

Chapter 8

Full Depth Concrete Repair

From... Maintenance Technical
Advisory Guide (MTAG)

Learning Objectives

1. List benefits of full-depth repairs
2. Describe primary design considerations
3. List available types of repair materials
4. Describe the recommended construction procedure
5. List important quality control activities
6. Describe potential construction and performance problems
7. Identify troubleshooting solutions

Presentation Outline

- Introduction
- Design considerations
- Construction
- Quality control
- Troubleshooting

Introduction

- Definition

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

- Purpose

- Repair localized distress
- Preparation for an overlay, as necessary

Candidate Distresses

- Transverse cracking (M, H)
- Longitudinal cracking (M, H)
- Corner breaks (L, M, H)
- Spalling (M, H)
- Blowup (L, M, H)
- D-cracking (M, H)
- Deterioration of existing repairs (M, H)

Benefits

- Restored rideability
- Restored structural integrity
- Prevents further deterioration

Limitations

- Does not address structural inadequacy
- Not a long-term solution for material-related distresses
- Widespread deterioration
- Cost considerations

Module 8-1

Design, Materials & Specifications

From... Maintenance Technical
Advisory Guide (MTAG)

Presentation Outline

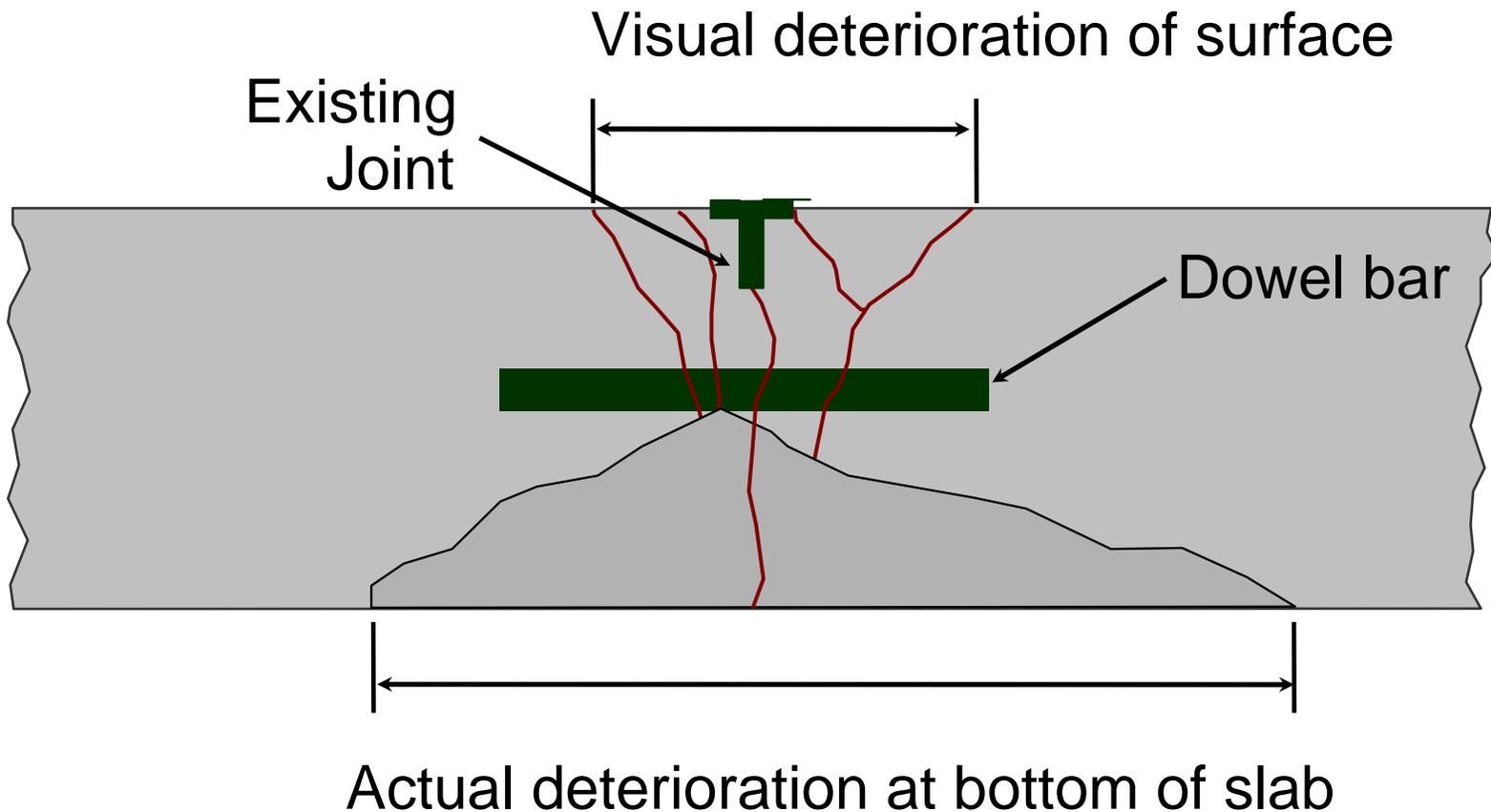
- Introduction
- Design considerations
- Construction
- Quality control
- Troubleshooting

