Airfield Concrete Pavement Maintenance and Rehabilitation Strategies

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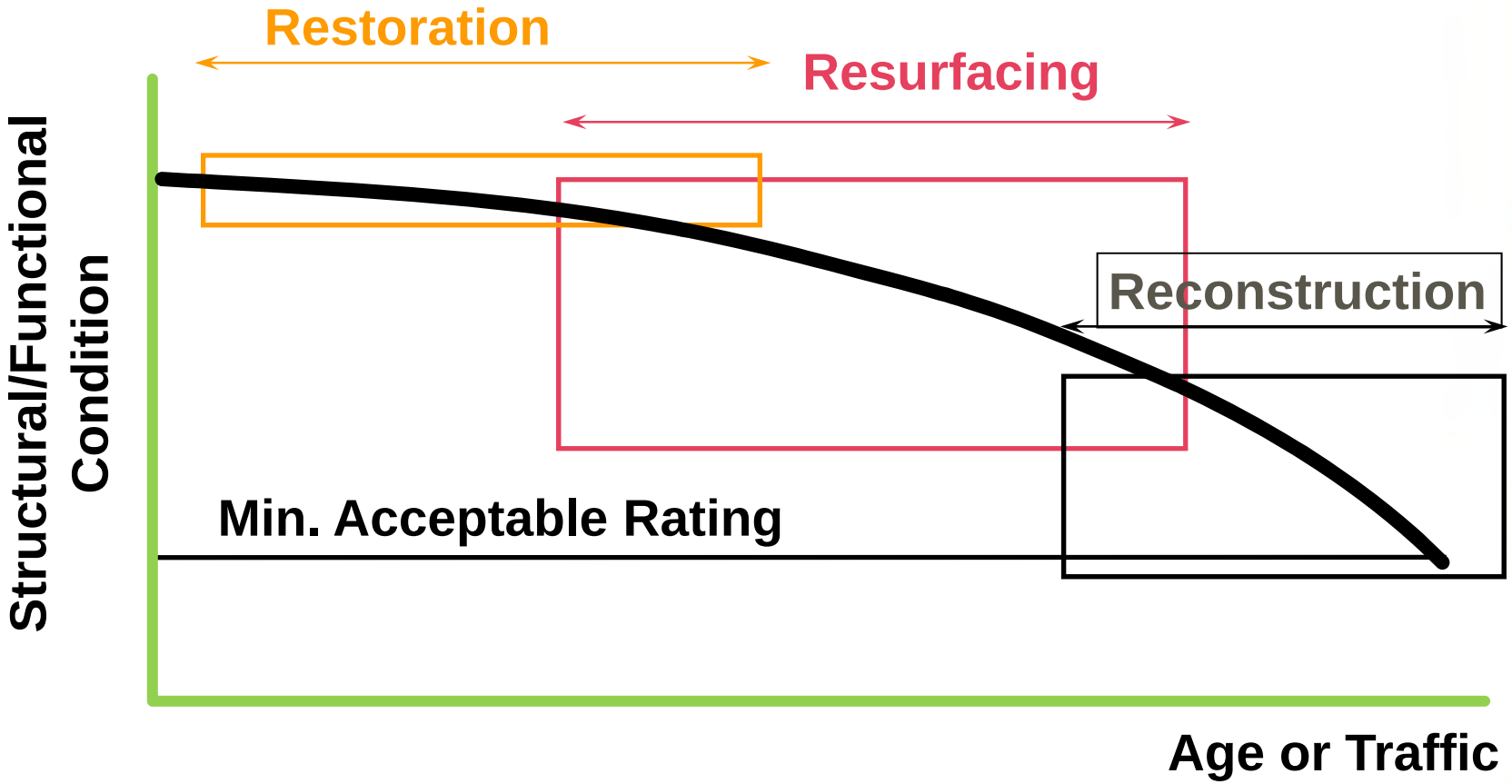
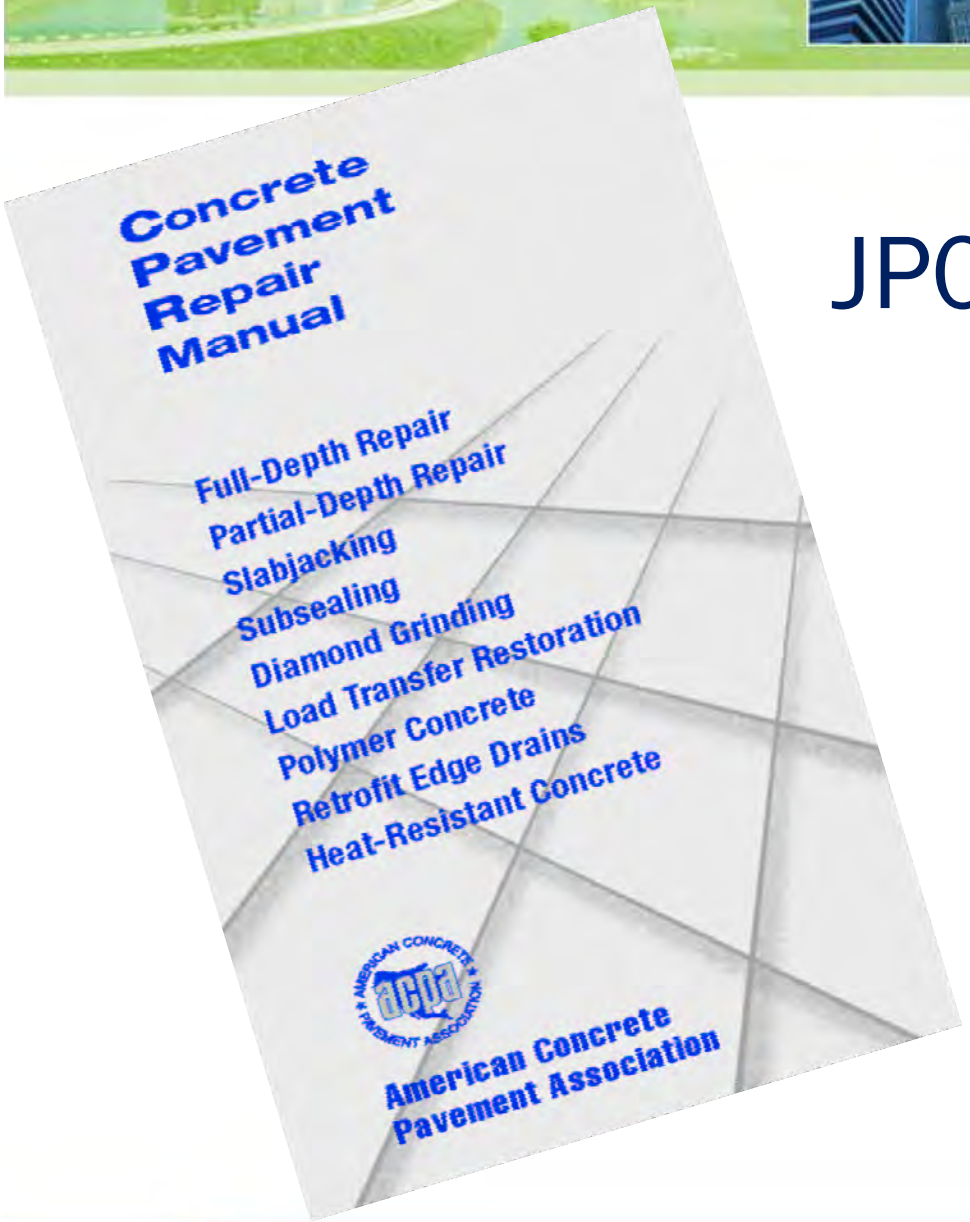
Cement Association of Canada
Association Canadienne du Ciment
ACPA

