Session 6: Full-Depth Repairs
Learning Outcomes

1. List the benefits of full-depth repairs
2. Describe primary design considerations in terms of dimensions, load transfer, and materials
3. Describe recommended construction activities
4. Identify typical construction problems and remedies
Introduction

• Definition

*Cast-in-place concrete repairs that extend the full-depth of the existing slab*

• Benefits
  – Restore rideability
  – Restore structural integrity
Jointed Concrete Pavements
Applications

- Structural deterioration
- Joint deterioration
- Utility cut repairs
- Overlay preparation
- Recommended evaluation procedures
  - Distress surveys
  - Deflection testing and coring, if required
Candidate Distresses (JCP)

- Transverse cracking (M, H)
- Longitudinal cracking (M, H)
- Corner breaks (L, M, H)
- Spalling (M, H)
- Blowups (L, M, H)
- D-cracking (M, H)
- Reactive aggregate spalling (M, H)
- Deterioration of existing repairs (M, H)
Distress? Candidate?
Distress? Candidate?
Distress? Candidate?
Distress? Candidate?
Distress? Candidate?
Limitations

- Does not address structural inadequacy
- Not a long-term solution for material-related distresses (ASR, D-cracking)
- Not cost effective for widespread deterioration
- Potentially an expensive cost item
Design Considerations

- Marking repair boundaries
- Load transfer design
- Selection of repair materials
- Curing
- Opening to traffic
Selecting Repair Boundaries
Potential Extent of Deterioration at Joint

Fig. 6.1 on p. 6.4
Selecting Repair Boundaries

Repair Dimensions

- Minimum dimensions
  - Use lane-width repairs
  - Length $\geq 1.8$ m (6 ft) (doweled)
  - Length 1.8 - 3.0 m (6 -10 ft) (nondoweled)

- Long repairs (>3 to 4 m [10 to 13 ft])
  - Provide reinforcement or intermediate joint

- Independent repairs in adjacent lanes

- If distress falls within 0.6 m (2 ft) of joint, extend repair to joint
Selecting Repair Boundaries

Example Repairs in JPCP

Before

After

L, M, H = Low-, Medium-, High-Severity

Fig. 6.2 on p. 6.6
Load Transfer Design

Dowel Bars
Load Transfer Design
Recommendations

- Smooth dowels 38 mm (1.5 in) dia.

- 3.7 m (12 ft) total length
- 0.6 m (2 ft) typical
- 0.3 m (1 ft) typical
- 1.8 m (6 ft) minimum

Fig. 6.5 on p. 6.10
Repair Materials

- PCC mixes
- Rapid set cement (RSC)
- Regulated set portland cement (RSPC)
- Proprietary materials
Construction Steps

1. Marking the boundaries
2. Concrete sawing
3. Concrete removal
4. Repair area preparation
5. Restoration of load transfer
6. Concrete placement
7. Curing
8. Diamond grinding (optional)
9. Joint sealing
Concrete Sawing

- Full-depth, diamond-bladed sawing
- Limit traffic loading on sawed pavement to avoid pumping
- Maintain straight edge along shoulder side
Layout of Sawcuts

- Full-depth sawcut along longitudinal joint
- Partial or full-depth sawcut
- Full-depth sawcuts at 75 mm
- Pressure relief cut at 125 mm

Fig. 6.8 on p. 6.14
Concrete Removal
Breakup and Cleanout Method

• Advantages
  – Simple and straightforward
  – Readily available equipment

• Disadvantages
  – Greatly disturbs subbase
  – Potential to damage slab and underground utilities
  – Relatively slow
  – Safety problems with flying debris
Concrete Removal
Concrete Breakup
Concrete Removal
Cleanout with a Backhoe
Concrete Removal
Liftout Method

• Advantages
  – Does not disturb subbase
  – More rapid material removal
  – High level of productivity

• Disadvantages
  – Handling and disposal of large concrete pieces
  – Process requires heavy lifting equipment
Concrete Removal
Liftout Method
Repair Area Preparation
Restoration of Load Transfer
Drilling Recommendations

