

# Treatment Types, Uses & Design

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# Surface Treatment

## AN AGENCY NEEDS TO DEFINE & UNDERSTAND:

Description/Purpose

Timing

Effects on various pavement distress

Anticipated performance/service life

Unit cost

Roadway use/level of traffic

Traffic control concerns

Limitations

- Seasonal
- Availability of qualified staff and contractors
- Availability of quality materials

Construction specifications



# Right Treatment Depends on

## Existing pavement

- *Type, structure, roughness, skid, distresses, climate, etc.*

## Environment

- *Climate, past & future traffic, noise, etc.*

## Life cycle costs

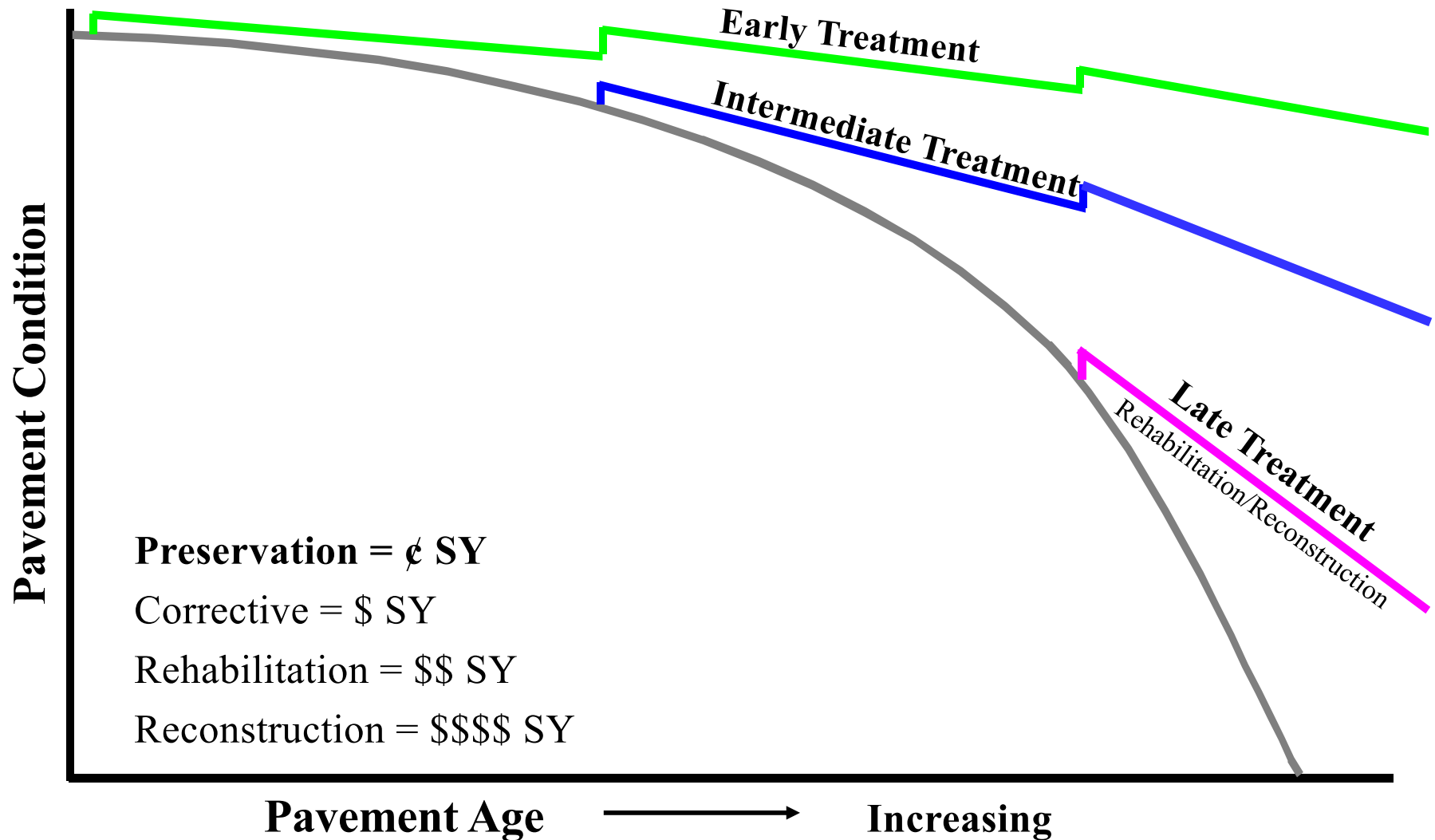
- *Construction, maintenance, rehabilitation, user-delay costs, impact on local businesses, vehicle repair, etc.*