3 Types of Rehabilitation



Pavement Maintenance Logic

- Correct Repair Procedures
  - Minimize **FOD**
- Airfield Rigid Pavement Distress Identification
  - Load Related vs. Environmental or Materials Related



JP002P, May 2003

www.acpa.org

Performance Issues

- Airfield Functional Condition
  - FOD potential
  - Friction/Hydroplaning

- Airfield Distress
  - cracking **(saw & sealing)**
  - corner breaks, shattered panels **(full depth)**
  - spalling **(partial depth)**
  - roughness / polished **(grinding)**

Distress Classification

Cracking

- Extends through the depth of a slab
- Caused by:
  - Poor Design - Long joint spacing
  - Poor Construction (Over Finished Surfaces)
  - Curling / warping (Stabilized bases)
  - Dowel Restraint
  - Load

Cracks and Causes

- Full Width of Panel (Slab)
  - Environmental Distress
  - Sealing (Sawing) Most Effective
- Corner Cracks (Diagonal) -
  - Load Distress
  - Full Depth Replacement Mandatory
- Shattered Slabs - More than Four Pieces
  - Full Depth Replacement Required

Rules of Thumb for Concrete Cracks (Environmental)

• to ¼” (6mm)	Leave alone
• ¼” to ½” (6 to 12.5mm)	Saw and Seal
• 3/8” to ¾” (9.5 to 19mm, Spalled)	Partial Depth Repair
• ¾” to 1-1/2” (19 to 38mm)	Saw and Seal
• 3/4 to 1-1/2 (19 to 38mm, Spalled)	Full Depth Patching
• More than 1-1/2” (38mm)	Full Depth Patching

Concrete Slab Repair

Depth of Repairs

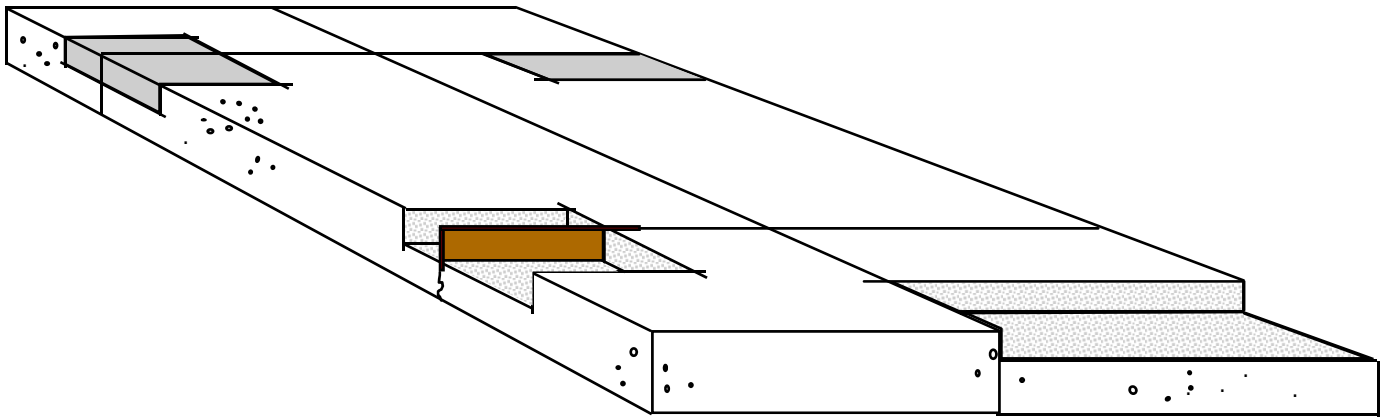
- Partial Depth - Intent is to bond repair material to existing concrete and be compatible in characteristics
- Full Depth - Intent is to make the repair a functional part of the existing slab.

Distress Classification-Spalling

- Breaking, cracking, or chipping at joints or cracks
  - Incompressible in Joint/Crack
  - Material Durability Problems
  - Poor Construction Techniques
- Full Depth Repair Required when unsound material deeper than 1/3 thickness

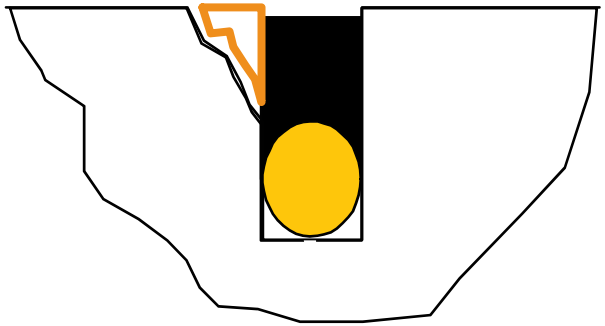
Partial Depth Repairs

- Generally spall repairs
- Repairs localized distress in the top 1/3 of the slab
- Generally located at joints, but can be placed anywhere surface defects occur



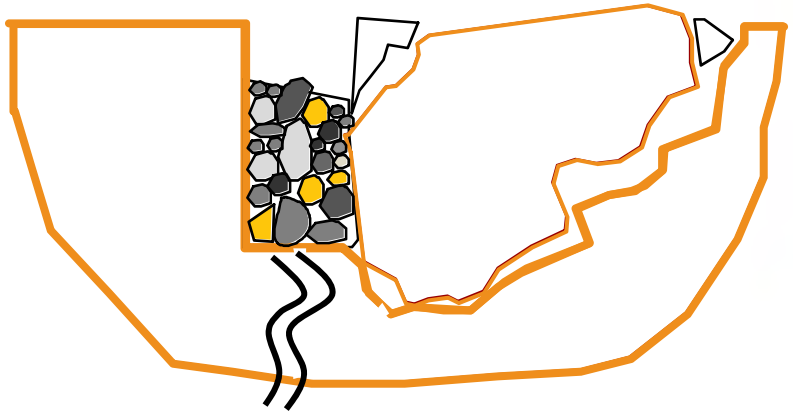
Minor
Sliver Spalling

Up to 6 mm (1/4”)



Will not affect performance of new sealant

Serious
Compression Spalling



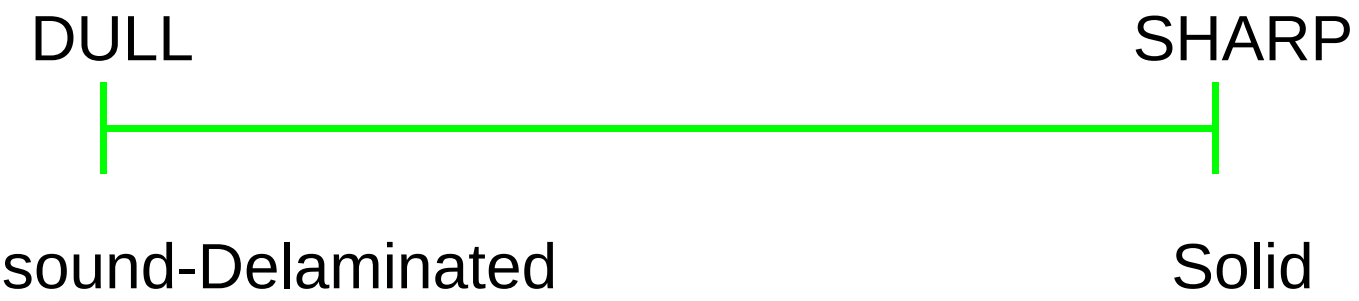
Will not provide reasonable surfaces for sealing

Partial Depth Repairs

Finding Unsound Concrete

Sounding the pavement:

