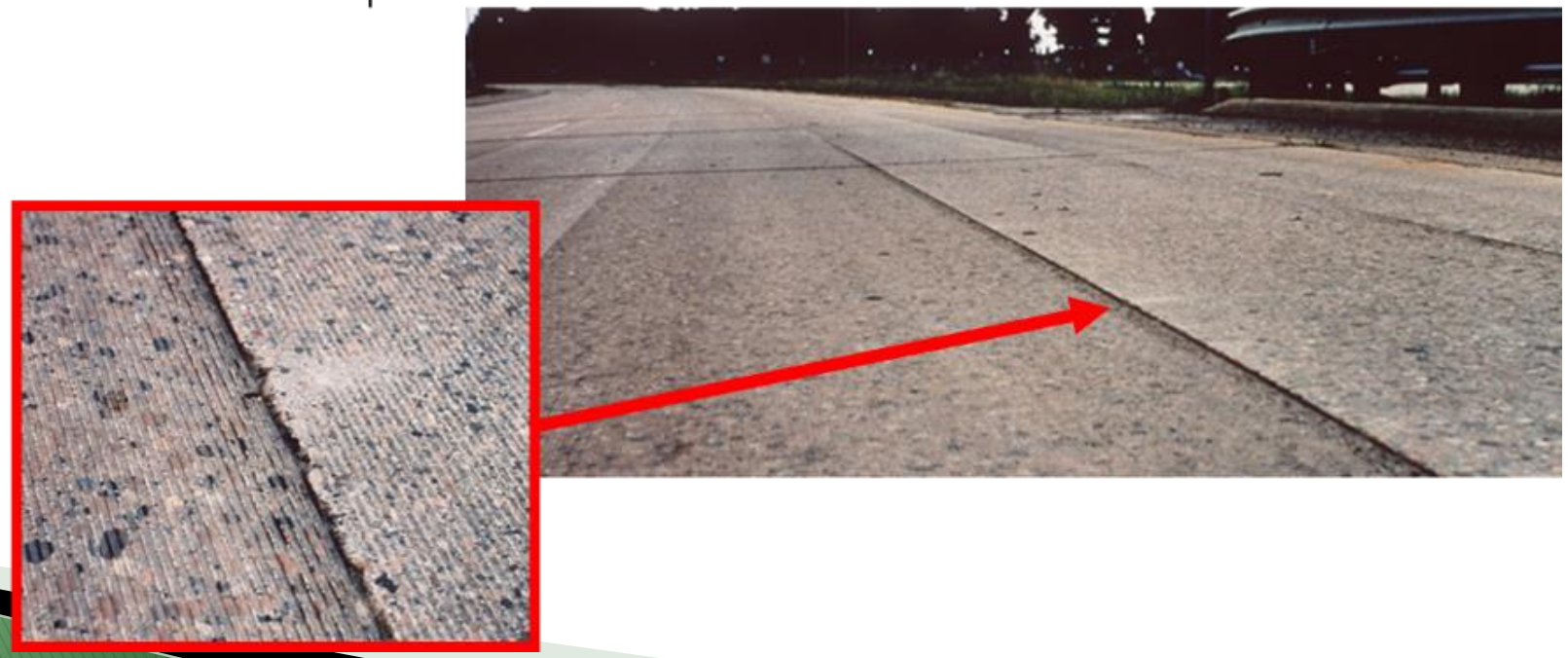


The Grinding Operation (Urban)

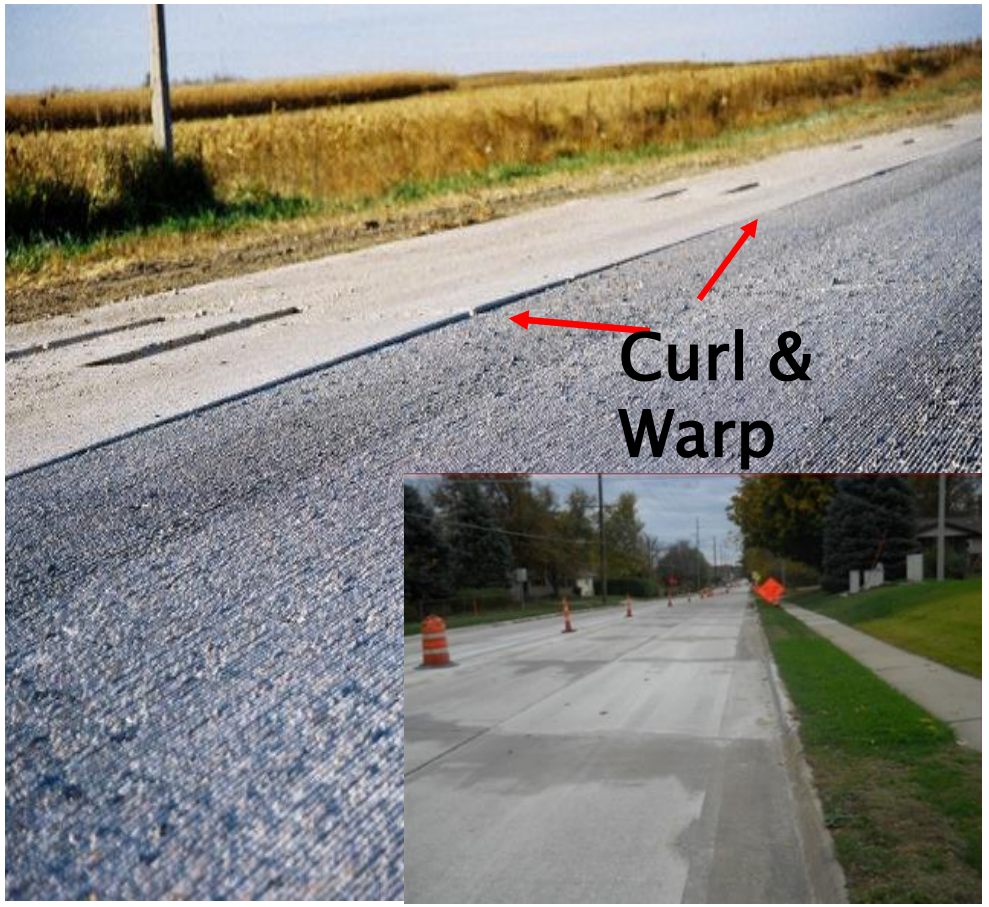
Construction Inspection

Poor Match Between Passes





Percent Coverage (95%)



Slurry Containment Vacuum

Diamond Grinding Slurry

Slurry Recovery Failure

Proper Slurry Recovery System

Effectiveness of Diamond Grinding – CALTRANS

STATE OF CALIFORNIA
DEPARTMENT of TRANSPORTATION

DIVISION OF
ENGINEERING SERVICES

MATERIALS ENGINEERING
AND TESTING SERVICES

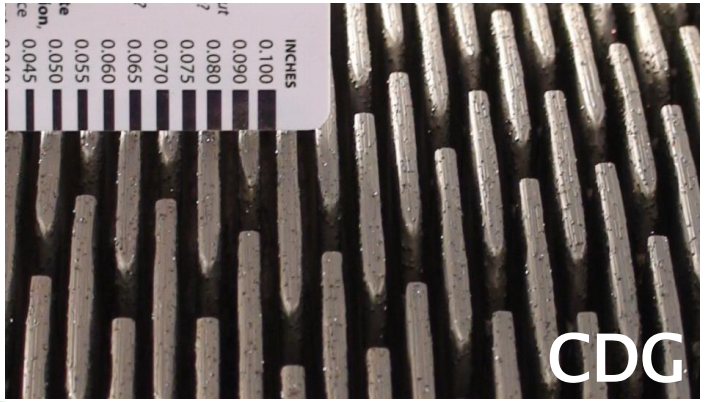
OFFICE OF RIGID PAVEMENT
AND STRUCTURAL CONCRETE

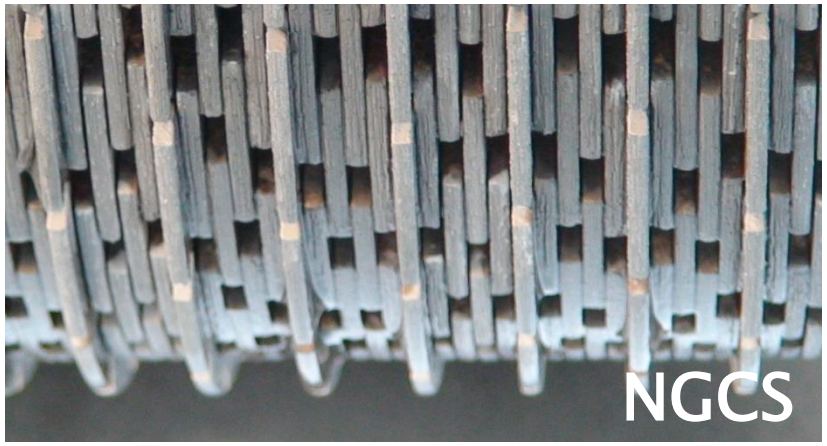
5900 Folsom Boulevard
Sacramento, California 95819