Design Considerations

- Selecting repair boundaries
- Load transfer design
- Selection of repair materials
- Curing
- Opening to traffic

Selecting Repair Boundaries

Extent of Deterioration at Joint



Selecting Repair Boundaries

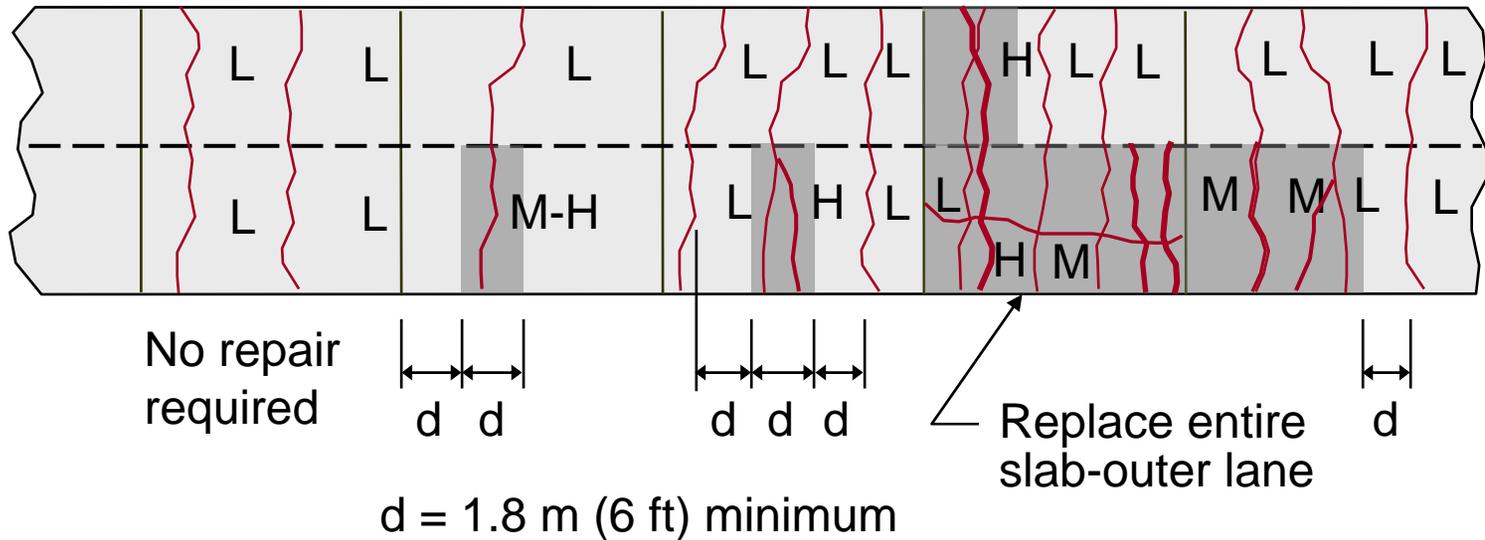
Repair Dimensions

- Minimum dimensions
 - Use lane-width repairs
 - Length \geq 6 ft
- Long repairs 12 ft or longer
 - Provide reinforcement, or
 - Provide intermediate doweled joint

Selecting Repair Boundaries

Repair Recommendations (JRCP)