- Hammer
- Steel rod
- Steel chain



Partial Depth Repairs

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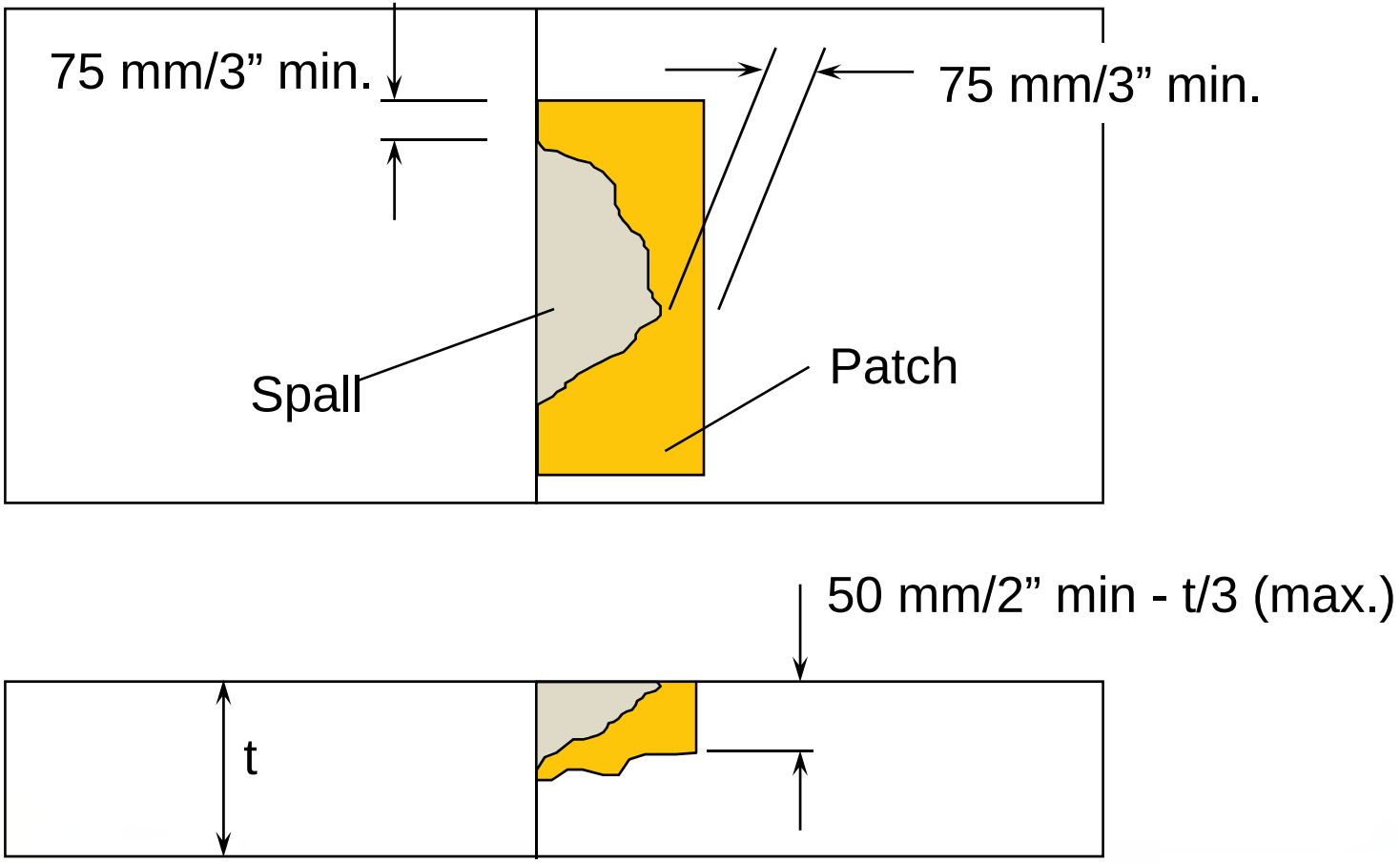
Defining Repair Boundaries



Partial Depth Repairs

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Placing Materials

- Applying **bonding** agent
  - Cement grout or Epoxy
  - Coat all surfaces (horizontal & vertical)
  - Do not allow bonding agent to set

Partial Depth Repairs

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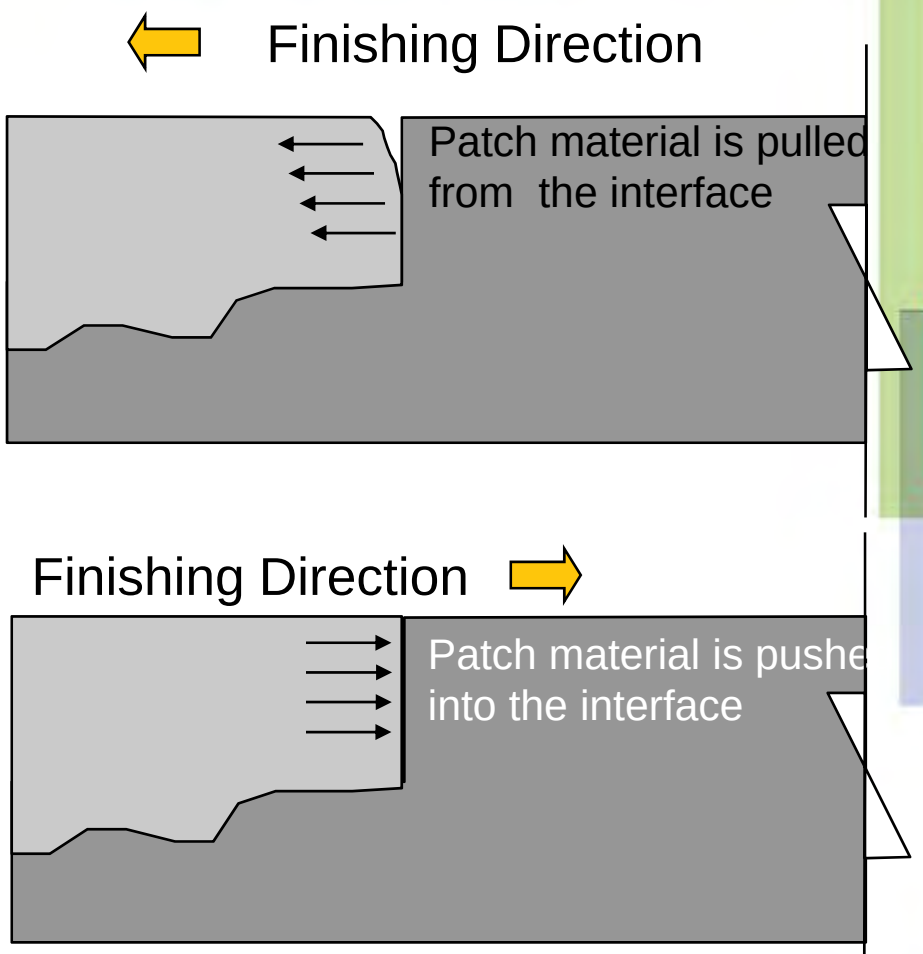
Finishing

- Match surrounding elevation
- Work tool from center toward edges

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Full Depth Repairs

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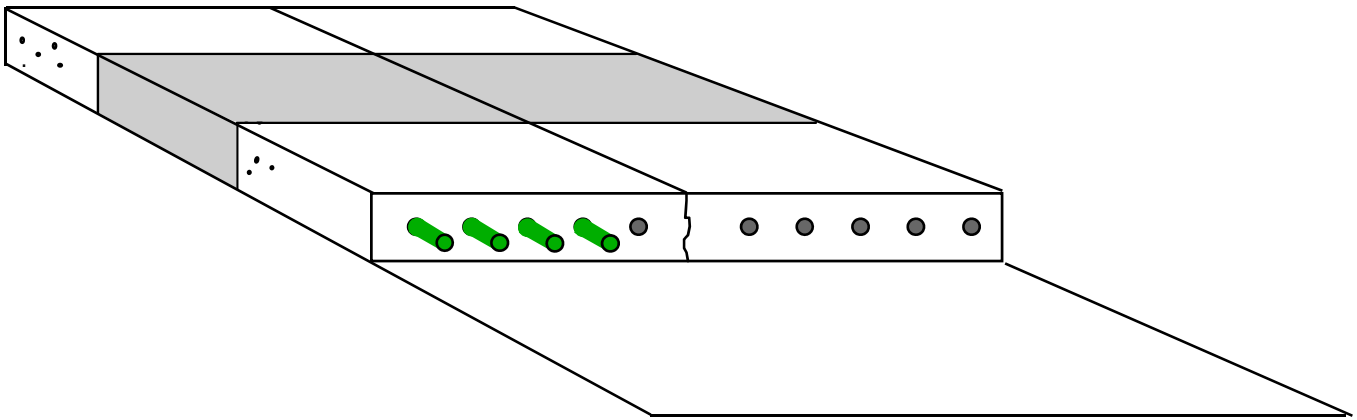
- Repairs distresses greater than 1/3 the slab depth.
- Consists of removing and replacing at least a portion of the existing slab to the bottom of the concrete.