THE EFFECTIVENESS OF DIAMOND GRINDING CONCRETE PAVEMENTS IN CALIFORNIA

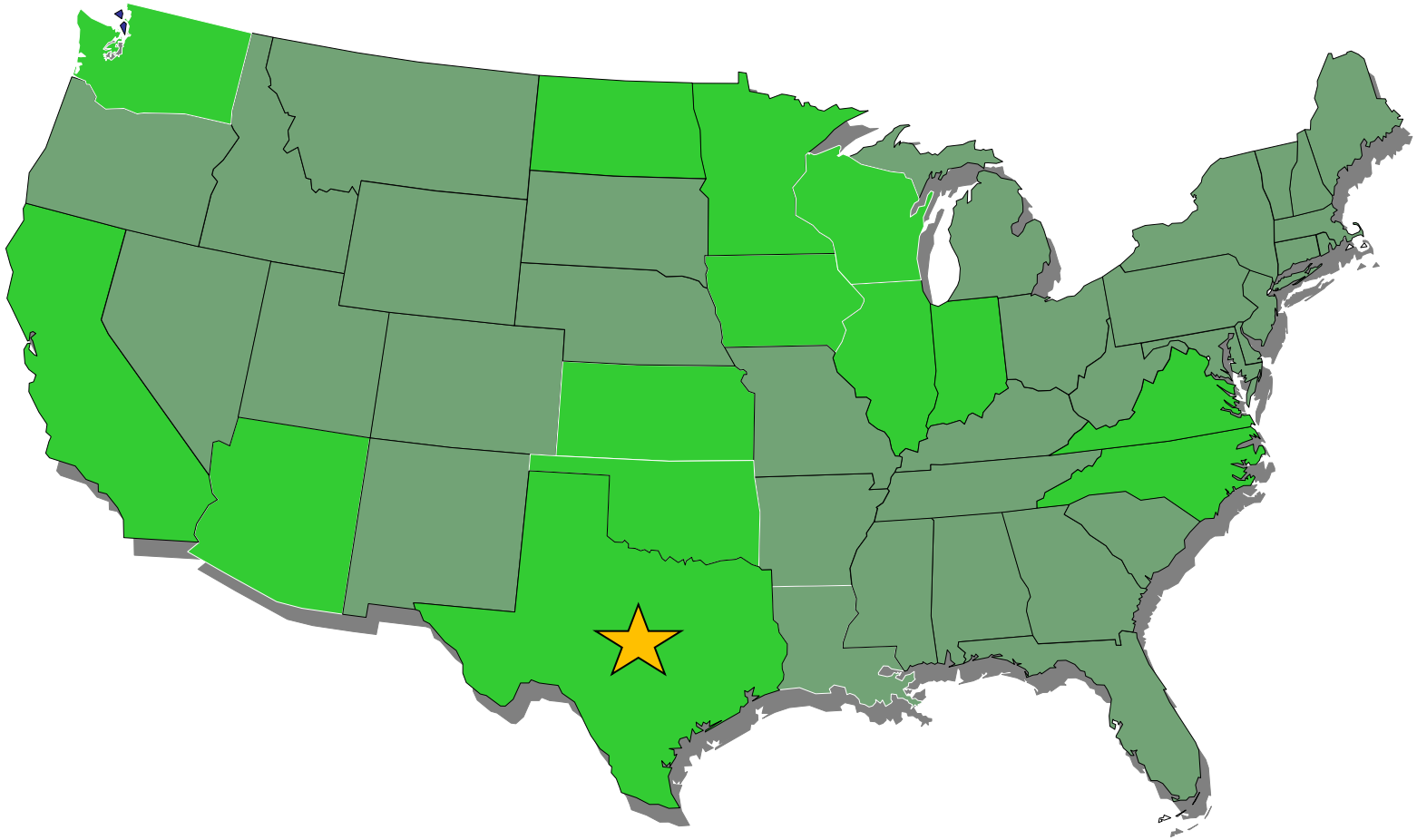
November 2004

NGCS is a Diamond Grinding Procedure





NGCS Site Locations in The USA



Urban Areas Issues
– Diamond Grinding –

Getting water and disposal of slurry
Difficulty in slurry disposal
    Typically further Haul
    May have to use treatment prior to disposal
Suburban level of expectation is more difficult-- grinding around manholes water valves Interchanges
Business entrances


Utility Adjustments
are Optional

Manholes Do Not Require Adjustment


JOHNSON ST
JOHNSON AV
Hardee's
RYDER
FLOWERAMA
ROSES 12

NCE Collaboration. Commitment. Confidence.℠

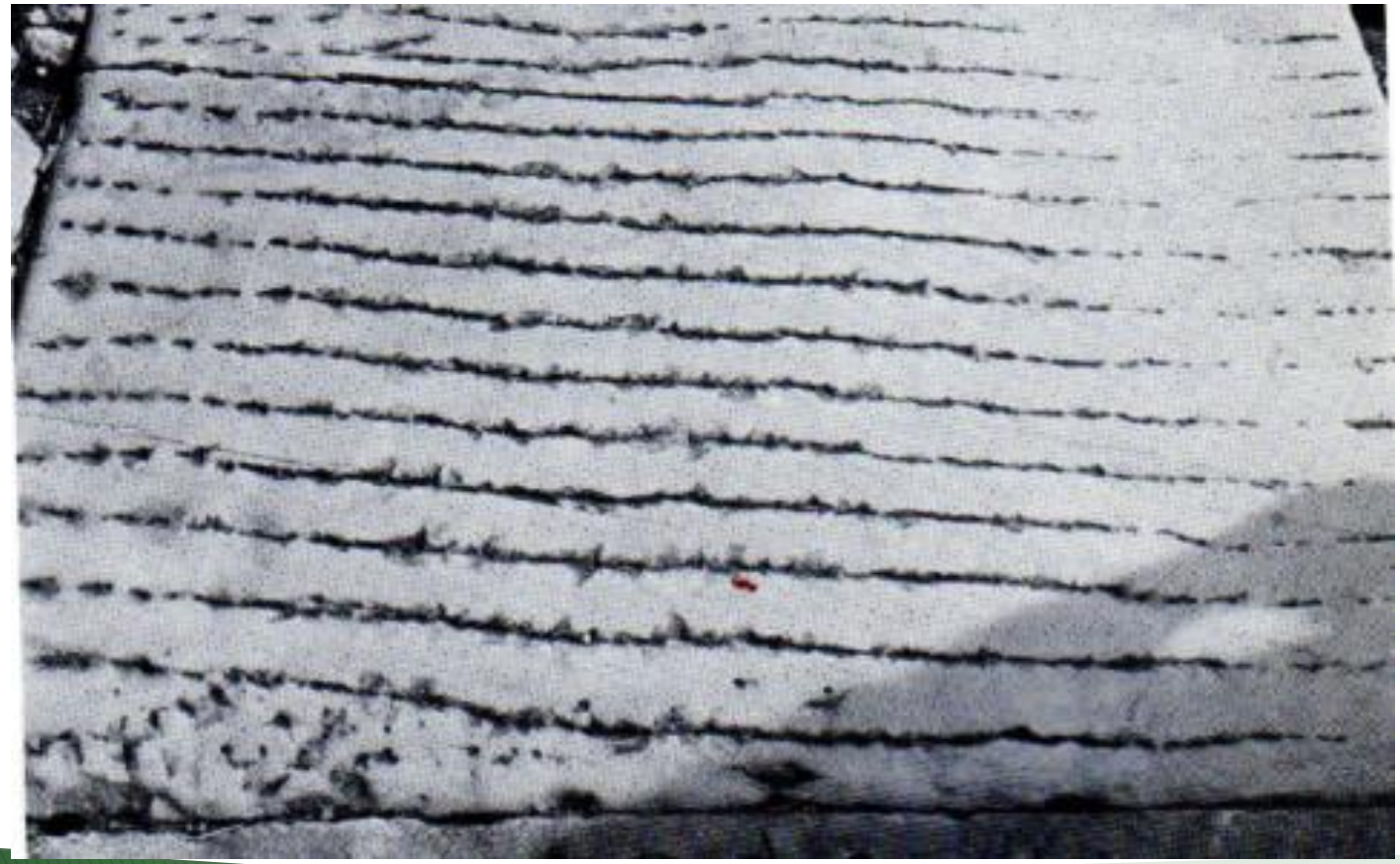
Carbon sequestration is the removal or capture of carbon dioxide from the atmosphere to reduce atmospheric CO2 pollution

Rate of Sequestration Decreases With Time

- Rate of carbonation related to the square root of time
- Roughly 45% of carbonation over 50 years occurs by Year 10
- Diamond grinding every 10 years will create a fresh surface for carbonation
  - Will more than double the amount of sequestered CO_2
  - Accounting for GHG emissions associated with grinding, likely close to net zero
- Overlaying concrete with asphalt will shut out atmospheric CO_2 and terminate sequestration

Courtesy of Tom Van Dam

Diamond Grooving!



Grooves in Marble Streets in Asia Minor Settled by the Greeks in 8th Century BC.

Diamond Grooving

- Cutting parallel grooves into the pavement using diamond saw blades
- Longitudinal (more common) or tran
- Benefits
  - Improved wet weather friction
  - Reduction in splash and spray

Caltrans Early Report and Test Results

Technical Report Documentation Page

1. REPORT No.

2. GOVERNMENT ACCESSION No.

3. RECIPIENT'S CATALOG No.

4. TITLE AND SUBTITLE
Study Of The Effect Of Grooving On Motor Vehicle Accidents

5. REPORT DATE
January 1972

6. PERFORMING ORGANIZATION

7. AUTHOR(S)
Darryl R. White

8. PERFORMING ORGANIZATION REPORT No.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
State of California
Business and Transportation Agency
Department of Public Works

10. WORK UNIT No.

11. CONTRACT OR GRANT No.

12. SPONSORING AGENCY NAME AND ADDRESS

13. TYPE OF REPORT & PERIOD COVERED

14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT
Grooving has proved to be one of the most cost-effective safety programs of the Department of Public Works. Grooving has contributed greatly to savings in lives, injuries and dollars for the travelling public. Rainfall is comparatively moderate in California but the accident rate is four times greater on wet pavement than on dry pavement. This is one of the problem areas for which a positive solution has been found.

The Department of Public Works' accident experience reveals that grooving has yielded a:

1) 20 percent reduction in total accidents
2) 50 percent reduction in fatal accidents
3) 70 percent reduction in wet pavement accidents

Motorcycle accident reports were reviewed from both grooved and ungrooved sections. Abstracts of these reports are given in the following pages. They show little evidence that grooves consitute a hazard to