## Available treatments

- *Construction requirements, performance, costs, capabilities of local contractors*



# Timing for Surface Treatments



# What Surface Treatments Are Available?

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**Asphalt Surface Treatment** is any application of asphalt materials to roadway with a thickness  $<1$ " , including Fog Seal, Slurry Seal, Chip Seal, and Micro-Surfacing [National Center for Pavement Preservation].

**Fog Seal** is a light application of diluted asphalt emulsion (normally 1:1) to enrich the pavement surface, seal small cracks & surface voids, and hinder oxidation.

**Slurry Seal** is a mixture of emulsified asphalt, fine aggregate and additives applied in a very thin layer to renew surfaces and protect against moisture and air intrusion.

**Chip Seal** is an application of asphalt emulsion followed by a thin layer of aggregate to renew and protect pavements and restore skid.

**Microsurfacing** is a mixture of emulsified polymer-modified asphalt, high quality fine aggregate, chemicals and other additives; is a sacrificial surface to protect the pavement from surface wear; to fill cracks or rutting; improve ride quality; and may improve friction.

# Fog Seal

## *Fog Seal*

is an application of asphalt emulsion sprayed onto a pavement surface. The emulsion is diluted to the proper consistency in order to get complete coverage on pavement but not be too thick to cause a slippery surface.

## *Equipment*

Standard asphalt distributor truck

## *Application*

Typical application rate: 0.05 to 0.15 gal/sy



# Fog Seal



## *Advantages*

Fog seals are inexpensive compared to other surface treatments.

## *Disadvantages*

Expected life is generally shorter than other surface treatments. If applied too heavily, the fog seal could be slippery.

## *Cost and life expectancy*

Typical costs ~ \$0.75/square yard  
The expected life ~ <1 to 2 years.



# Slurry Seal

## *Slurry Seal*

is a mixture that consists of emulsified asphalt, mineral aggregate, water, and additives, proportioned, mixed and uniformly spread over a properly prepared surface.

## *Equipment*

Slurry truck

## *Application*

Type I: 8 to 12 lb/sy

Type II: 10 to 18 lb/sy

Type III: 15 to 22 lb/sy



American Pavement Preservation Co.



# Slurry Seal Aggregates

**Type I.** This aggregate gradation is used to fill surface voids, address moderate surface distresses, and provide protection from the elements. The fineness of this mixture provides the ability for some crack penetration.

- Parking Areas, Residential Streets, Airport Runways, AADT < 100

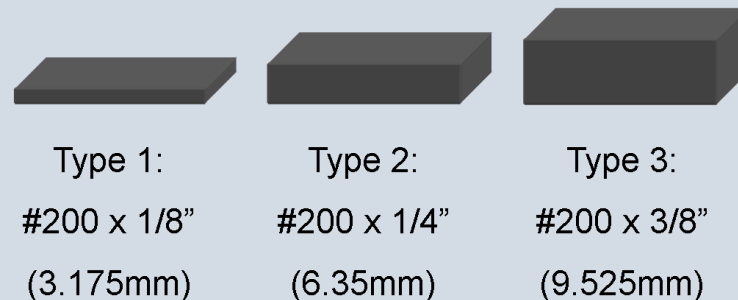
**Type II.** This aggregate gradation is used to fill surface voids, address more severe surface distresses, seal, and provide a durable wearing surface.

- Urban and Residential Streets, Airport Runways, AADT < 1,000

**Type III.** This aggregate gradation provides maximum skid resistance and an improved wearing surface.

- Primary and Interstate Routes  
AADT < 5,000

## TYPES OF SLURRY SEAL



# Slurry Seal



## *Advantages*

Reduce or prevent oxidation and water infiltration. Can correct raveling and weathering while improving friction properties.

## *Disadvantages*

Does not fill large cracks. Must have warm, dry weather.