Full Depth Repairs

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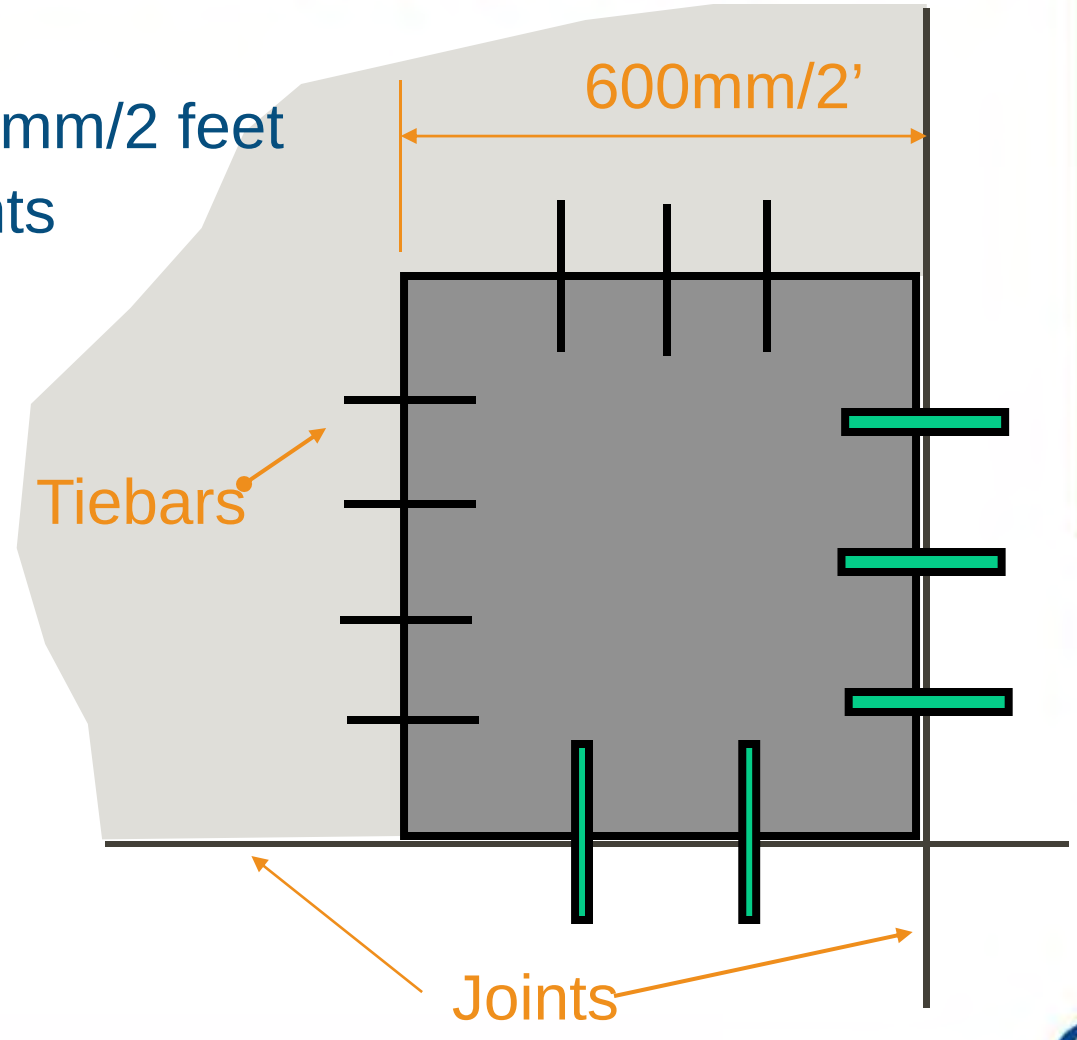
- Minimum Repair 600 mm/2 feet
- Full Depth Cut at Joints
- Diamond-Blades
- Tie to Existing



Gang Drill



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E-Z DRILL
51546

Cleaning Holes (Air Blast)

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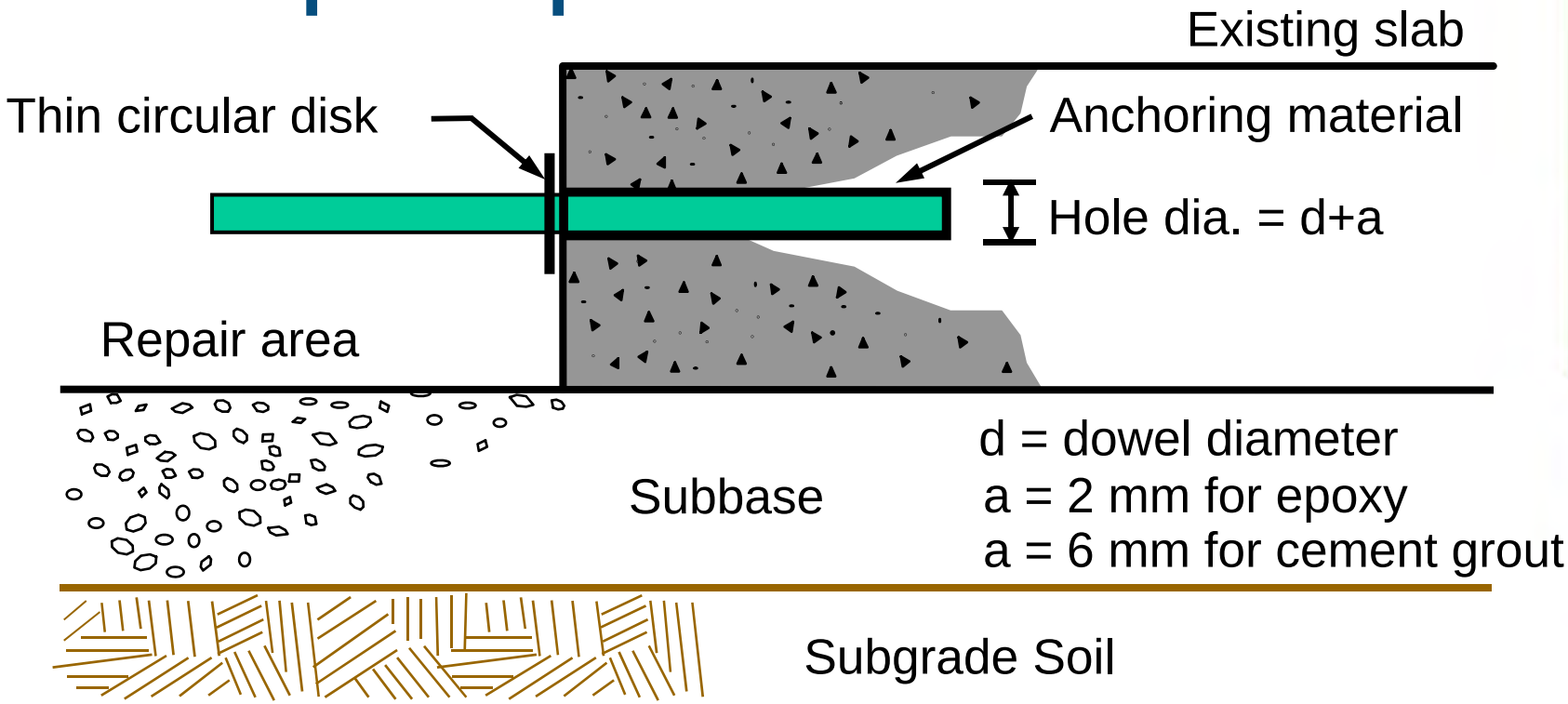
Dowel Bar Placement
for Full Depth Repairs



