Session 6: Full-Depth Repairs
Introduction

• Definition

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

• Benefits
  – Restore rideability
  – Restore structural integrity
Applications

• Address structural deterioration
  – Cracking/corner breaks
  – Punchouts
• Address joint deterioration
  – Severe spalling
  – Joint lockup
• Utility cut repairs
• Prepare pavement for overlay
Design and Materials Considerations

- Repair boundaries
- Repair materials
- Load transfer design
Repair Boundaries

- Encompass all deterioration
- Minimum dimensions
  - Use lane-width repairs
  - Length ≥ 1.8 m (6 ft)
- Provide intermediate joint for long repairs (>4.6 m [15 ft])
- Independent repairs in adjacent lanes
- If distress falls within 0.6 m (2 ft) of joint, extend repair to joint
Repair Materials

- Based largely on required opening times
  - Conventional PCC mixes most common
  - Proprietary materials and specialty cements available
- Various materials can be used within a project to meet opening requirements
Load Transfer Design

Dowel Bars

- Critical to long-term performance
- Dowel characteristics:
  - Diameter: Typically D/8
  - Length: Typically 457 mm (18 in)
  - Corrosion-resistant (epoxy common)
  - Debonding medium
Load Transfer Design

Example Layout

Traffic Direction

Mid-depth slab

Smooth dowels
38 mm (1.5 in) dia.

3.7 m (12 ft)
0.6 m (2 ft)
0.3 m (1 ft) typical

1.8 m (6 ft) minimum

Fig. 6.5 on p. 6.10
Construction Steps

1. Concrete sawing
2. Concrete removal
3. Repair area preparation
4. Restoration of load transfer
5. Treatment of longitudinal joint
6. Concrete placement and finishing
7. Curing and Opening to Traffic
1. Concrete Sawing

Fig. 6.9 on p. 6.15
2. Concrete Removal

- Breakup and Cleanout Method
  - Simple and straightforward
  - May disturb base and underlying utilities
  - Relatively slow
- Litfout Method (preferred)
  - Minimizes disturbance
  - High productivity
  - Requires heavy lifting equipment
Concrete Removal
Breakup and Cleanout
Concrete Removal
Liftout Method
3. Repair Area Preparation
4. Restoration of Load Transfer

Drilling Recommendations

- Dowel holes drilled at mid-depth of existing slab at specified spacings
- Dowel holes drilled slightly larger than dowel diameter
- Use gang drills for better alignment and increased productivity
Restoration of Load Transfer

Schematic of Dowel Bar Installation

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. 6.13 on p. 6.19
Restoration of Load Transfer

Drilling Holes for Dowels
Restoration of Load Transfer
Drilled Holes
Restoration of Load Transfer
Dowel 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
Area Prepared with Dowels in Place
5. Treatment of Longitudinal Joint
6. 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

Finishing

< 10 ft

> 10 ft

Straight Edge

Vibrating Screed

Fig. 6.15 on p. 6.21
Concrete Placement

Texturing
7. Curing and Opening to Traffic

- White-pigmented curing compound
- Apply immediately after texturing
- Uniform coverage
- Opening strength: 2000 to 3000 psi
## Opening Strength Matrix

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<th>Slab Thick, in</th>
<th>Strength for Opening to Traffic, psi</th>
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<th>Slab Replace</th>
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<td>MR (3rd)</td>
<td>f’c</td>
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Table 6.6 on p. 6.13
Key Factors For Success

- Selection of proper candidate projects
- Properly sized repairs
- Good material removal practices
- Properly prepared repair area
- Effective restoration of load transfer
- Selection of appropriate repair material
- Proper material placement, finishing, and curing
Troubleshooting
Troubleshooting

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

What is wrong here?
Troubleshooting

What is wrong here?
Troubleshooting

What is wrong here?
Utility Cut Repairs
Utility Cuts

- “Openings” in pavements to gain access to utilities
- Proper repair of openings critical to performance of overall pavement
  - Settlements
  - Cracking
  - Roughness
- Follow good FDR practices
Key Items

- Planning:
  - Avoid odd shaped repairs
  - Use good jointing practices
- Leave rim of compacted base/subgrade along cut
- Provide load transfer
- Backfill/compaction
  - Consider flowable fill
- Finish smooth and level with surrounding pavement
Precast Concrete Repairs