Some typical distress conditions noted with
 L = low M = medium H = high

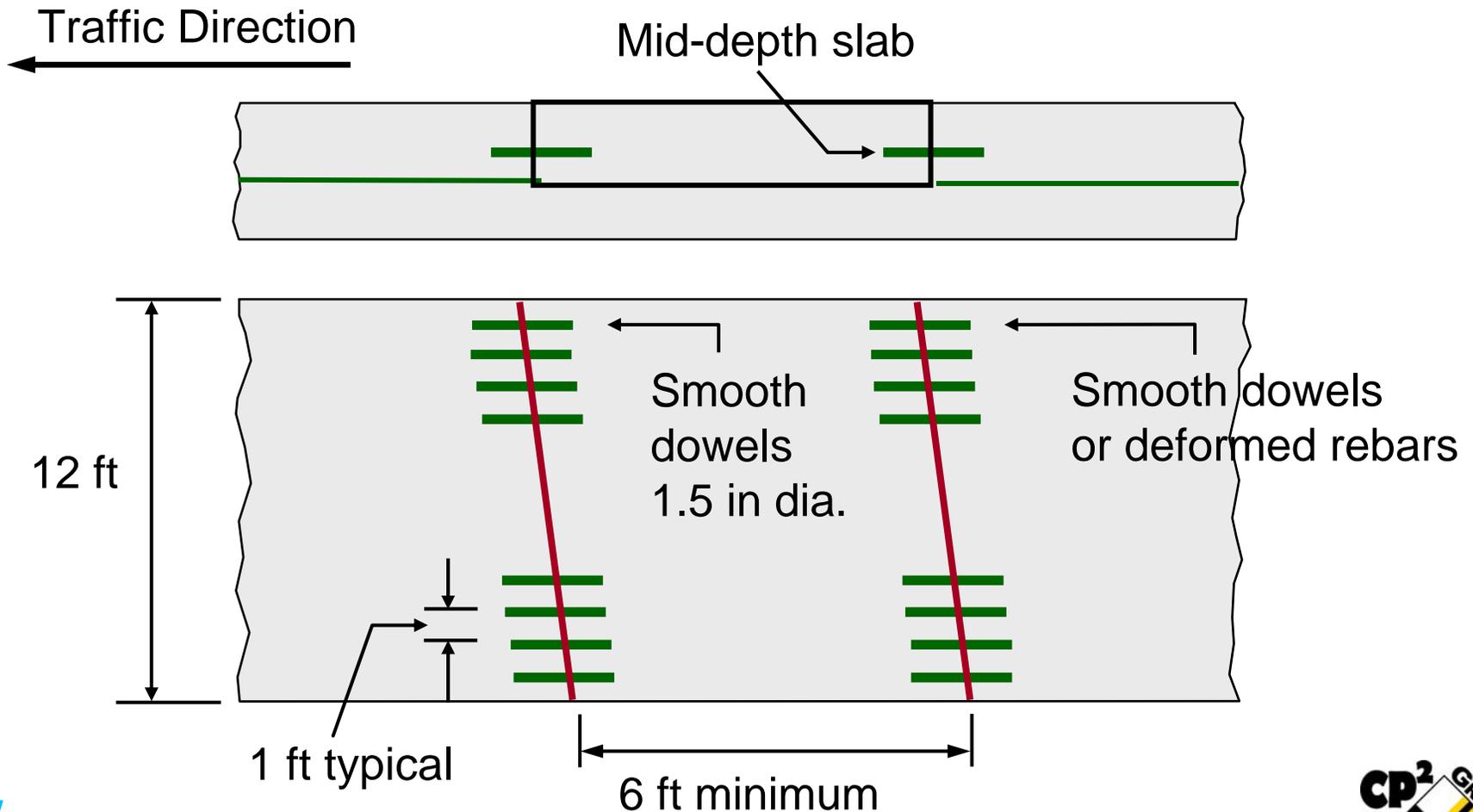


Selecting Repair Boundaries

Multi-Lane Considerations

- Adjacent lanes can be repaired independently
 - Matching joints is not essential
 - Avoid small offsets
- If blowups in adjacent lane
 - Delay until hot weather
 - Cut pressure relief joints

Load Transfer Design Recommendations



Load Transfer Design

Dowel Bars



Load Transfer Design

Tie Bars



Repair Materials Recommendations

- PCC mixes
- Rapid strength concrete (RSC)
- High early strength materials
- Specialty materials

Curing

- Curing compound
- Insulation blankets
- HIPERPAV software

Opening to Traffic

- Opening criteria
 - Minimum strength
 - Minimum time
- Typical strength
 - 3,500 psi compressive
 - 400 psi center-point
 - 250 psi third-point

Typical Item Codes

Item Code	Description
120090	Construction area signs
120100	Traffic control system
128650	Portable changeable message sign
150846	Remove concrete pavement
150306	Repair spalled concrete
156515	Repair spalled and unsound surface area
401108	Replace concrete pavement (rapid strength concrete
406100	Dowel bar retrofit
413101	Repair corner breaks
413111	Repair spalled joint
413114	Replace joint seal (existing concrete pavement)
413115	Seal joint (existing concrete pavement)
420201	Grind existing concrete pavement
511040	Concrete surface finish
511055	Concrete surface texture
515028	Repair spalled surface area

http://i80.dot.ca.gov/hq/esc/oe/awards/#item_code

Module 8-2

Construction and Inspection

From... Maintenance Technical
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Presentation Outline