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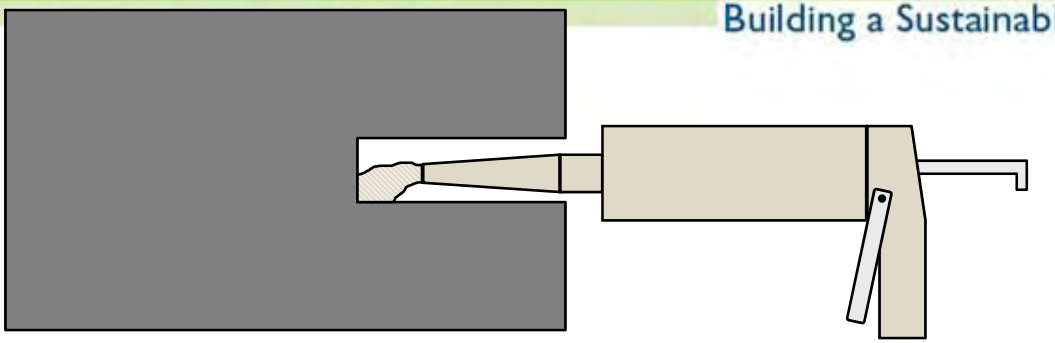
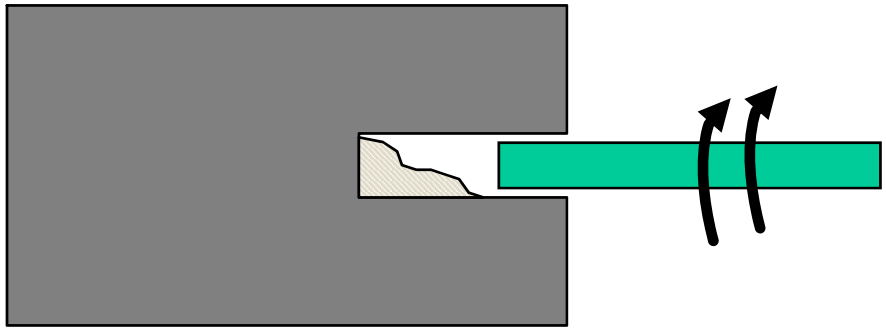


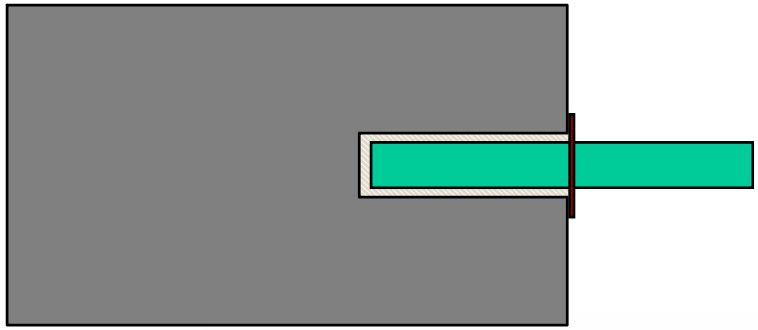
Inject Grout
to Back of Hole

2



Twist one turn
while pushing
in dowel

3



Place grout
retention disk to
hold in grout


09/07/2016

Repair Materials

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Ideal Repair Materials

- Good workability
- Quick mixing time
- Fast setting time
- Rapid strength development
- Low shrinkage
- Strong bonding capability
- Durability
- Thermal compatibility with concrete

Repair Materials

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Cementitious Materials

- High early strength concrete
  - CSA A3001 Type HE cement
  - With or without admixture
  - Reach 20.7 MPa/3000 psi in 24 hours
  - Use cement grout/epoxy bonding agent

Cross-Stitching

- Grouting of tiebars in holes drilled across nonworking longitudinal cracks at an angle to the pavement surface
- Prevents horizontal and vertical crack movements