17. KEYWORDS

18. No. OF PAGES: 54

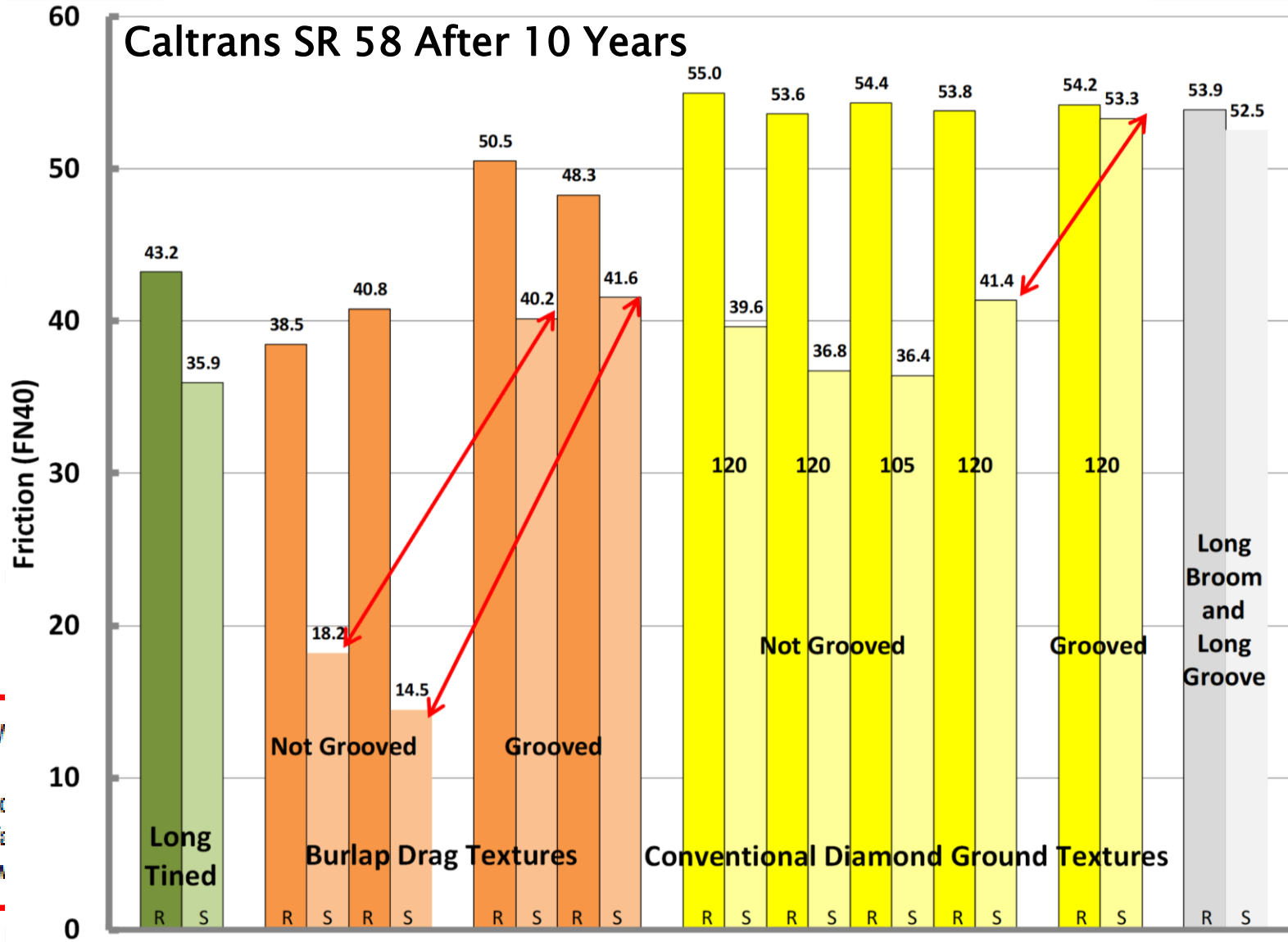
19. DRI WEBSITE LINK
http://www.dot.ca.gov/hq/research/researchreports/1

20. FILE NAME
72-69.pdf

This page was created to provide searchable keywords and abstract text for older scanned research reports.
November 2005, Division of Research and Innovation

The Department of Public V

1) 20 percent reduction in t
2) 50 percent reduction in f
3) 70 percent reduction in w



Splash and Spray Durability

ARFC

Longitudinally Grooved PCCP

March 2006 after 143 Days w/o Rain

Full Depth Repair

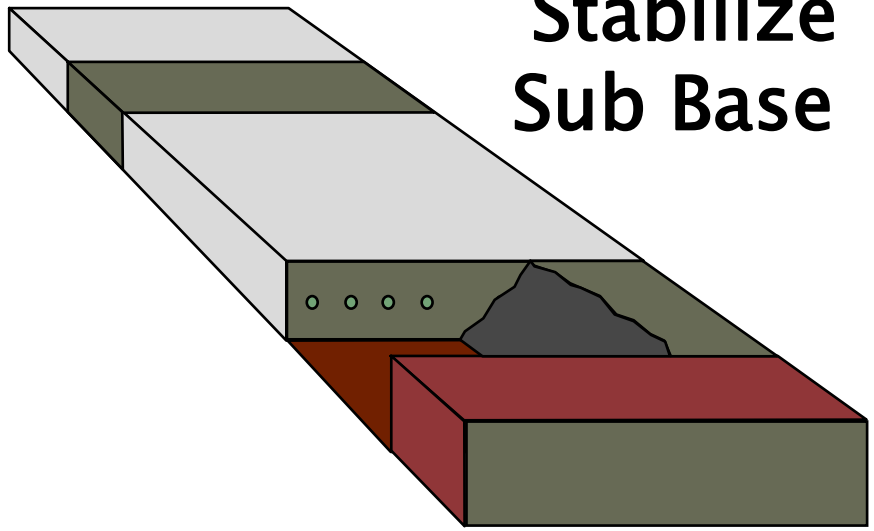
Full-Depth Repairs

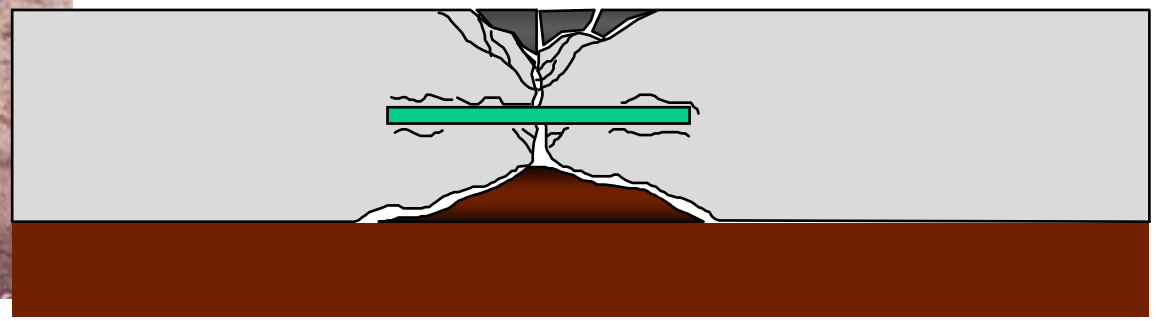
- "Workhorse" treatment
- Removal/replacement of concrete pavement at deteriorated joints/cracks
- focus on workmanship
  - Dowel bar installation
- Need for rapid opening times
  - Accelerated materials
  - Precast repairs