## *Cost and life expectancy*

Typical costs (Type II) ~ \$1.50/square yard  
The expected life ~ <3 to 5 years.



# Microsurfacing

## *Microsurfacing*

is a mixture of polymer-modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives that is uniformly spread over a properly prepared surface.

## *Equipment*

Specialized microsurfacing truck similar to a slurry truck

## *Application*

Type II: 10 to 20 lb/sy

Type III: 15 to 30 lb/sy



# Microsurfacing



## *Advantages*

Chemical break does not rely on weather conditions. Can correct rutting and minor profile irregularities. Provides skid resistance.

## *Disadvantages*

Does not correct structural deficiencies.

## *Cost and life expectancy*

Typical costs ~ \$2.00/square yard  
The expected life ~ < 5 to 7 years.



# Chip Seal

## Chip Seal

is a uniform spray application of an asphalt binder followed by a uniform application of a graded cover coat aggregate which is then set with a pneumatic tire rollers.

## Equipment

Standard asphalt distributor truck  
Aggregate chip spreader  
Pneumatic tire roller



## Application

	<u>Type I</u>	<u>Type II</u>	<u>Type III</u>
Emulsified Asphalt	0.28 to 0.34 gal/sy	0.34 to 0.40 gal/ sy	0.38 to 0.46 gal/sy
Aggregate Chip	18 lb/sy	22 lb/sy	25 lb/sy

# Chip Seal



## *Advantages*

Are inexpensive compared to other surface treatments. Waterproof the pavement and increase skid resistance.

## *Disadvantages*

Excess aggregate needs to be removed to avoid vehicle damage. Chip seals can impede certain recreation activities. Requires warm, dry weather.

## *Cost and life expectancy*

Typical costs ~ \$1.20/square yard  
The expected life ~ <4 to 6 years.  
AADT <10,000

# Chip Seal

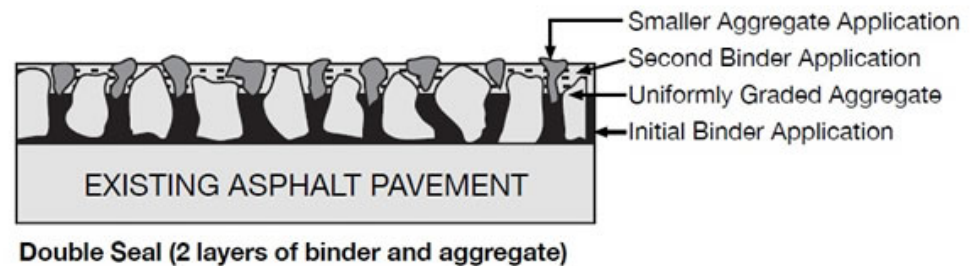
## Single Chip Seal

A single chip seal consists of a spray application of asphalt emulsion followed by an application of aggregate chips, preferably one stone layer thick.