Cross-Stitching Schematic

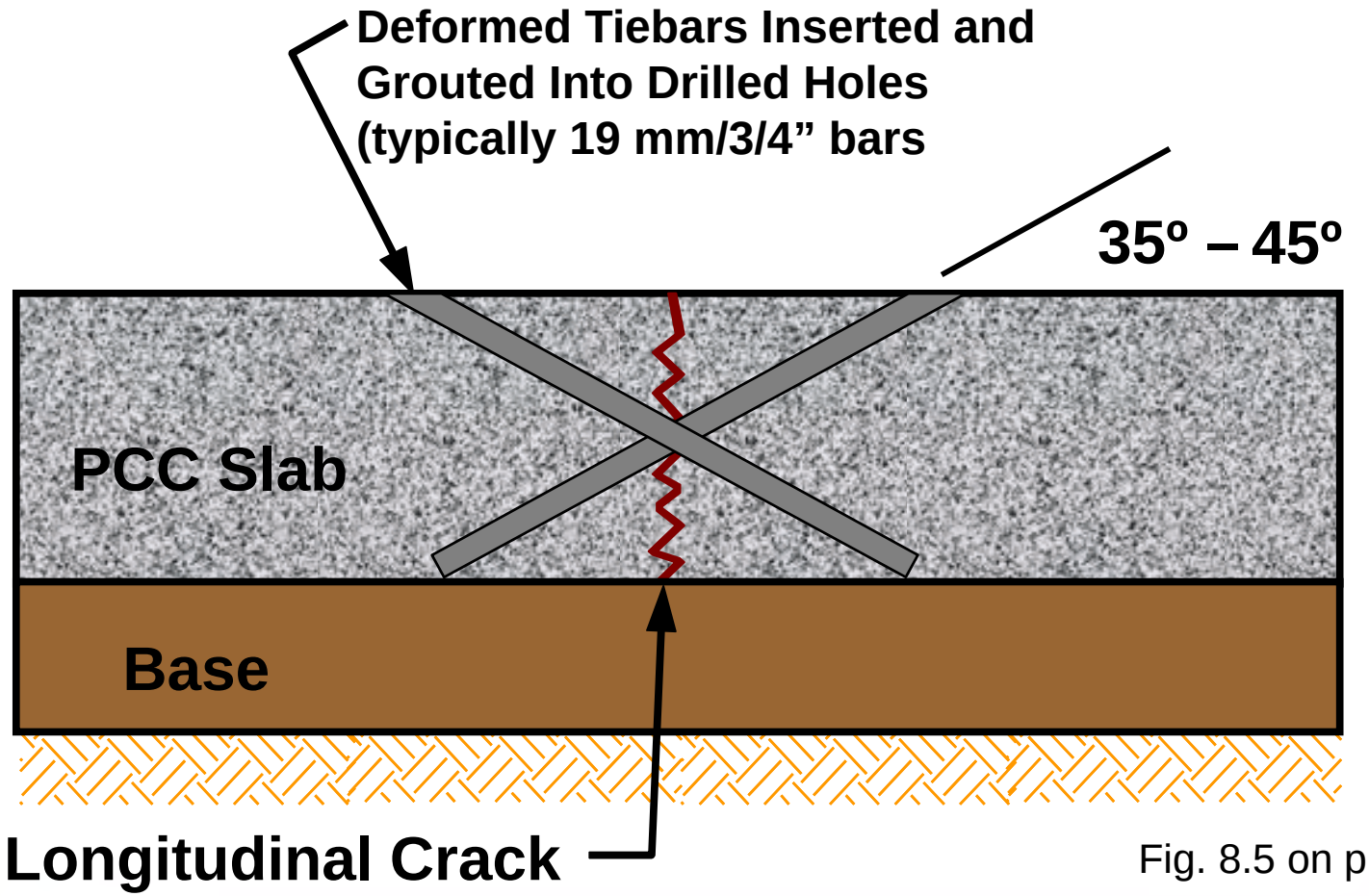

Fig. 8.5 on p. 8.14

Cross-Stitching

Drilling of Holes

Cross-Stitching

Grout Insertion

Cross-Stitching

Bar Insertion

Cross-Stitching

Final Grouting

Diamond Grinding

- Improves safety and roughness by:
  - Smoothing the ride
  - Reestablishing the friction properties
  - Correcting the cross-slope


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CONSTRUCTION
S
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Concrete Overlays for Airfield Pavements – A Long-Life Rehabilitation Alternative

ACPA

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Vice President – Airports and Pavement Technology

American Concrete Pavement Association

Concrete Overlays

Budgets

Airport Sponsors are asked to more with less

Time

Airport Sponsor needs

- proactive, sustainable pavement Maintenance
- Longer lasting rehabilitation strategies
- Reasonable cost

Concrete overlays represent such strategies

HISTORICAL REVIEW

- Began in late forties and early fifties
- First used on Airports and Secondary Roads
- In mid-seventies acceptance grew
- By late eighties this was normal practice
- Then in early nineties Ultra-Thin Whitetopping
- Today concrete overlays are often used strategy

RUNWAY WHITETOPPING - IOWA

1971 Storm Lake - 5” IDOT
1979 Centerville - 5” IDOT
1982 Clarion - 5” IDOT
1983 Waverly - 5” IDOT
1987 Corning - 5” IDOT
1988 Carroll - 5” IDOT
1991 Fort Madison - 5” IDOT
1992 Spencer - 6” FAA
1993 Oelwein - 5” IDOT
1994 Spencer - 6” FAA
1994 Muscatine - 7” FAA
1996 Hampton - 6” IDOT
1996 Clarinda - 5” FAA
1998 Oskaloosa - 6” FAA
2001 Jefferson - 5” FAA
2001 Greenfield - 5” IDOT
2001 Webster City- 6” FAA

Benefits of Concrete Overlays

- Cost-effective solution
- Quick and convenient
- Easy to repair
- Durable rehabilitation tool
- Sustainability
  - Albedo
  - Longevity, and
  - Surface profile stability

THE ADVANTAGE OF CONCRETE APRONS & TAXIWAYS

- Concrete is resistant to deformation, rutting, “birdbaths”, etc.
- Concrete is not damaged by fuel spillage, oil drippings, or jet heat and blast.


3-Year old Reconstruction
3-Year old Asphalt overlay
Reflective cracks

Family of Concrete Overlays

Thinner

Thicker

Concrete Overlays

Bonded Overlay Family

Add Structural Capacity

Unbonded Overlay Family

Restore Structural Capacity

Bonded Concrete Overlay of Concrete Pavements

Bonded Concrete Overlay of Asphalt Pavements

Bonded Concrete Overlay of Composite Pavements

Unbonded Concrete Overlay of Concrete Pavements

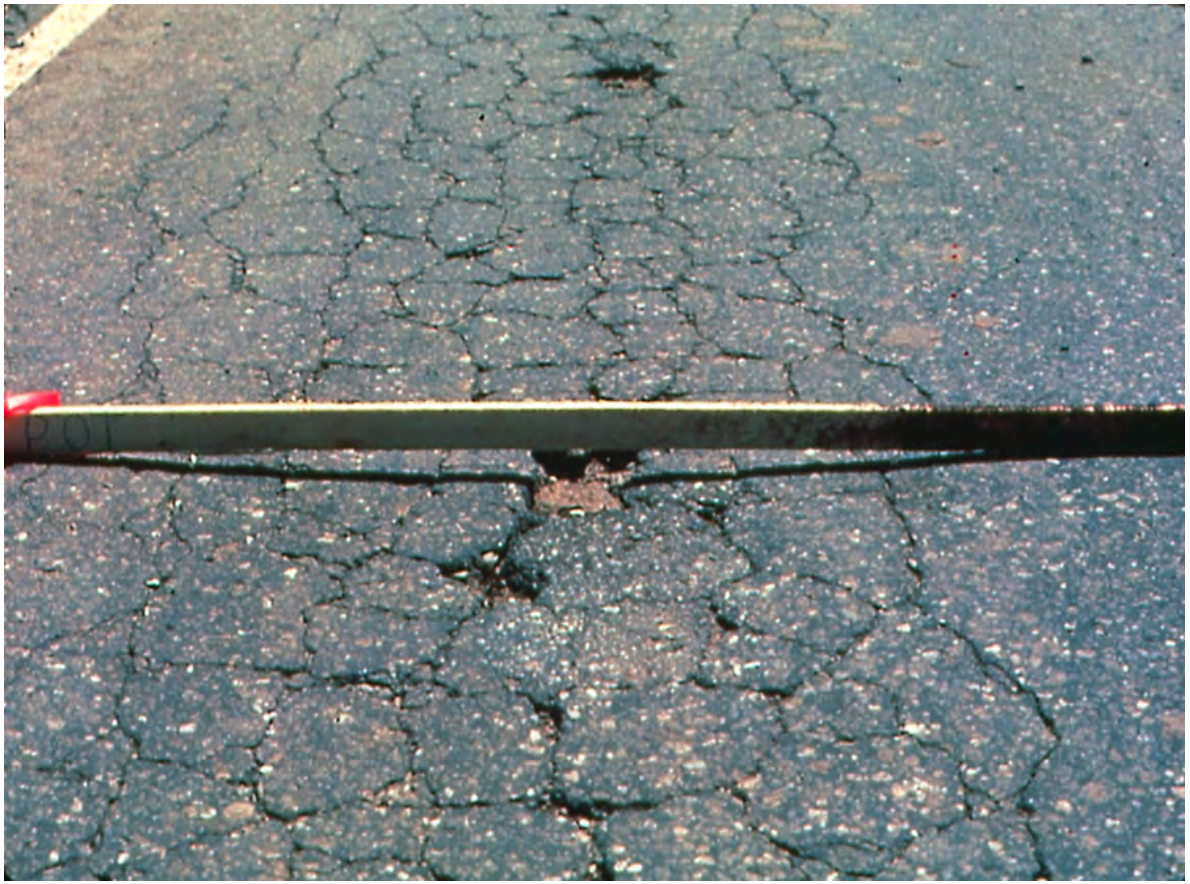
Unbonded Concrete Overlay of Asphalt Pavements