Full Depth Repair

Full Depth Repair

May also need to:
Stabilize
Sub Base



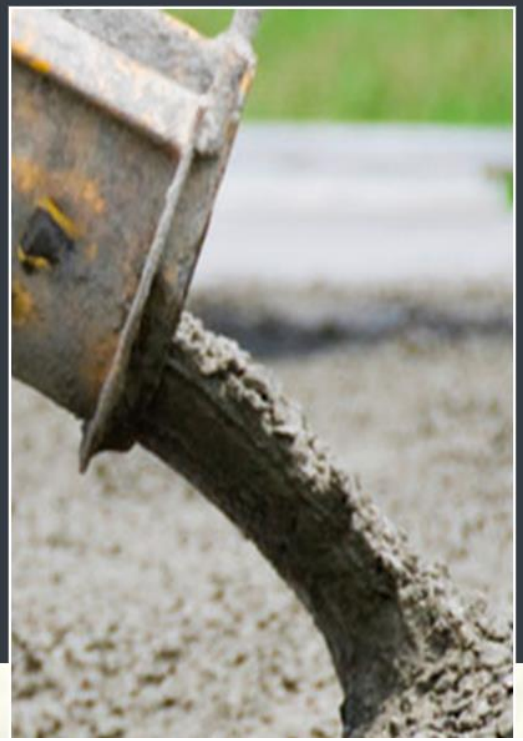


Full Depth Repair

Installing Steel Dowels

Placing and Completing a Full Depth Repair

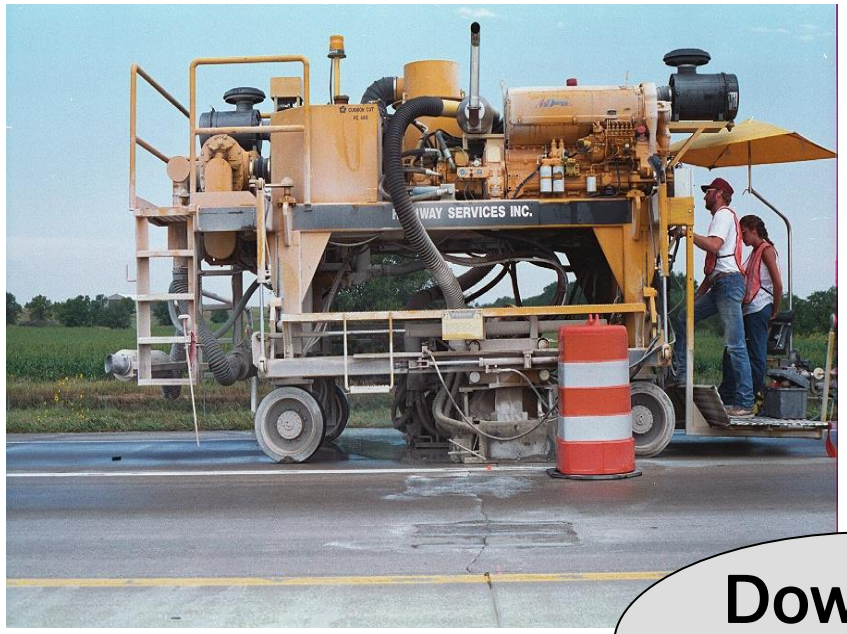
- **Step 1: Place Concrete**



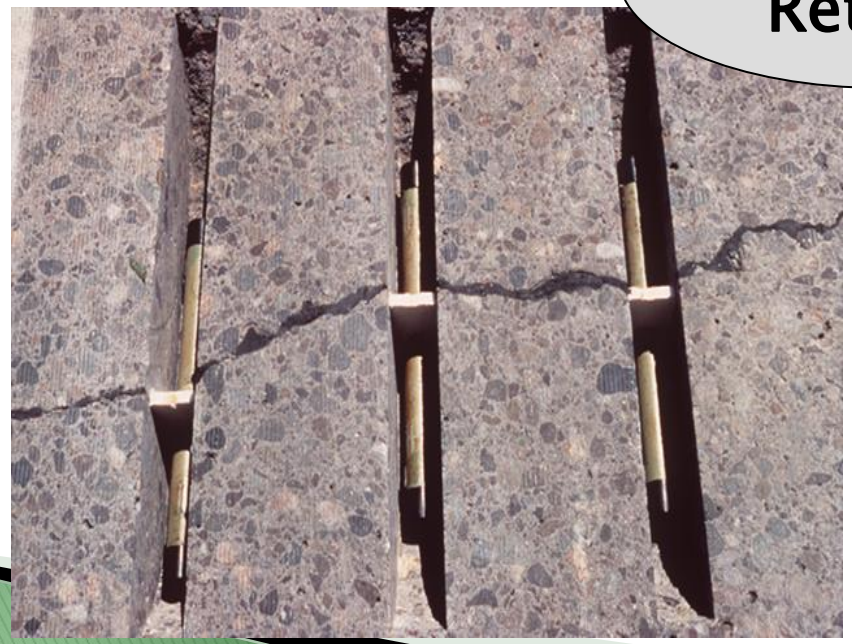
- **Step 2: Finish & Texture**

- **Step 3: Cure Concrete**

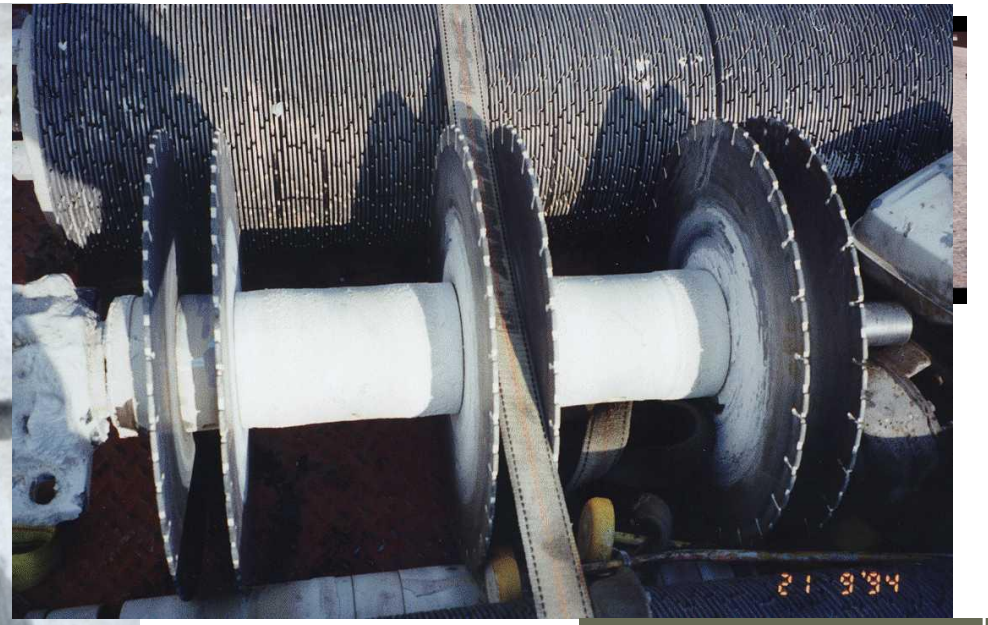
- **Step 4: Saw & Seal**

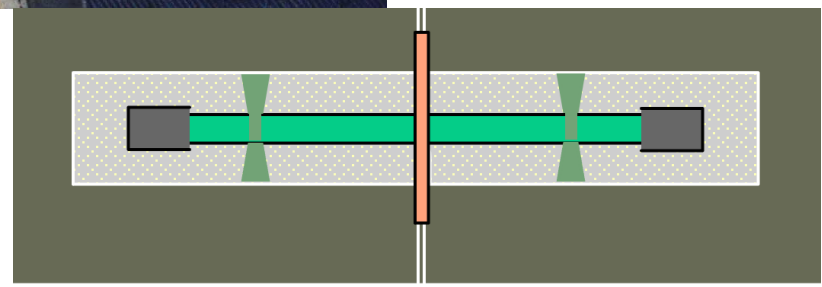


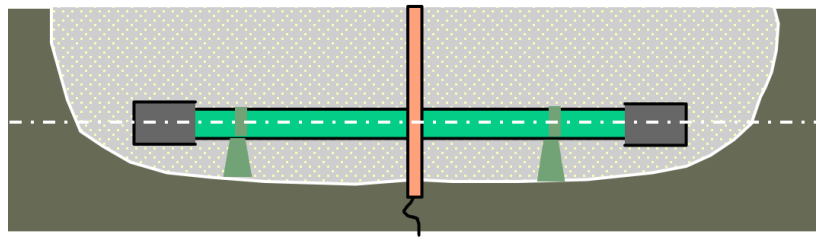
Dowel Bar Retrofit



Dowel Bar Retrofit



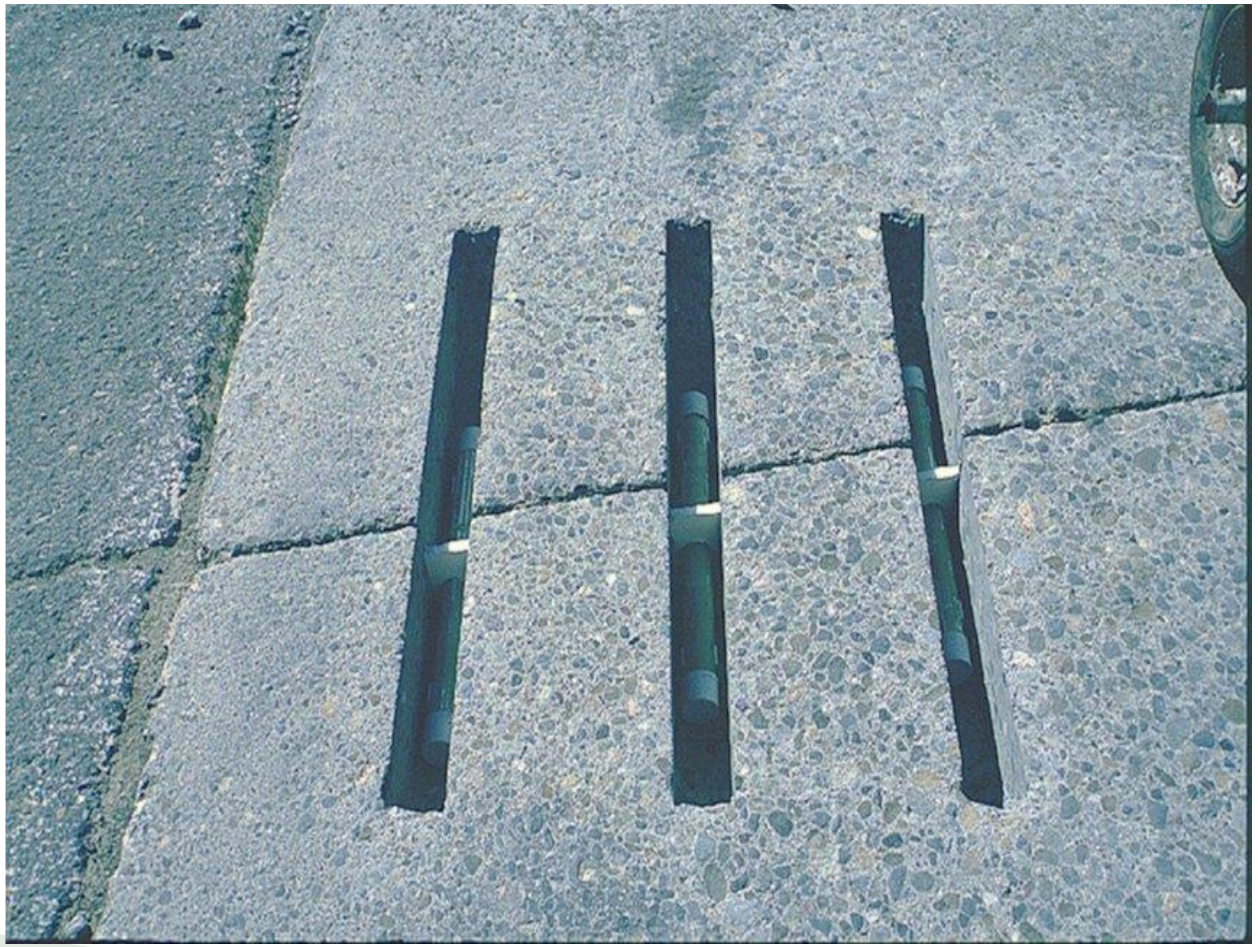




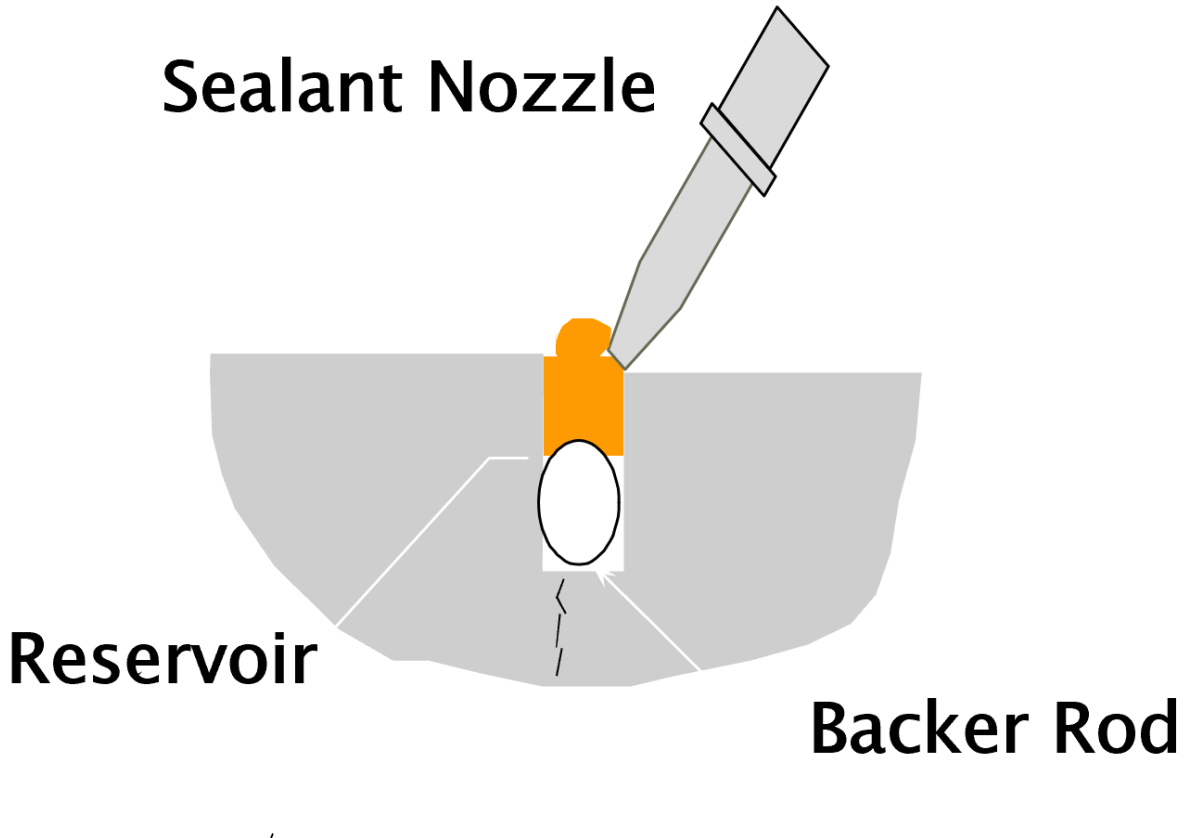
Also need to:
Reseal Joints

Load Transfer Restoration

- Placement of load transfer devices across joints or cracks of existing pavements
- Candidate projects
  - Poor load transfer (< 60 %)
  - Pumping
  - Faulting
  - Corner breaks