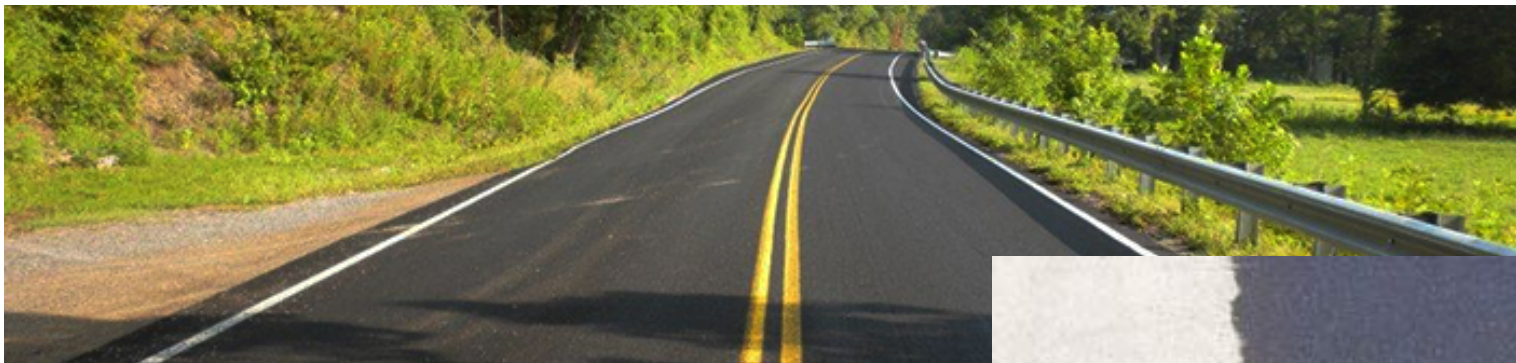
## Double Chip Seal

A double chip seal is two applications of a single chip seal. The first chip seal is constructed with aggregate one sieve size larger than the second chip seal.



# Cape Seal

Chip Seal with a Slurry Seal On Top





# Other Surface Treatment Types

**Scrub Seal** is performed by dragging brooming mechanism over pavement surface after asphalt emulsion is applied to fill the pavement cracks and voids. Apply a layer of sand or aggregate over the emulsion followed by another drag broom, forcing the sand into the emulsion filled cracks and voids. A pneumatic tire roller is then used over the seal.



**Sand Seal** is a sprayed application of asphalt emulsion followed immediately by a covering of clean sand or fine aggregate.

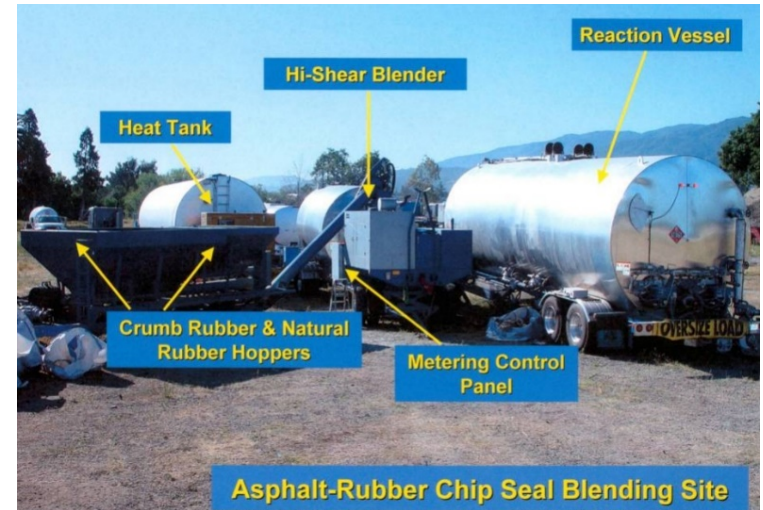
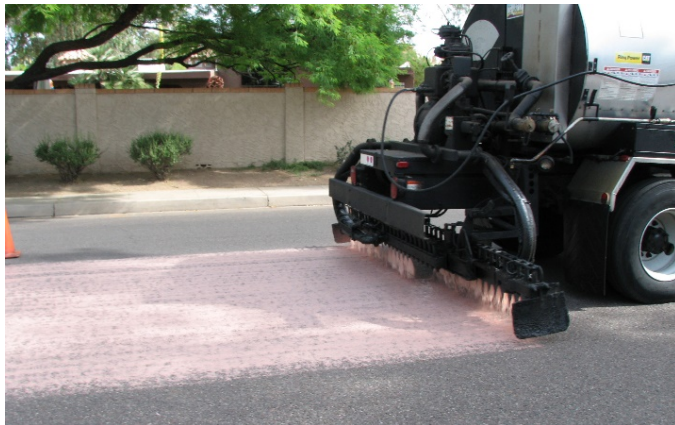
Sand seals enrich weathered pavements and fills fine cracks in the pavement surface. The sand can provide additional skid resistance to the pavement while also inhibiting raveling.



# Other Surface Treatment Types

## Asphalt Rubber Chip Seal

- Crumb rubber is blended into modified/neat asphalt binder and placed with a agitated distributor truck, followed by aggregate chips.



## Rejuvenating Seal

- A penetrating seal that restores lost oils and softens the oxidized asphalt surface.