Unbonded Concrete Overlay of Composite Pavements

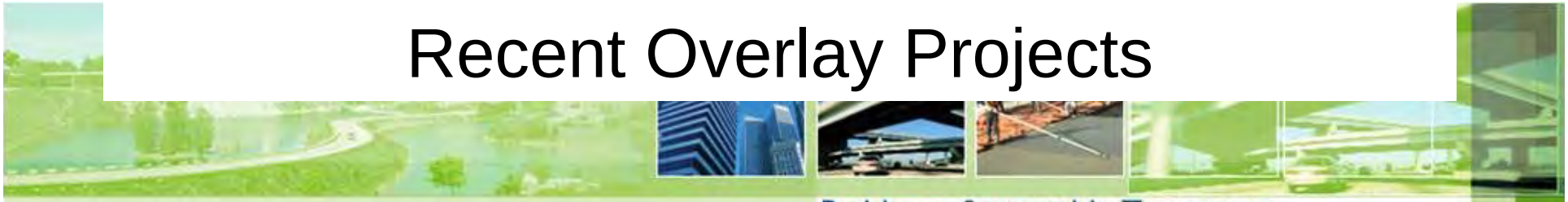
Bond is integral to design

Old pavement is base

Existing Asphalt



Recent Overlay Projects



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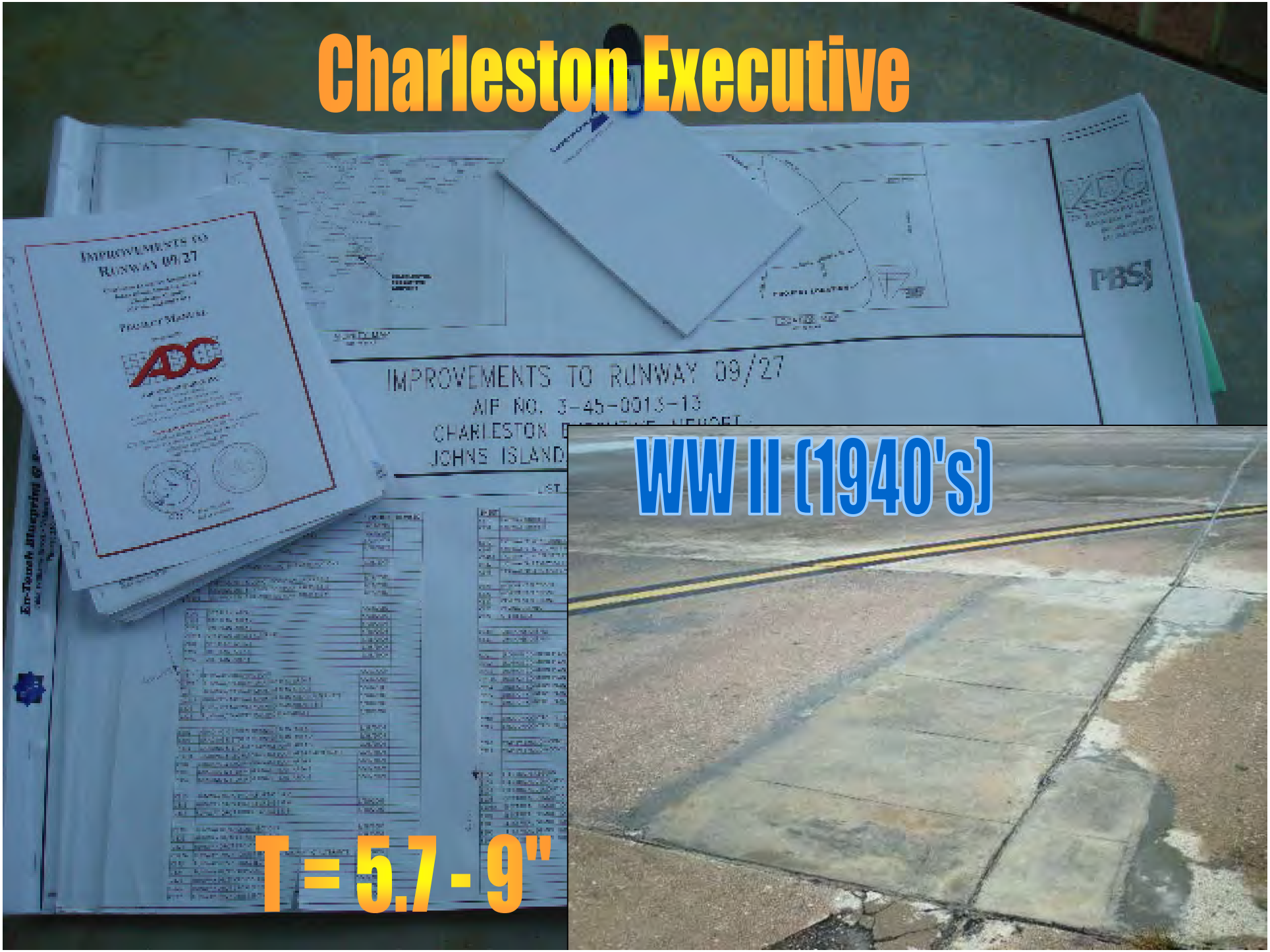
Airport Name	Bid Date	Type	PCCP SY & Depth	Price per SY
Williamsburg Co (SC) - apron	June 2004	WT = Unbonded over asphalt	7000 (5-inch)	$41.96 (Bid SY/CY)
Cobb County (GA) - runway	Apr 2008	WT	70,881 (7-inch)	$29.39
Lancaster County (SC) - runway	Apr 2009	WT	66,870 (6.5-inch)	$22.75
Charleston (SC) Executive - runway	June 2009	Unbonded over PCCP	59,700 (11-inch)	$39.45
Berkeley County (SC) - runway	June 2010	WT	36,260 (9-inch)	$32.90
Augusta (GA) Regional - runway	Sept 2010	WT	141,308 (14-inch)	$37.84

Charleston Executive




350’ Extension
Batch Plant On-Site
Crushing Operation – Base Material
WW II Era PCCP
RW Width reduced to 100’
Asphalt Sep Layer

Quotes from Open House

- A Concrete Overlay kept us “out of the subgrade” vs. reconstruction option.
- A Concrete Overlay raised our pavement elevation out of the high water table
- Inch per Inch concrete was less expensive than the asphalt leveling (separation) layer
- Our original PCCP surface lasted 60+ years, no reason why this surface cannot last another 60 years!

Williamsburg Co Apron Whitetopping

Asphalt PCI = 53/16

Project Details / 2004

Two Alternatives
Volatile Material Cost
Alternate Bids Accepted

Contractor	Alternative Bid Amount ($)	
	Asphalt	Concrete
A	$474,770	$421,625
B	$482,725	-
C	-	$454,510
D	-	$521,521