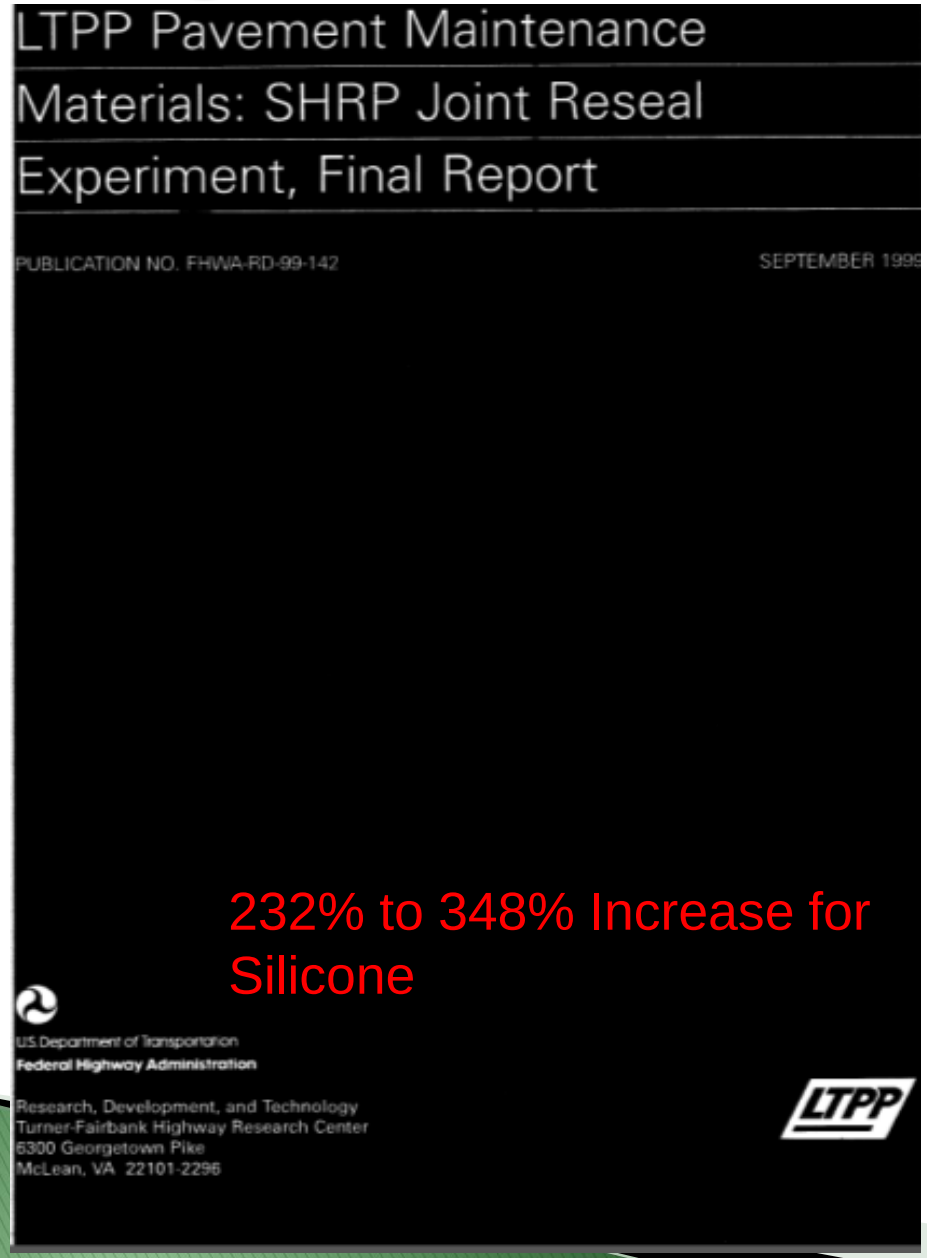
Sealing and Resealing



Incompressibles!

Base Erosion

Long Term Performance of Sealants

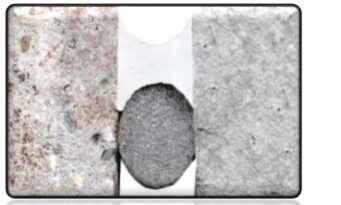


Sealant Material	Config-uration	Time at Which 75% Effectiveness Level Was Reached, months *					
		Arizona	Colorado	Iowa	Kentucky	South Carolina	Average
Koch 9005	1	116	66	94	156	63	99
	2	112	66	91	191	90	110
	3			148	182	49	126
	4	105	61				83
Crafco RS 231	1	52	80	76	86	92	77
	2	135	69	118	108	138	114
	3			103	155	80	113
	4	83	72				78
Meadows Sof-Seal	1		34	40	39	55	42
	2		40	51	64	46	50
	3			57	161	31	83
	4		43				43
Koch 9030	1		31	50	60	41	46
	2		32	63	50	58	51
	3			59	143	15	72
	4		37				37
Meadows Hi-Spec	1	43					43
	2	94					94
	4	76					76
Crafco RS 221	1	65					65
	2	105					105
	4	117					117
Dow 888	1	198	145	130	186	178	167
Dow 888-SL	1	183	110	125	164	186	154
Mobay 960-SL	1	194	93	65	115	168	127
Mobay 960	1			143			143
Crafco 903-SL	1	194					194
Koch 9050	1		19		136		78
Dow 888 w/ primer	1			151			151
Dow 888-SL w/ primer	1			143			143
Koch 9005 w/ primer	1				173		173

* Times greater than 82 months are extrapolated to a maximum of 200 months.

