Session 8: Load Transfer Restoration
Learning Outcomes

1. List benefits and applications of load transfer restoration
2. Describe recommended materials and mixtures
3. Describe recommended construction procedures
4. Identify typical construction problems and remedies
Load Transfer

• Ability of a joint or crack to transfer a wheel load from one side to the other
• Accomplished through:
  – Mechanical devices (dowel bars)
  – Aggregate interlock
  – Foundation support
• Load transfer efficiency (LTE)
Load Transfer (continued)

0% Load Transfer

Wheel Load

Direction of Traffic

Approach Slab  Leave Slab

100% Load Transfer

Wheel Load

Direction of Traffic

Approach Slab  Leave Slab

LT = \frac{Unloaded}{Loaded}

Fig. 8.1 on p. 8.2
Causes of Poor Load Transfer

- Absence of load transfer devices
- Failed load transfer devices
- Excessive crack/joint opening
- Poor pavement drainage
- Erodible base
Results of Poor Load Transfer
Pumping
Results of Poor Load Transfer

Transverse Joint Faulting
Results of Poor Load Transfer
Corner Breaks
Results of Poor Load Transfer
Deteriorated Mid-Panel Cracking
Load Transfer Restoration

- Definition

  *Installation of mechanical devices in an existing pavement to restore load transfer*

- Suitable for transverse joints or cracks
- Should last for the remaining life of the pavement
Retrofitted Dowel Bar

END VIEW

SIDE VIEW

- As required
- Compressible insert
- Mid-depth of slab
- Chair
- Joint or crack
- Endcap

Fig. 8.3 on p. 8.7
Load Transfer Restoration

Benefits

• Reduced probability of pumping, faulting, and corner breaks
• Improved long-term rideability
• Increased service life
Good Candidate Projects

- Relatively good structural condition but:
  - Poor load transfer (< 50–60%)
  - Differential deflections > 0.25 mm (0.01 in)
  - Faulting: 3–13 mm (0.12–0.5 in)
  - <10% slabs with multiple cracks
- Medium to heavy truck traffic
- Recommended evaluation procedures:
  - Distress survey
  - Deflection testing
Material Selection

- Load transfer devices
  - Dowel bars
- Repair (filler) materials
  - Portland cement concrete (PCC)
  - Rapid-setting proprietary materials
  - Polymer concretes
  - Epoxy-resin adhesives
Load Transfer Devices
Dowel Bars
Dowel Design and Layout

Centerline

12 to 18 in (300 to 450 mm)

24 in (600 mm)

2 groups of 3 bars on 12-in (300-mm) centers

Fig. 8.2 on p. 8.6
Construction

1. Slot creation
2. Slot preparation
3. Dowel bar placement
4. Repair material placement
5. Diamond grinding (optional)
6. Joint sealing
Slot Creation

- Diamond-bladed slot cutting machines
  - Ganged sawblades for multiple cuts
- Slots parallel to pavement centerline
- Slot dimensions
  - Length: Varies (1 m [3 ft] for 350-mm [14-in] dowel bar)
  - Width: Typically 65 mm (2.5 in)
  - Depth: 13 mm (0.5 in) below dowel
Slot Creation
Slot Cutting Machine
Slot Creation
Close-Up of Sawblades
Slot Creation

Slot Sawcuts
Slot Creation
Slot Cutting with Milling Machine
Slot Preparation
Material Removal
Slot Preparation
Material Removal
Slot Preparation

Sandblasting Slots
Slot Preparation

Cleaning Slots after Sandblasting

Airblasting

Cleaned Slot
Slot Preparation
Caulking of the Joint or Crack
Dowel Bar Placement

- Add joint reformer to dowel bar
- Attach non-metallic expansion caps to dowel ends
- Apply bondbreaker to dowels
- Place dowel on non-metallic chair at slab mid-depth
- Adjust joint reformer as necessary to align with joint
Dowel Bar Placement
Repair Material Placement

- Mix material in small quantities
  - Generally 10 mm (3/8 in) top size aggregate
  - Do not retemper mix
- Totally encase dowel bar with material
- Provide effective consolidation
  - Small 25 mm (1 in) spud vibrator
  - Do not contact dowel bar
Repair Material Placement

Backfilling
Repair Material Placement
Consolidation and Finishing
Final Steps

- Curing
- Re-establish joint reservoir
- Diamond grinding
- Joint sealing
Key Factors For Success

- Selection of proper candidates
- Proper dowel design and layout
- Cutting of dowel bar slots
- Proper preparation of slots
- Proper placement of dowels
- Selection of appropriate material
- Careful material placement and curing
Troubleshooting

What is wrong here?

Misaligned Joint Forming Material
Troubleshooting
What is wrong here?

Jackhammer Angle Too Great
Troubleshooting
What is wrong here?

Sawcuts Not Parallel to Centerline
Troubleshooting
What is wrong here?

Nonuniform Sawcarts
Troubleshooting
What is wrong here?

Poor Consolidation
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

Deformed Tiebars Inserted and Grouted Into Drilled Holes (typically 19 mm [3/4 in] bars)

Fig. 8.5 on p. 8.14
Cross-Stitching
Drilling of Holes
Cross-Stitching
Grout Insertion

8.43
Cross-Stitching
Bar Insertion
Cross-Stitching

Final Grouting
Review: Learning Outcomes

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