Cobb Co - McCollum Field

7-in Whitetopping

@ 29.39 / SY

Berkeley County Whitetopping

March, 2011

John F. Kennedy International Airport

THE PORT AUTHORITY
OF NEW YORK & NEW JERSEY

John F. Kennedy International Airport

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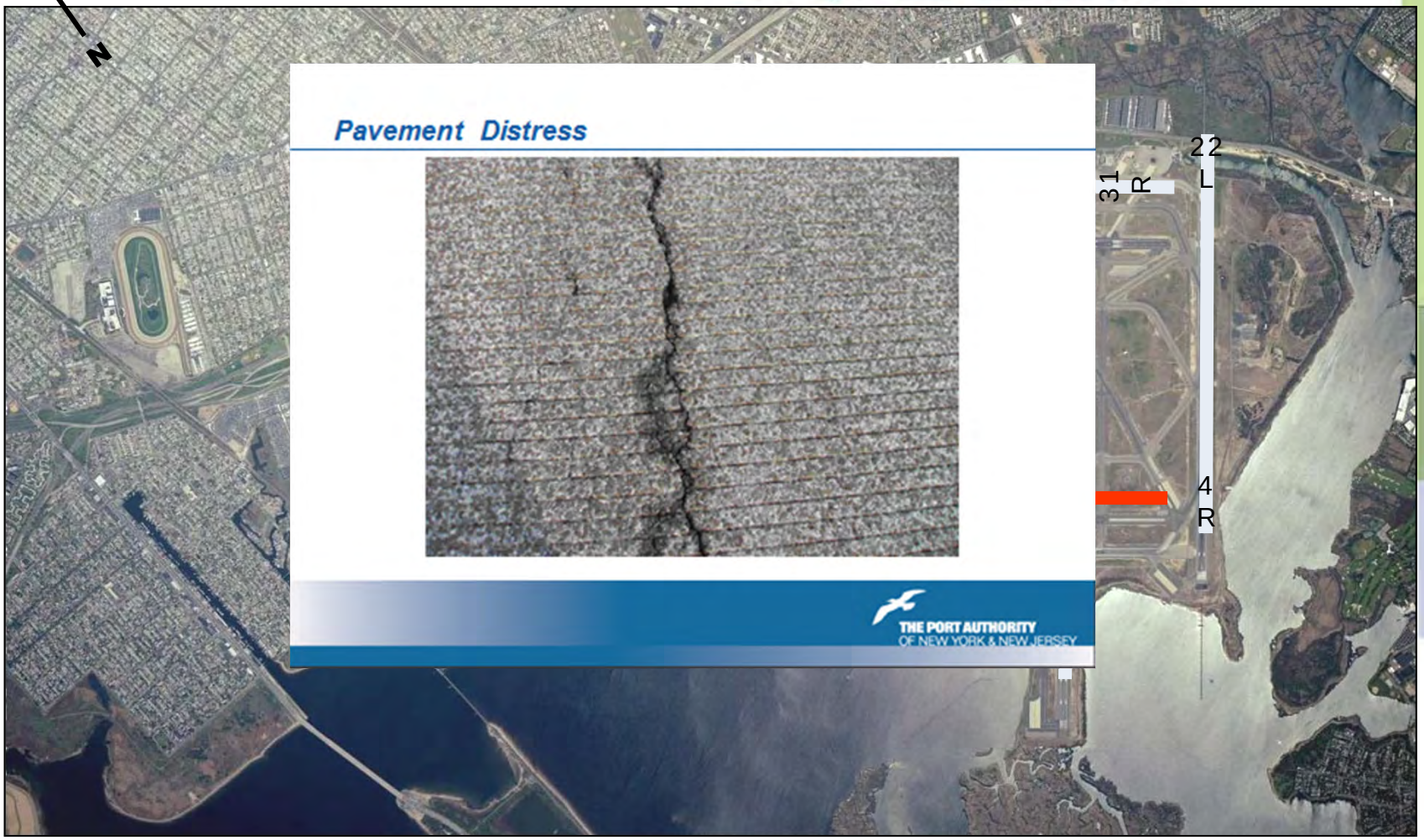
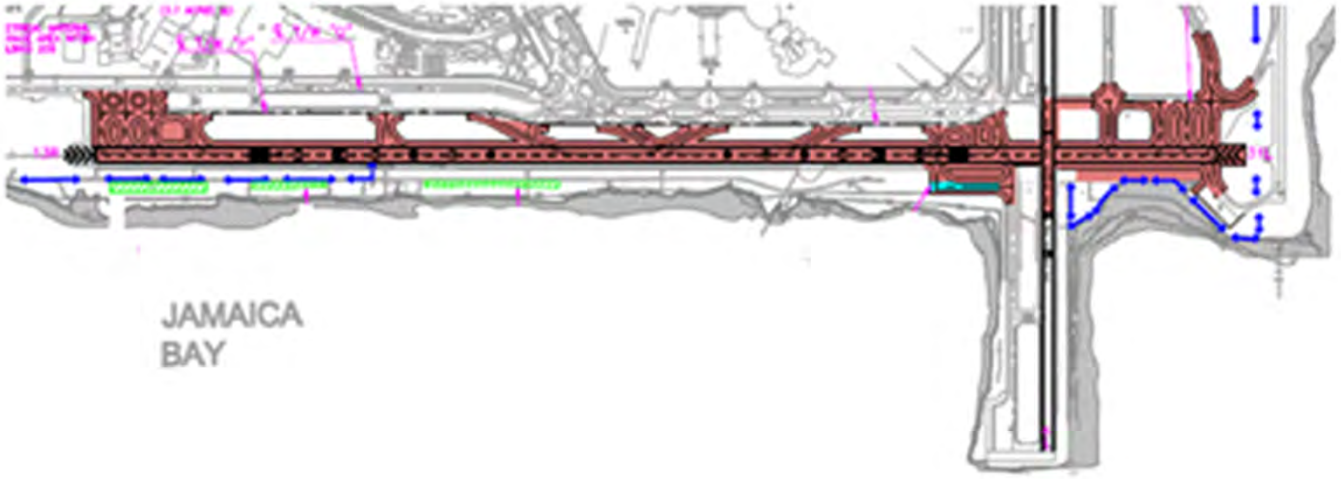
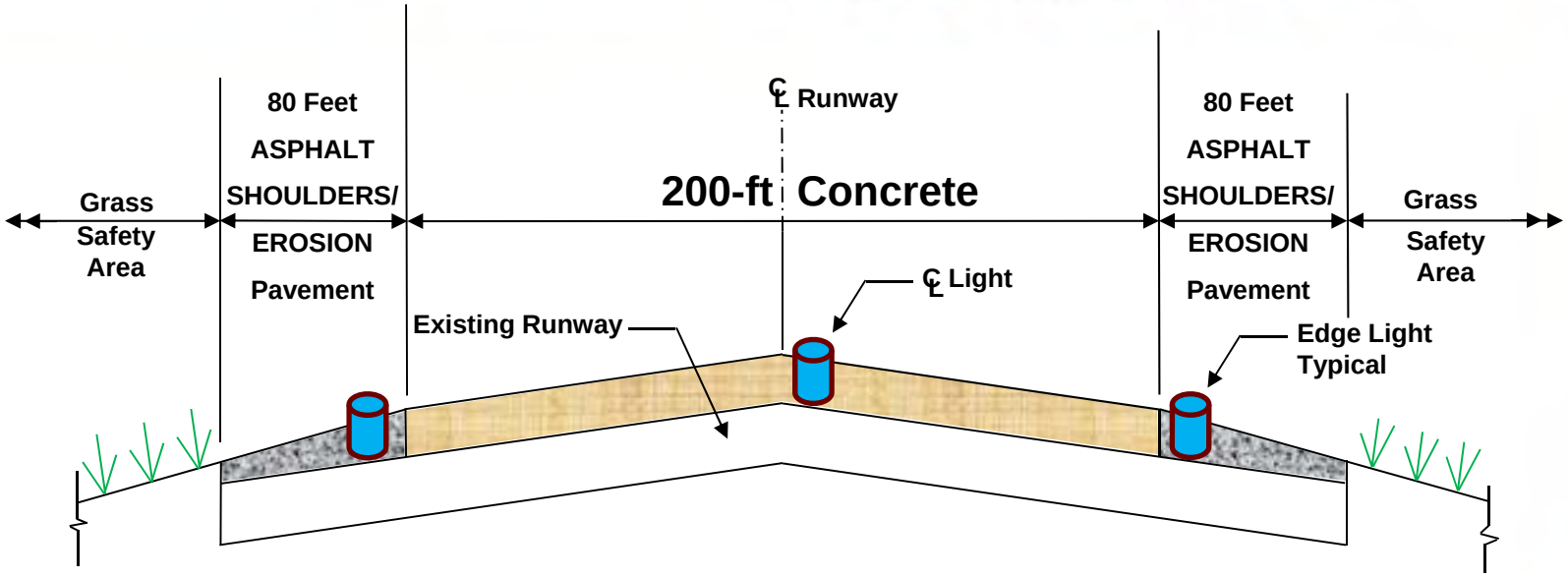


Final Project Design



120 Days - Paved over 12,000 feet



Concrete Runway Typical Section

Runway Cross Section

Construction Progress- Slipform Paving

Questions & Comments

THANK YOU!

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Pavements 4life

www.pavements4life.com