- Introduction
- Design considerations
- Construction
- Quality control
- Troubleshooting

Construction Procedure

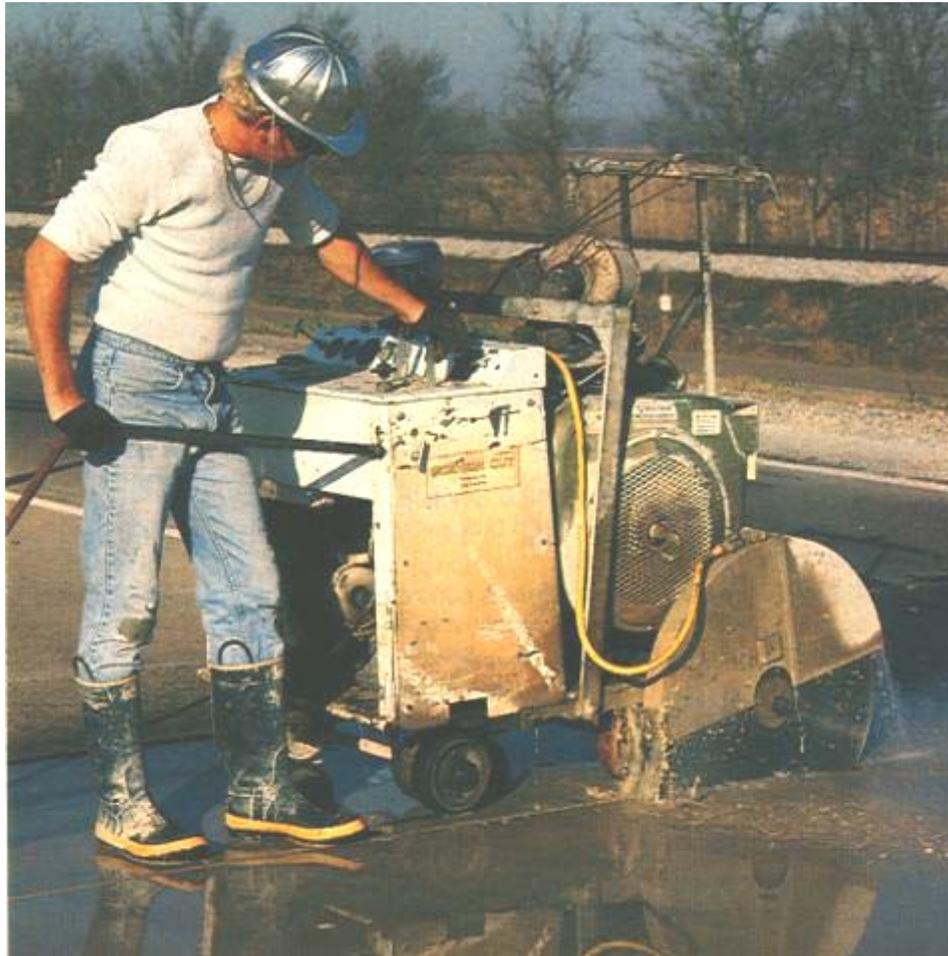
1. Concrete sawing
2. Concrete removal
3. Repair area preparation
4. Load transfer provision
5. Material placement
6. Curing
7. Joint sealing

Concrete Sawing Considerations

- Full-depth, diamond-bladed sawing
- Pressure relief cuts on hot days
- Limit traffic loading on sawed pavement to avoid pumping
- If asphalt shoulder present, remove 150 mm (6 in) for form space