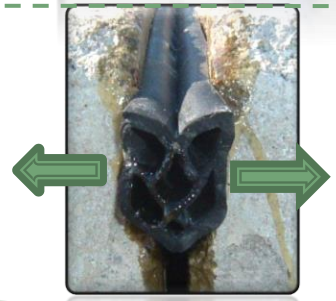
Sealant Types

- Silicone
  - Non Sag
  - Self Leveling
  - Rapid Cure



- Hot Pour
  - Standard Modulus
  - Low Modulus

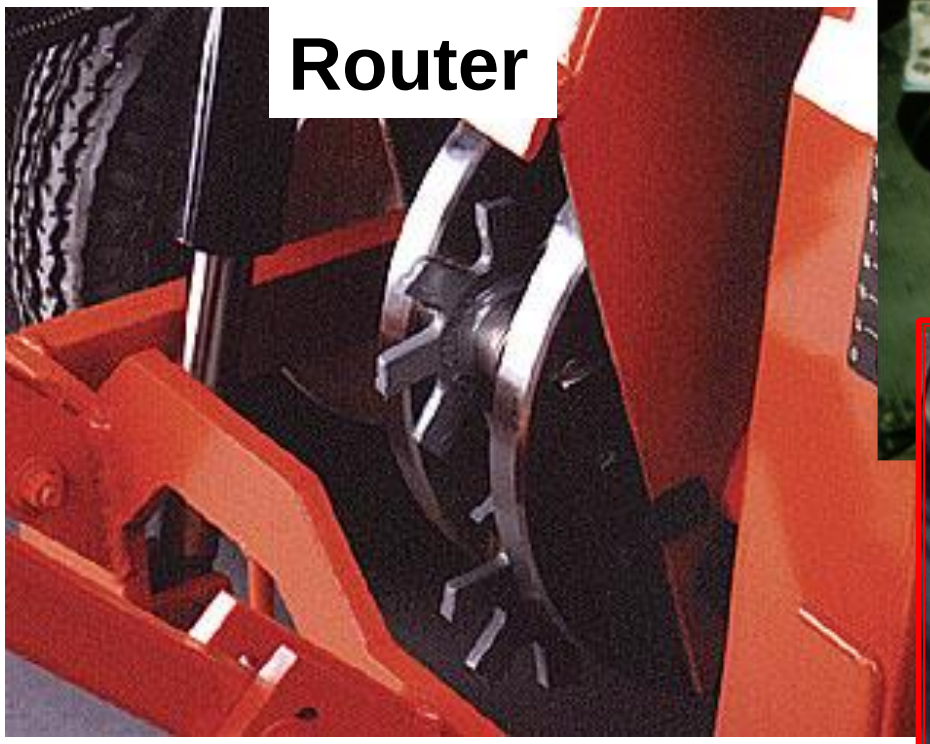
- Compression Seal

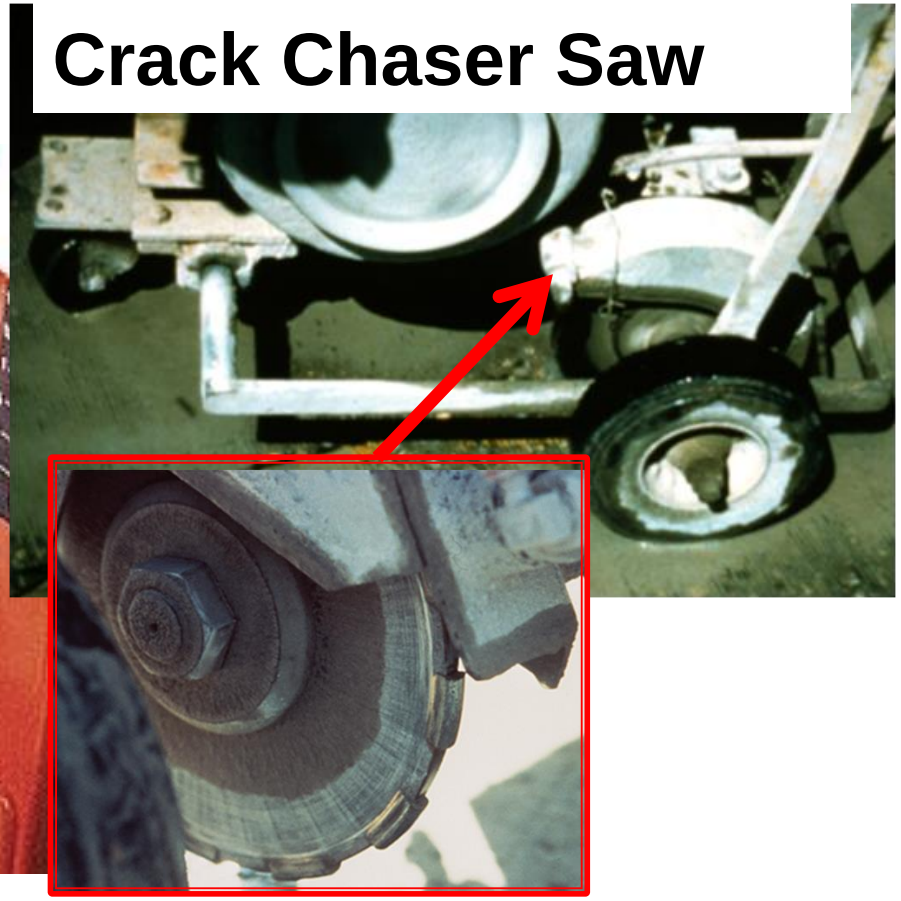


Joint Sawing Equipment

- Early Entry Sawing
  - Walk Behind
- Wet Sawing
  - Walk Behind
  - Rider/Span Saws
- Dry Sawing
  - Conventional Saws
  - Crack Chasing Saws

Crack Chaser Saw





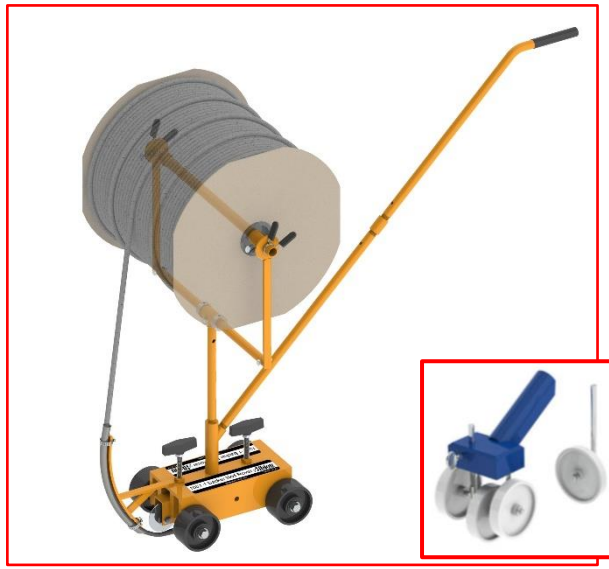
Sealant Removal Equipment

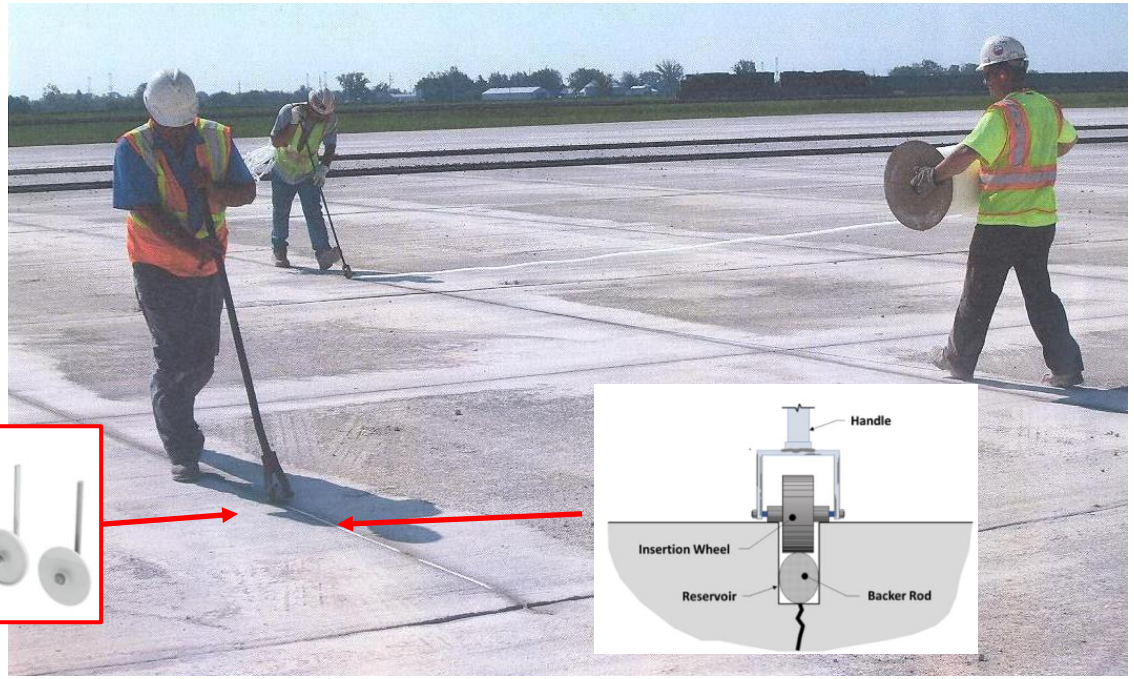
Cleaning & Preparation Equipment

- Air Compressors
- Abrasive Blast Equipment
- Water Blast Equipment
- Air Blasting

Backer Rod Installation Equipment

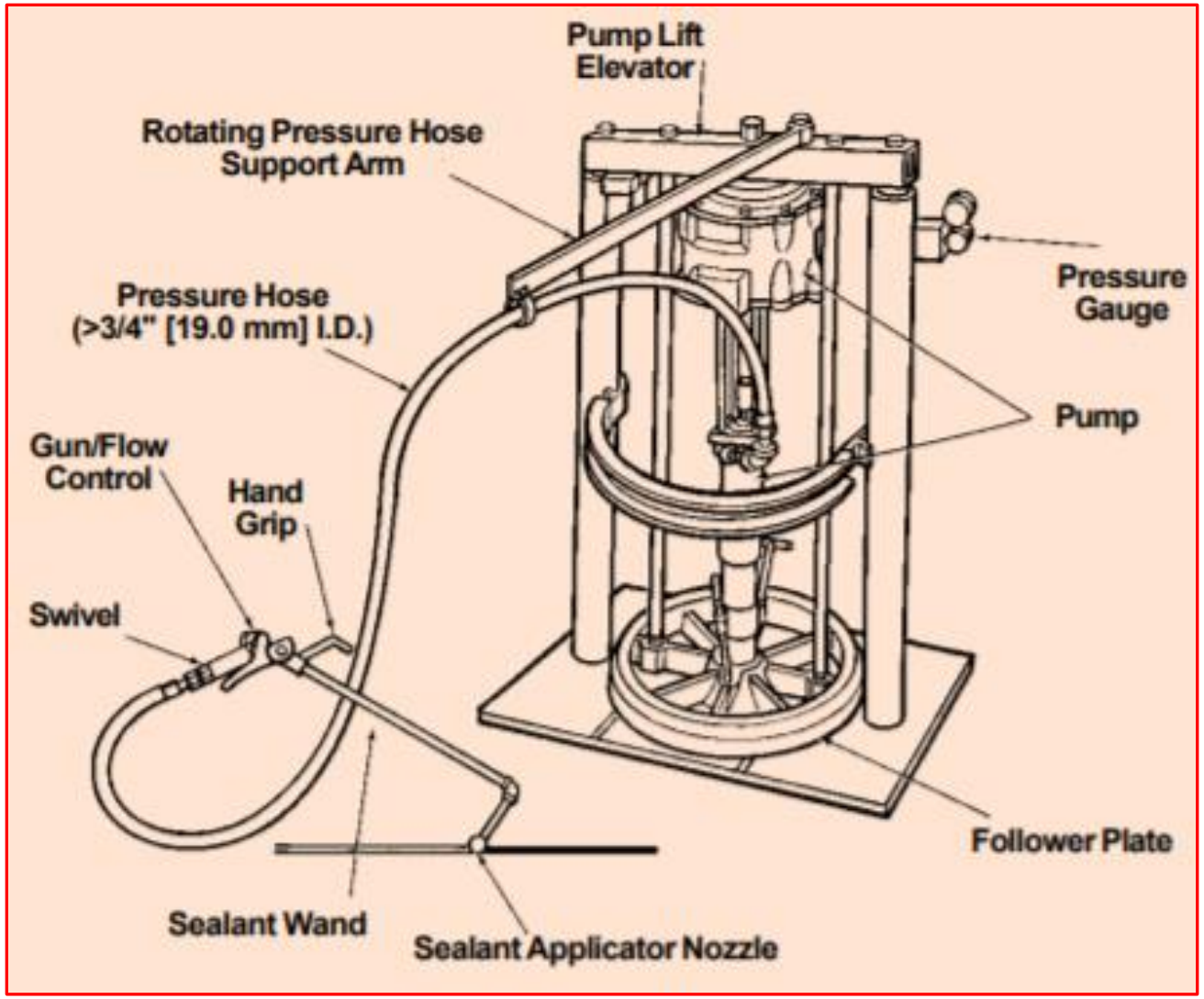
- Backer rods are manually installed using simple tools. They typically consist of person or a cart that is used to roll the rod out in front of the manual insertion tool.