## Bonded Wearing Course

- A thin, Hot Mix Asphalt Overlay placed over a polymer modified emulsion membrane, aka Novachip

Emulsion membrane

HMA



# Surface Treatment Selection

Table 2.1. Possible Preventive Maintenance Treatments for Various Distress Types

Pavement Distress	Crack Sealing	Fog Seal	Microsurfacing	Slurry Seal	Cape Seal	Chip Seal
Roughness						
Nonstability Related			X		X	
Stability Related						
Rutting			X			
Fatigue Cracking <sup>b</sup>		X	X	X	X	X
Longitudinal and Transverse Cracking	X		X	X	X	X
Bleeding			X			X
Raveling		X	X	X	X	X

Key: X = appropriate strategy

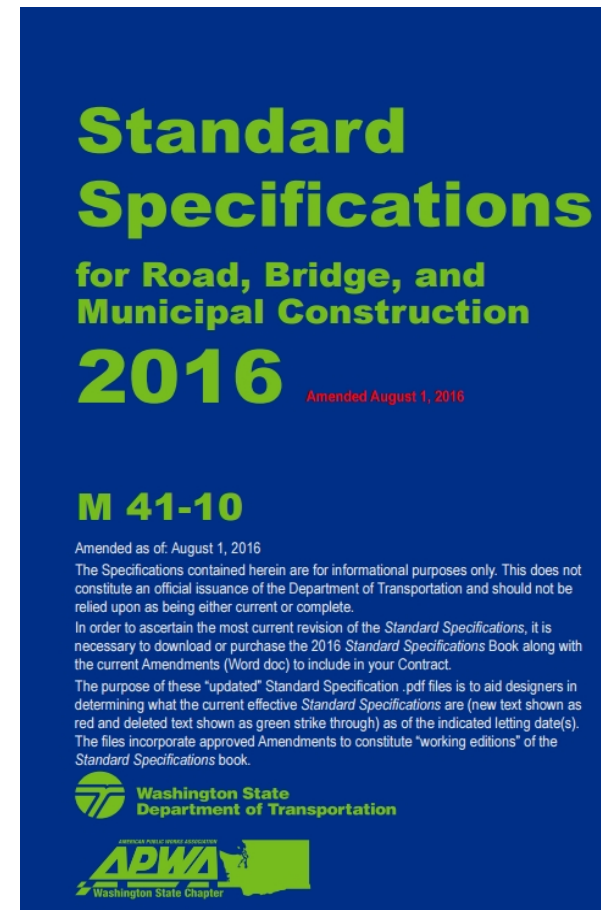
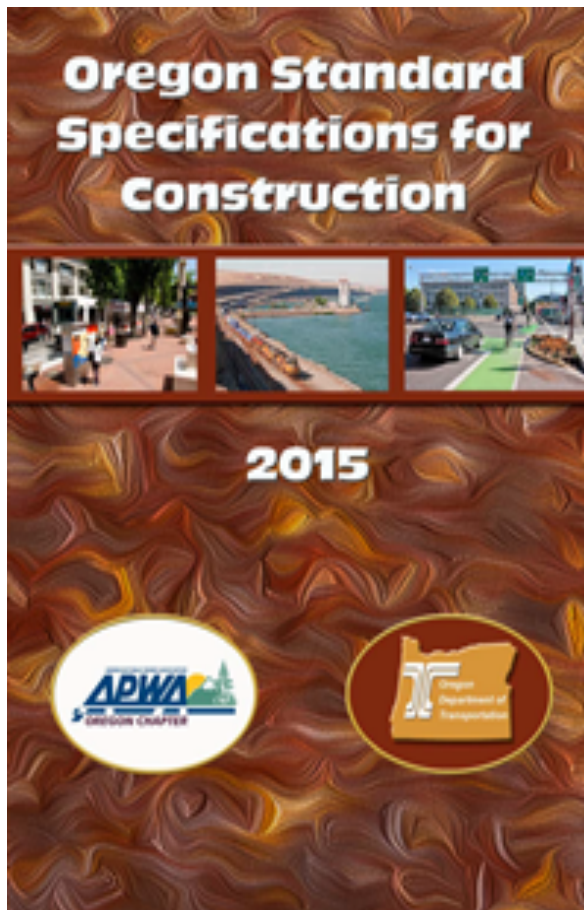
<sup>a</sup>This is a corrective maintenance technique

<sup>b</sup>For low severity only; preventive maintenance is not applicable for medium to high severity fatigue cracking