Concrete Sawing

Example Sawcut



Concrete Removal

Concrete Breakup



Concrete Removal Removal with a Backhoe

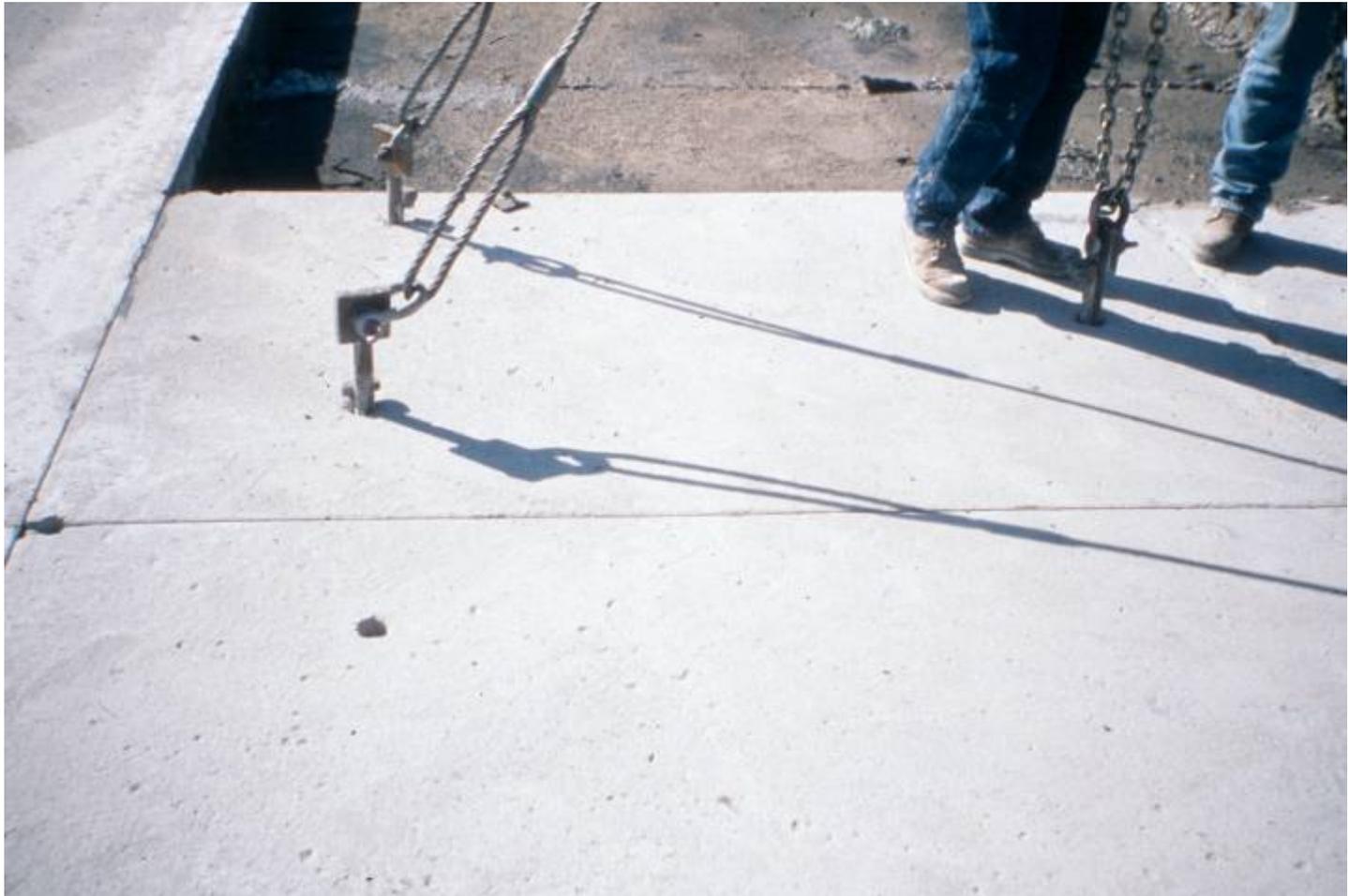


Concrete Removal Liftout Method

- Advantages
 - Does not disturb subbase
 - More rapid material removal
- Disadvantages
 - Process requires lifting pins and heavy lifting equipment

Concrete Removal

Placement of Lifting Pins



Concrete Removal

Lifting of Slab Pieces



Concrete Removal Disposal of Slab Pieces



Repair Area Preparation



Load Transfer Provision

Drilling Recommendations

- Dowel holes drilled on-center (12 in) at mid-depth
- Dowel holes drilled slightly larger than dowel diameter
- Smooth steel dowel bars or deformed tie bars can be used

Load Transfer Provision Gang Drill



Load Transfer Provision

Dowel-Bar Placement

- Blow debris and dust from holes
- Place grout or epoxy in holes
- Insert dowel into hole with slight twisting motion
- Install grout retention disks
- Grease protruding dowel ends

Load Transfer Provision Cleaning Holes



Load Transfer Provision Injecting Grout (or Epoxy)