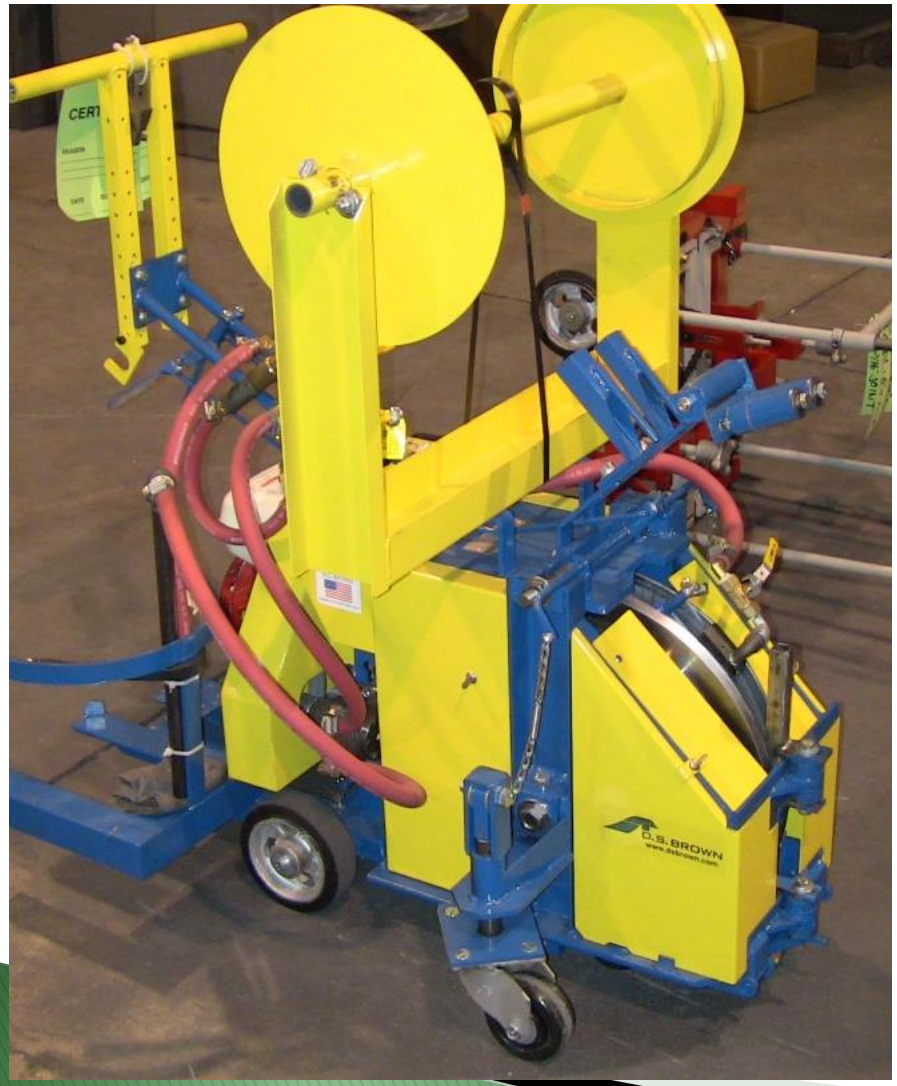


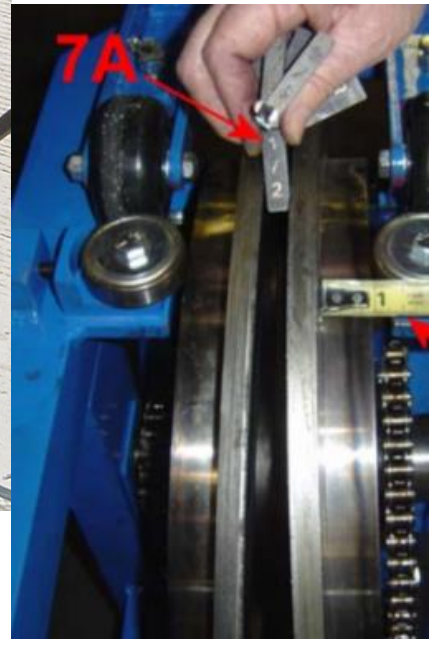
Silicone Sealant Installation Equipment

- Installation equipment consists of an extrusion pump that sets in a pail or drum. The material is then pumped through a high pressure hose to the sealant wand and application nozzle.



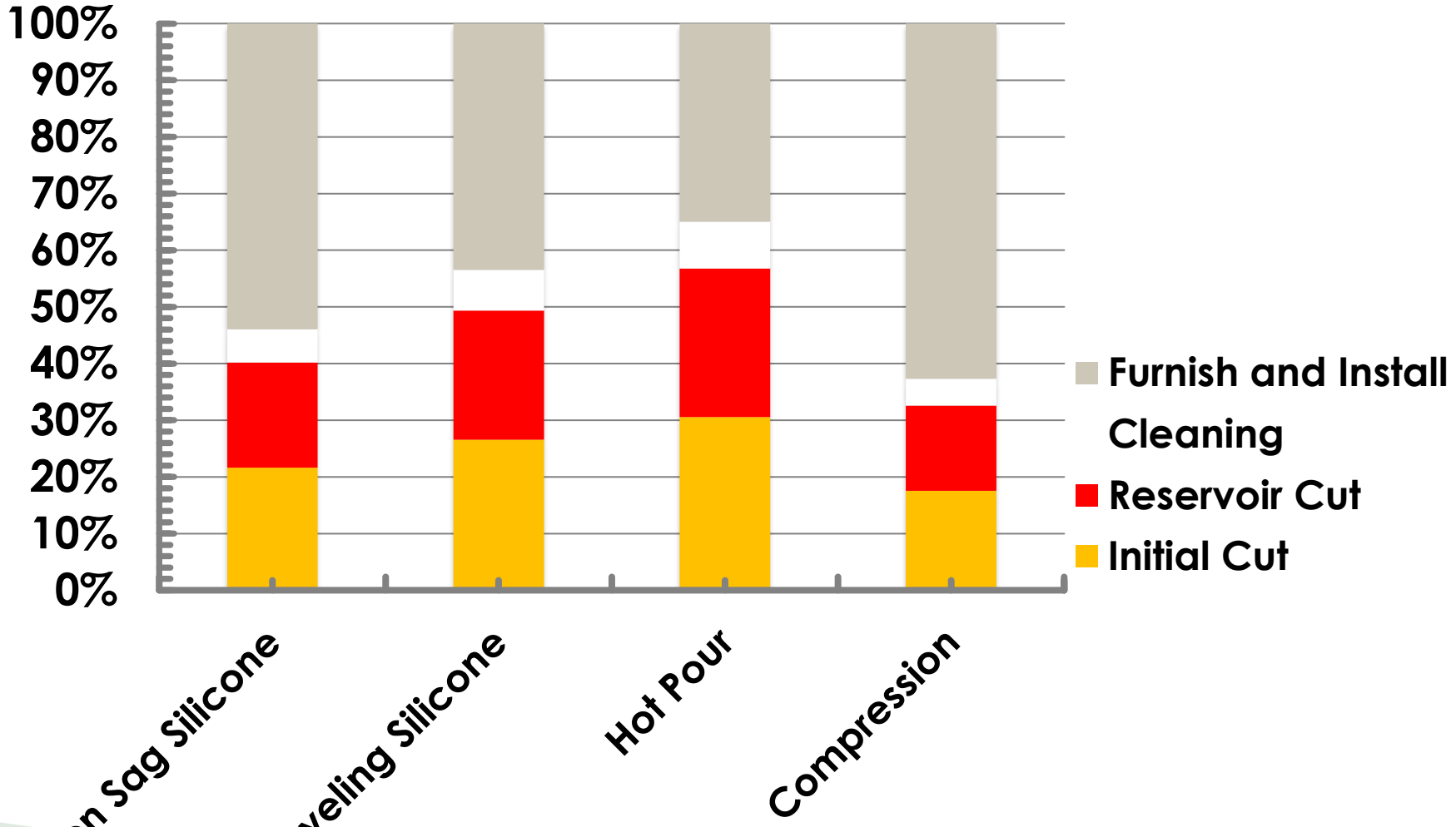
Compression Seal Installation Equipment





Hot Pour Sealant Installation Equipment

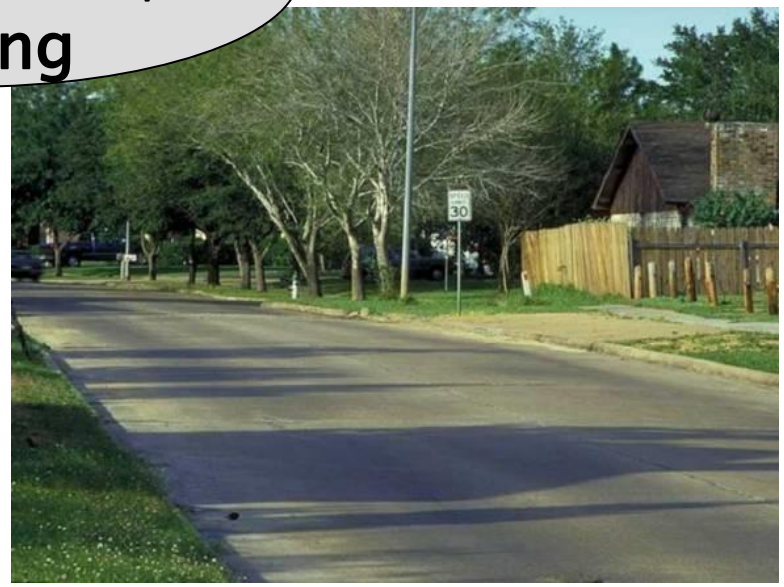
Percent of Total Cost For Each Operation of Sealing a Joint*