# Specifications

## ODOT Section 00706 - Emulsified Asphalt Slurry Seal Surfacing

## WSDOT Section 5-02 – Bituminous Surface Treatment



# Specifications

## Slurry Seal

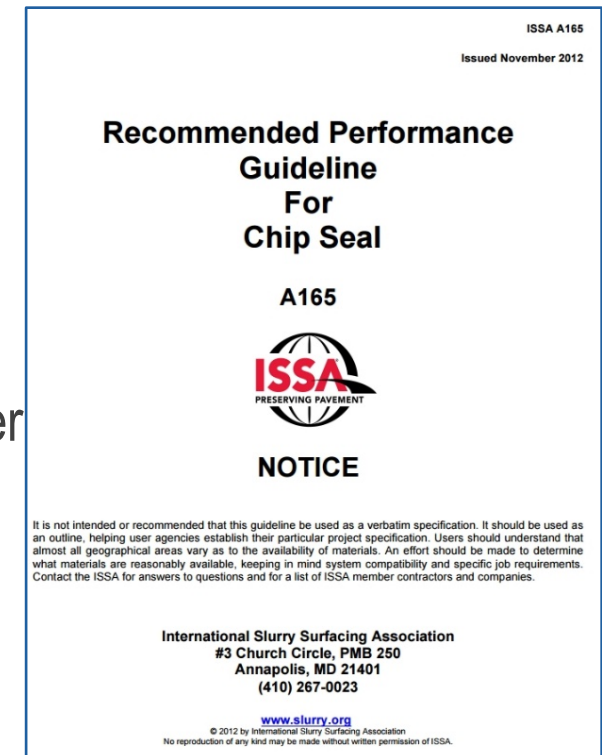
- **ISSA A-105:** Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal
- **ASTM D 3910-15** Standard Practices for Design, Testing, and Construction of Slurry Seal

## Microsurfacing

- **ISSA A-143:** Recommended Performance Guidelines for Polymer Modified Micro Surfacing, 2010
- **ASTM D 6372-15** Standard Practices for Design, Testing, and Construction of Microsurfacing

## Chip Seal

- **ISSA A-165:** Recommended Performance Guideline for Chip Seal
- **ASTM D5360-15** Standard Practice for Design and Construction of Bituminous Surface Treatments



# What Triggers ADA Improvements?



U.S. Department of Justice  
Civil Rights Division  
Disability Rights Section



U.S. Department of Transportation  
Federal Highway Administration

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## Department of Justice/Department of Transportation Joint Technical Assistance<sup>1</sup> on the Title II of the Americans with Disabilities Act Requirements to Provide Curb Ramps when Streets, Roads, or Highways are Altered through Resurfacing

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### When is resurfacing considered to be an alteration?

Resurfacing is an **alteration** that triggers the requirement to add curb ramps if it involves work on a street or roadway spanning from one intersection to another, and includes overlays of additional material to the road surface, with or without milling...

### What kinds of treatments constitute maintenance rather than an alteration?

Treatments that serve solely to seal and protect the road surface, improve friction, and control splash and spray are considered to be **maintenance** because they do not significantly affect the public's access to or usability of the road...In some cases, the combination of several maintenance treatments occurring at or near the same time may qualify as an alteration and would trigger the obligation to provide curb ramps.