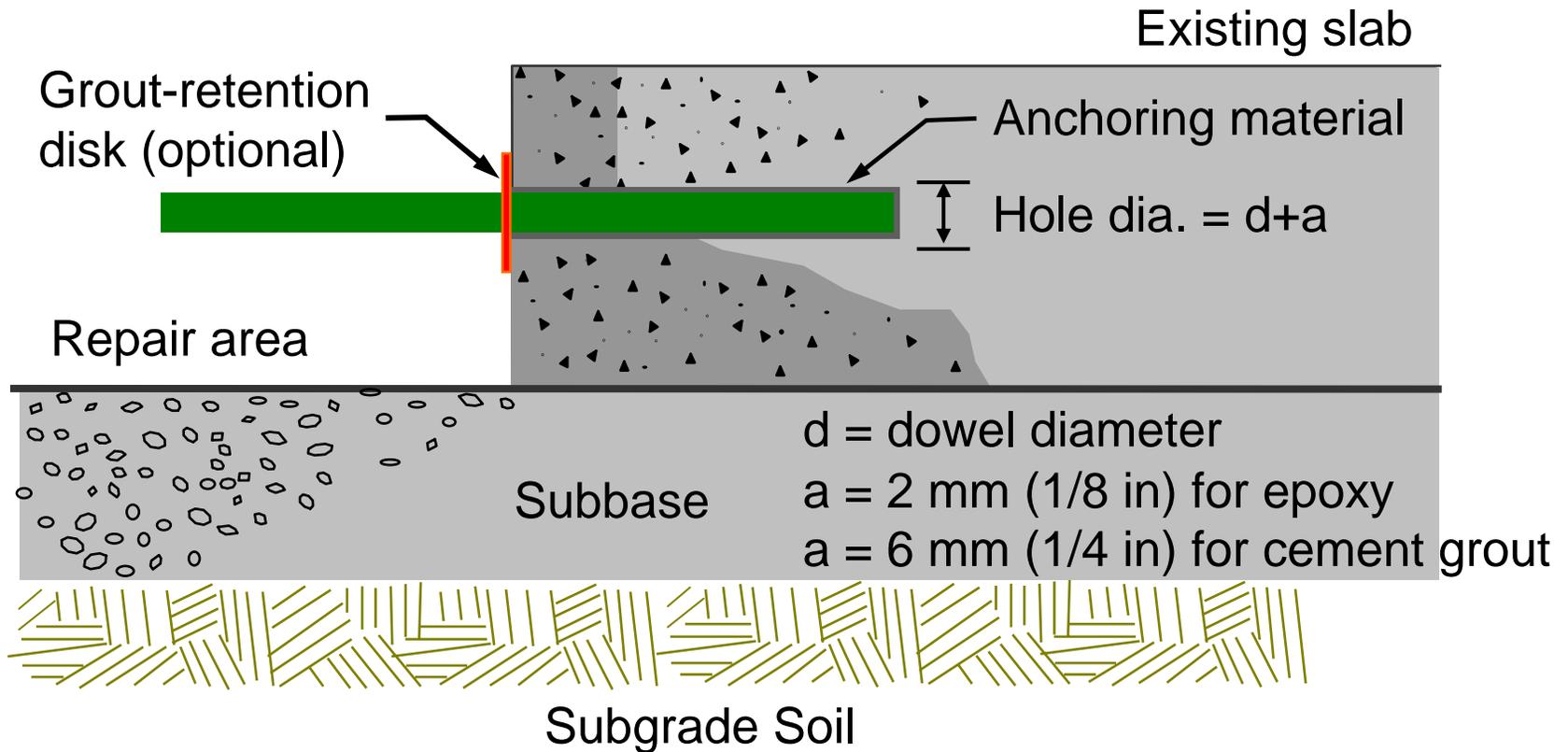
Load Transfer Provision

Dowel-Bar Placement



Load Transfer Provision

Dowel-Bar Placement



Load Transfer Provision

Area Prepared with Dowels in Place



Material Placement

- Consolidation and level finish are critical
- Vibrate along edges of repair
- Avoid addition of extra water
- Texture surface to match existing pavement

Material Placement



Material Placement Screeding



Material Placement Finishing



Material Placement Texturing



Curing

Application of Curing Compound



Joint Sealing

- Saw and seal as soon as possible after placement
- Follow the procedures described in Module 4