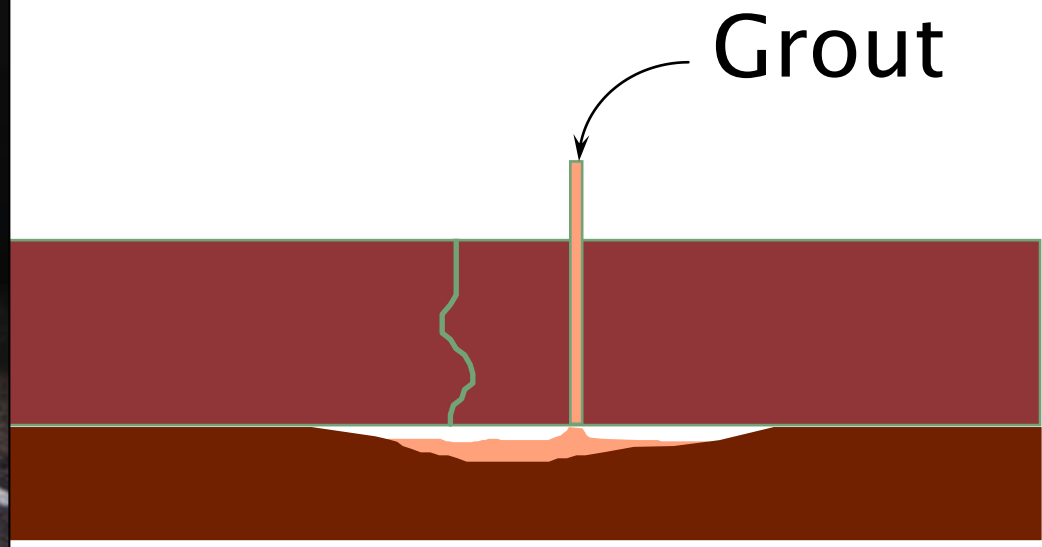
* ACPA Relative Cost Study

Clean Isn't an Option

Slab Stabilization/ Jacking



Slab Stabilization

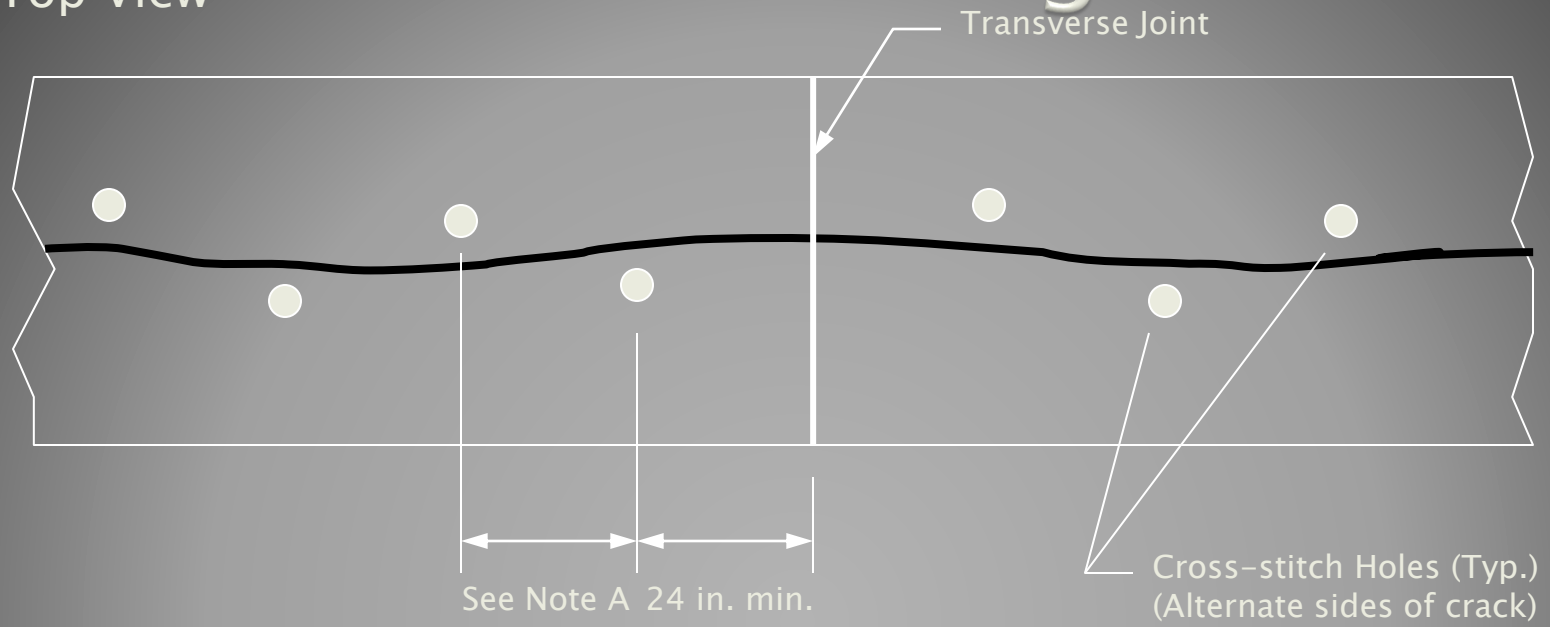


Fill Void or Level Slab

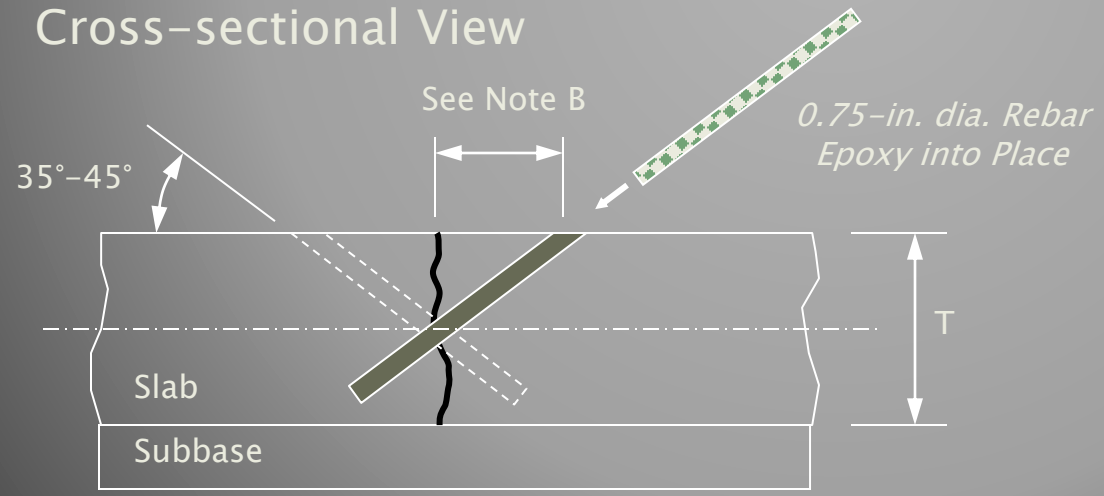
Cross Stitching

Cross Stitching

Top View



Cross-sectional View

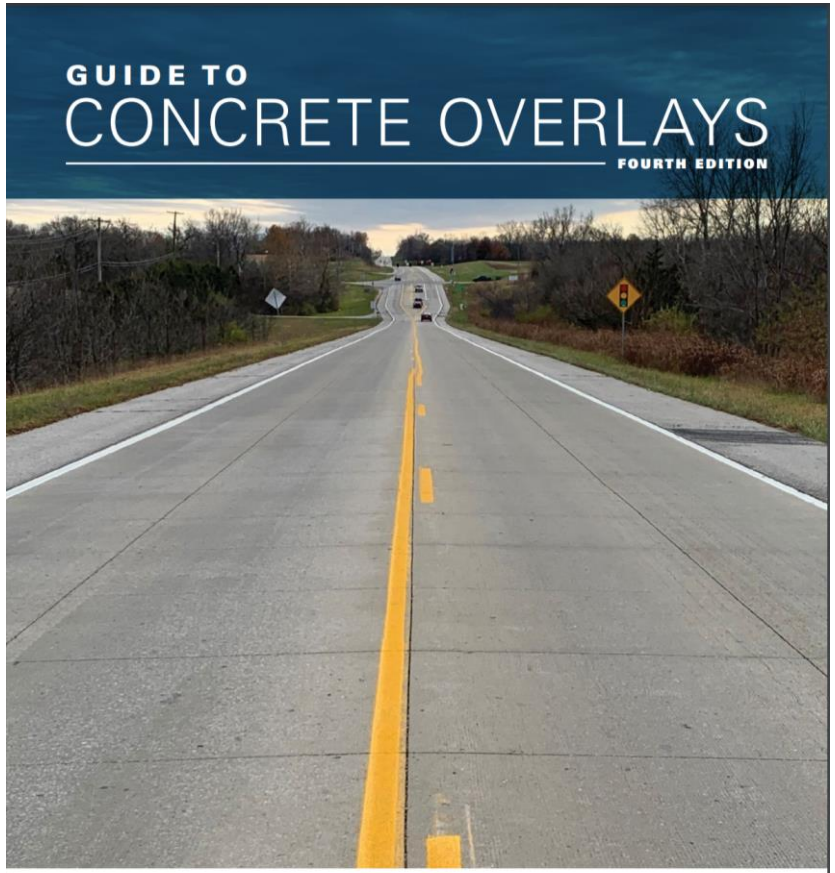


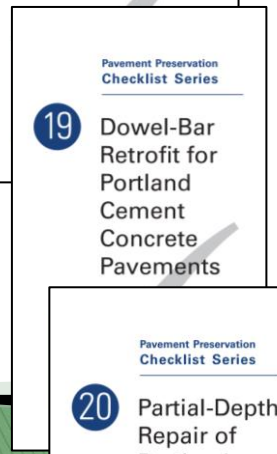
Note A: *Distance between holes is 24 in. for heavy traffic; 36 in. for light traffic*
Note B: *Determine distance from longitudinal crack to hole based on slab thickness T and drill angle. Slabs less than 12 inches thick require a 35° insertion angle.*

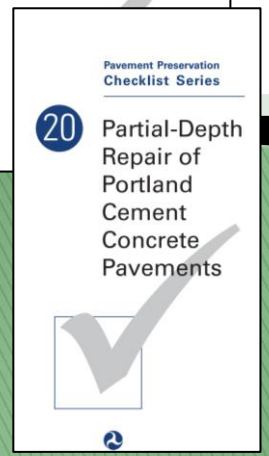
Summary

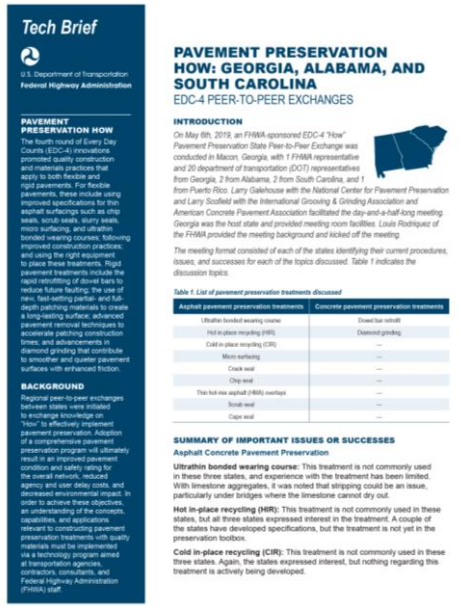
- Concrete pavement preservation works in all environments
- Based on traffic and schedule the appropriate techniques and products need to be selected

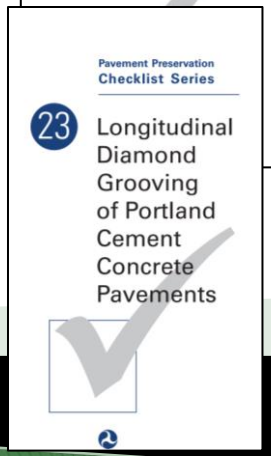
Concrete Pavement Preservation Tools












Questions?
Thank You!