

## Module 4-9

# ***Load Transfer Restoration***

## Objectives

Identify problems that can be addressed by load transfer restoration

Describe the available techniques for assessing need for load transfer

Describe the installation procedures

Identify the performance capabilities of load transfer devices

## Pumping



## Faulting



## Corner Cracking



## Load Transfer Restoration

Increasingly popular method

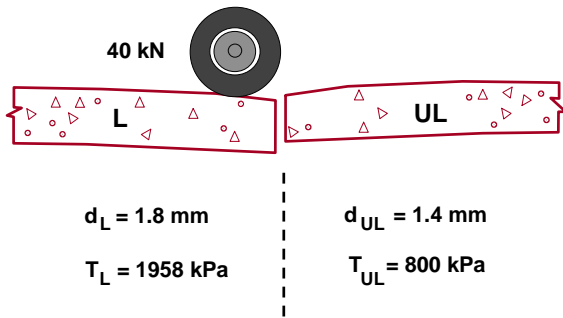
Installation of devices to transfer load

Transverse joints and cracks

Reduces further deterioration

- Pumping and faulting
- Spalling
- Corner breaks

## Load Transfer Efficiency



## Deflection Load Transfer Efficiency

Method 1:  $LT_1 = \frac{d_{UL}}{d_L}$

$$= \frac{1.4}{1.8} = 0.80 \text{ (80\%)}$$

Method 2:  $LT_2 = \frac{2d_{UL}}{d_L + d_{UL}}$

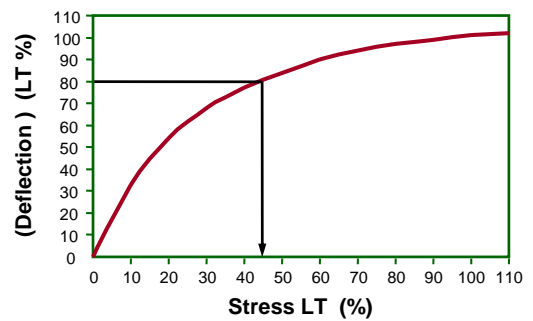
$$= \frac{2(1.4)}{1.8 + 1.4} = 0.88 \text{ (88\%)}$$

## Stress Load Transfer Efficiency

$$\text{Stress Load Transfer} = \frac{T_{UL}}{T_L}$$

$$= \frac{800}{1958} = 0.41 \text{ (41\%)}$$

## Relationship Between Stress and Deflection Load Transfer



## Types of Load Transfer Devices

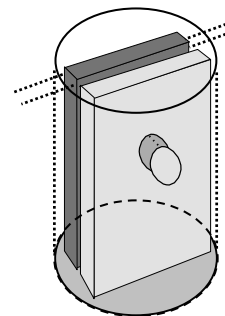
Plate and stud device

Double-vee device

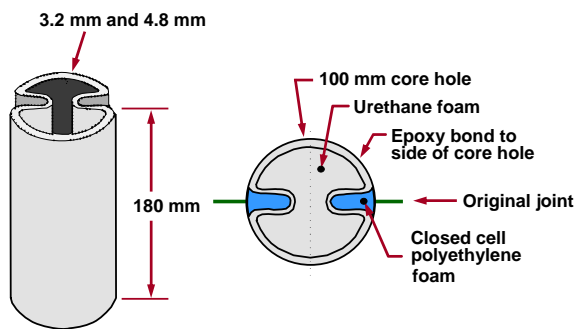
Dowel bars (epoxy coated)

- Round bars
- I-beams

## Plate and Stud Device



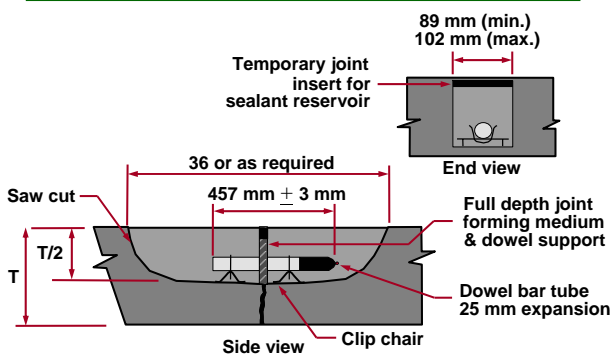
## Double-Vee Device



## Double-Vee Device



## Retrofit Dowel Bar Layout



## Repair Material

### Required characteristics

- Little or no shrinkage
- Rapid strength development
- Good bond with device and with concrete