Special CRCP Considerations



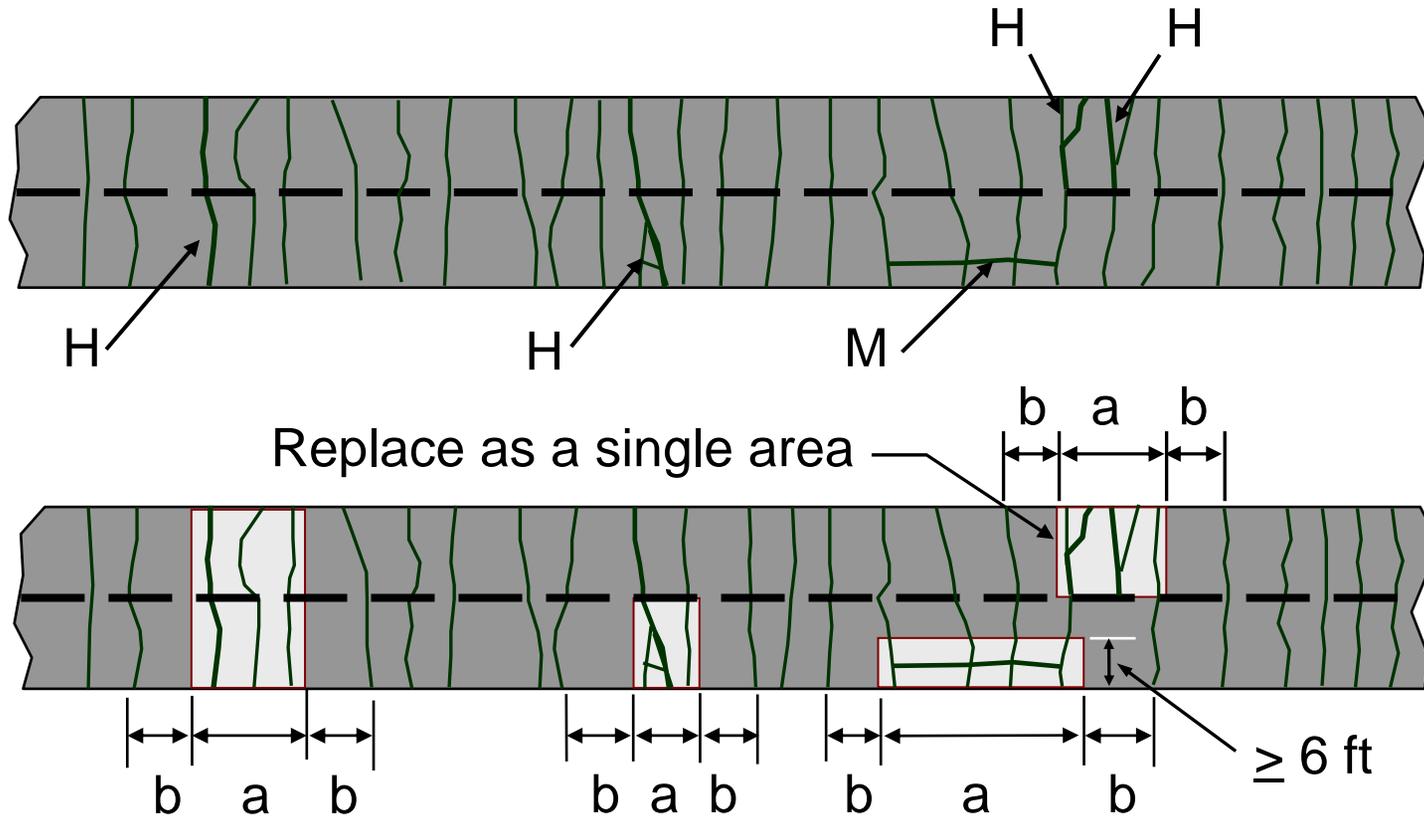
CRCP Pavements

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



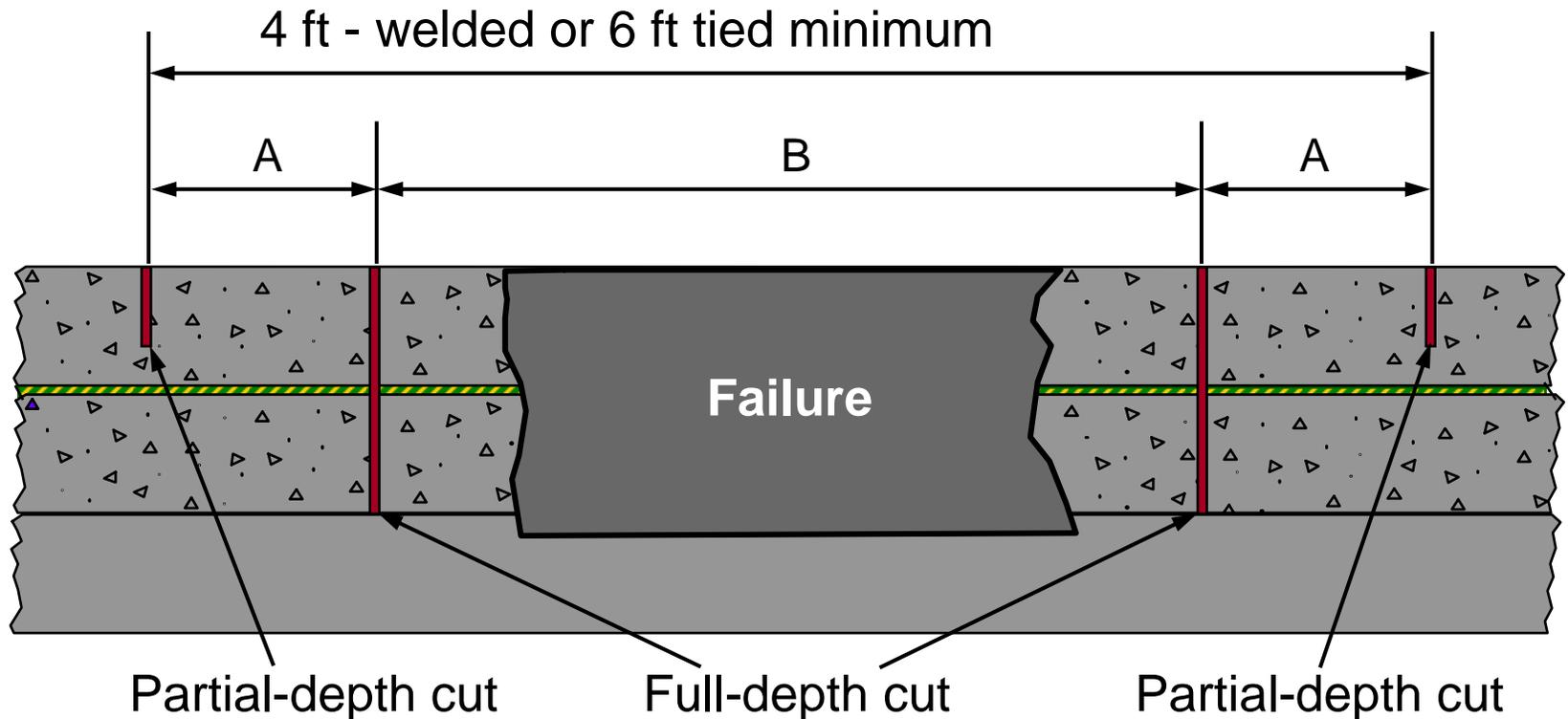
$a \geq 6$ ft tied steel

$a \geq 4$ ft welded or mechanical connection

$b \geq 18$ in

CRCP Pavements

Sawcut Locations



A = 8 in minimum – welded; 24 in minimum – tied

B = 32 in minimum – welded; 24 in minimum – tied

CRCP Pavements

Restoring Continuity of Reinforcing Steel



Presentation Outline

- Introduction
- Design considerations
- Construction
- Quality control
- Troubleshooting

Quality Control

- Similar to conventional PCC paving
- Verify repair boundaries
- Monitor to ensure no damage to surrounding concrete
- Project inspection
- Proper curing techniques

Project Checklist

- Preliminary Responsibilities
 - Document review
 - Project review
- Materials Checks
 - Concrete patch material
 - Load transfer devices
 - Other materials
 - General

Project Checklist

- Equipment Inspections
 - Concrete removal equipment
 - Patch area cleaning equipment
 - Testing equipment
 - Placing and finishing equipment
- Others
 - Weather requirements
 - Traffic control

Project Checklist

- Project Inspection Responsibilities
 - Concrete removal and cleanup
 - Patch preparation
 - Placing, finishing, and curing concrete
 - Resealing joints and cracks
- Cleanup Responsibilities