- Dowel holes drilled on 300 mm (12 in) centers at mid-depth
- Dowel holes drilled slightly larger than dowel diameter
- Smooth steel dowel bars (typically 1.25 to 1.5 inch)
Restoration of Load Transfer

Drilling Holes for Dowels
Restoration of Load Transfer
Bar Installation Recommendations

• Blow debris and dust from holes
• Place grout or epoxy in holes
• Insert dowel into hole with slight twisting motion
• Install grout retention disks (optional)
• Apply bondbreaker to protruding dowel ends
Restoration of Load Transfer

Cleaning Holes
Restoration of Load Transfer
Injecting Anchoring Material
Restoration of Load Transfer

Dowel Bar Placement

1

2

3
Restoration of Load Transfer

Dowel Bar Placement

Grout-retention disk (optional)

Existing slab

Anchoring material

Hole dia. = \(d + a\)

Repair area

Subbase

d = dowel diameter

a = 2 mm (1/8 in) for epoxy

a = 6 mm (1/4 in) for cement grout

Subgrade Soil

Fig. 6.10 on p. 6.18
Restoration of Load Transfer
Area Prepared with Dowels in Place
Longitudinal Joint
Placement of Bondbreaker Board
Concrete Placement

- Consolidation and level finish are critical
- Vibrate along edges of repair and in vicinity of dowel bars
- Don’t use vibrators to move concrete
- Avoid addition of extra water
- Texture surface to match existing pavement
Concrete Placement
Concrete Placement

Screeding
6.41

Finishing

< 10 ft

Straight Edge

> 10 ft

Vibrating Screed

Fig. 6.11 on p. 6.18
Concrete Placement

Texturing
Curing

Application of Curing Compound

- White-pigmented curing compound
- Apply immediately after texturing
- Uniform coverage
Diamond Grinding (optional)
Joint Sealing
# Opening to Traffic

<table>
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Table 6.6 on p. 6.12
Key Factors For Success (JCP)

- Selection of proper candidate projects
- Properly sized repairs
- Good material removal practices
- Well prepared subbase
- Effective restoration of load transfer
- Selection of appropriate repair material
- Proper material placement, finishing, and curing
Continuously Reinforced Concrete Pavements
CRCP Pavements

Candidate Distresses

- Punchouts (L, M, H)
- Deteriorated transverse cracks (M, H)
- Longitudinal cracking (M, H)
- Blowup (L, M, H)
- D-cracking (M, H)
- Deterioration of or near repair (M, H)
CRCP Pavements
Repair Recommendations

Replace as a single area

a \geq 1.8 \text{ m (6 ft)} \text{ tied steel}

a \geq 1.2 \text{ m (4 ft)} \text{ welded or mechanical connection}

b \geq 46 \text{ cm (18 in)}

Fig. 6.4 on p. 6.7
CRCP Pavements

Sawcut Locations

A = 200 mm (8 in) minimum for welded or mechanical connections
= 610 mm (24 in) minimum for tied connections

B = 810 mm (32 in) minimum for welded or mechanical connections
= 610 mm (24 in) minimum for tied connections

1.2 m (4 ft) for welded/mechanical or 1.8 m (6 ft) tied

Fig. 6.9 on p. 6.15
CRCP Pavements
Restoring Continuity of Reinforcing Steel
CRCP Pavements

Concrete Placement
Key Factors For Success (CRC)

- Selection of proper candidate projects
- Properly sized repairs
- Effective sawcutting practices
  - Full-depth cuts
  - Partial-depth cuts
- Well prepared subbase
- Effective restoration of reinforcement
- Selection of appropriate repair material
- Proper material placement, finishing, and curing
Troubleshooting

What is wrong here?
Troubleshooting
What is wrong here?
Troubleshooting
What is wrong here?
Troubleshooting

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Troubleshooting
What is wrong here?
Review: Learning Outcomes

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