### Types of materials

- Proprietary materials
- Polymer concrete
- Portland cement concrete
- Epoxy-resin adhesives

## Applications

Joints exhibiting distresses due to poor load transfer (LTE < 50%)

Uniform cracks that have not opened or faulted

Prior to HMA or bonded PCC overlay

More appropriate on pavements experiencing heavy truck traffic

Pavements > 200 mm (8 in) thick

## Effectiveness

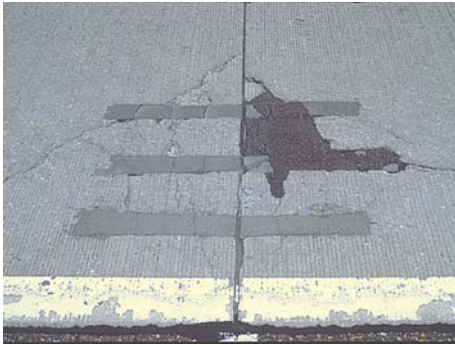
Retrofitted dowel bars have performed well

Performance of double-vee device has been poor

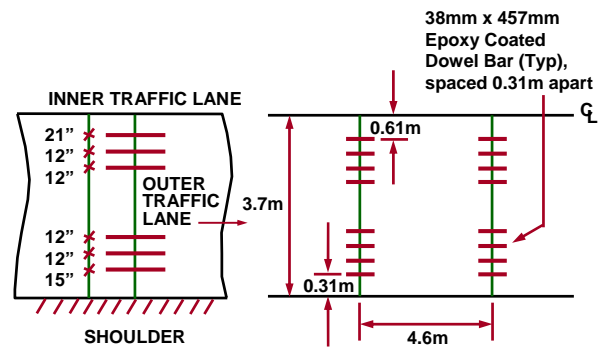
Not much performance data on other types of devices

**Dowel bars are the only recommended devices for load transfer restoration**

## Dowel Bar Design Considerations



## Typical Layout (Plan View)



## Pavement Surveys

### Measure faulting

### Measure load transfer efficiency

- Falling weight deflectometer (FWD)
- Temperatures < 27 °C (80 °F)
- Outer wheel path of outside lane
- Account for slab bending effects

### Lift slabs and examine condition

### Examine cores

## Costs

### Costs are on the decline

- Contractor experience
- Innovative methods and equipment

Typical costs per dowel range  
from \$22 to \$50

## Slot Preparation

Slots should be parallel to centerline

Saw depth should be 13 mm below bottom  
of dowel bar

Remove material with jackhammers or  
hand tools

Caulk joints to prevent intrusion

Provide clean surface (a bonding agent is  
sometimes required)

## Slot Sawcuts



### Slot Cutting

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### Slot Cutting

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### Material Removal

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### Material Removal

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### Cleaning Slots after Sandblasting

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### Dowel Bar Placement

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- Lightly grease or oil the full length
- Expansion cap is required
- Place at mid-depth on chairs
- Proper alignment is critical
- Use filler board or styrofoam at mid-point of dowel bar

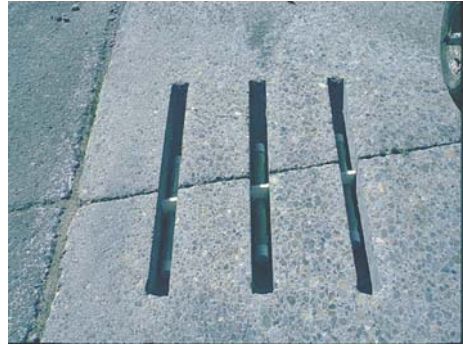
### Dowel Bar Placement

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### Dowel Bar Placement

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### Joint Sealed with Caulk

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### Mixing Grout Repair Material

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### Wetting and Filling Slots

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### Finished Dowel Bar Retrofit

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## Retrofit Dowel Project

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## Retrofit Dowel Project

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## Summary

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**Increasingly popular method of establishing good load transfer**

**Dowel bars only are recommended**

**New equipment has improved efficiency and cost of process**

**Deflection testing is recommended for evaluation and acceptance**