- Others identified in Special Provisions

Presentation Outline

- Introduction
- Design considerations
- Construction
- Quality control
- Troubleshooting

Troubleshooting

- Construction and performance problems
- Approach:



What is wrong here?



Selecting Repair Boundaries

What is wrong here?



Selecting Repair Boundaries

What is wrong here?



Selecting Repair Boundaries

What is wrong here?



Troubleshooting

Possible Performance Problems

- Problem:
Longitudinal cracking in the patch
- Potential causes?

Troubleshooting

Possible Performance Problems

- Problem:
Transverse cracking in the patch
- Potential causes?

Troubleshooting

Possible Performance Problems

- Problem:
Surface scaling
- Potential causes?

Troubleshooting

Possible Performance Problems

- Problem:
Spalling in patch at the transverse or longitudinal joint
- Potential causes?

Troubleshooting

Possible Performance Problems

- Problem:
Deterioration adjacent to the patch
- Potential causes?

Troubleshooting

Possible Performance Problems

- Problem:
Settlement of the patch
- Potential causes?

Troubleshooting Guide – Causes and Solutions

- Undercut spalling
- Saw binds
- Adjacent slab damage
- Slab disintegration
- Patch filled with water
- Grout flow out of dowel holes
- Misaligned dowels

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Thank You

Questions?