# What Triggers ADA Improvements?

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## MAINTENANCE

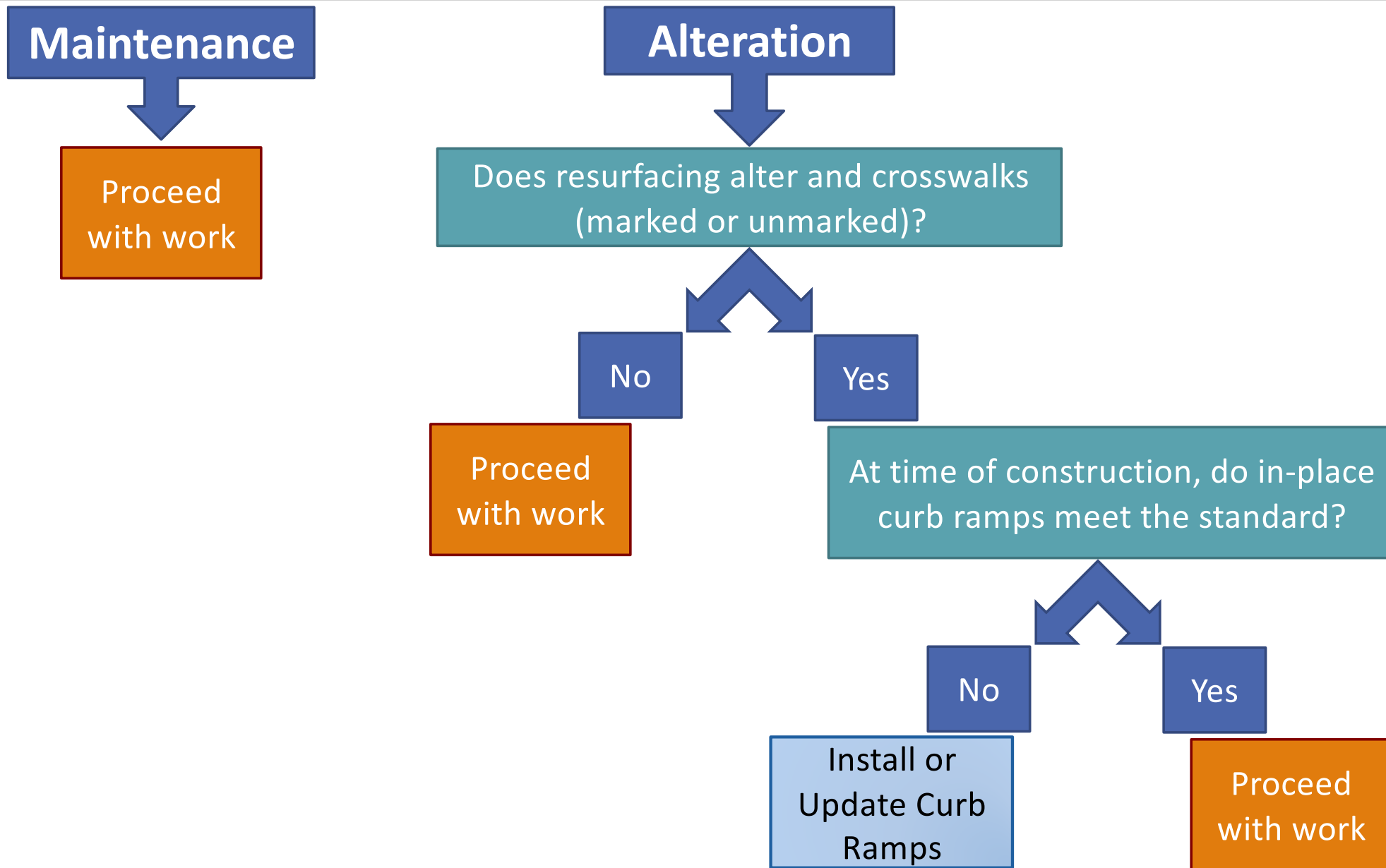
- Chip Seals
- Fog Seals
- Scrub Sealing
- Crack Filling and Sealing
- Joint Crack Seals
- Slurry Seals
- Diamond Grinding
- Joint repairs
- Spot High-Friction Treatments
- Dowel Bar Retrofit
- Pavement Patching
- Surface Sealing

## ALTERATION

### TRIGGERS ADA!

- Addition of New Layer of Asphalt
- Mill & Fill / Mill & Overlay Cape Seals
- New Construction
- Hot In-Place Recycling
- Open-graded Surface Course
- Microsurfacing
- Thin-Lift Overlay
- Rehabilitation and Reconstruction

# What Triggers ADA Improvements?





# Typical Structural Improvements

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**Overlay** is placed in 2 to 3-in. lifts above the existing pavement surface with an increase in grade equal to the overlay thickness.

**Inlay** is removal of a portion of the existing asphalt concrete (by milling) and replacement with new asphalt concrete, with no increase in grade.

**Mill and Overlay** is removal of a portion of the existing asphalt concrete and placement of new asphalt concrete that results in an increase in grade.

**Partial Depth Reconstruction** is removal of the entire thickness of existing asphalt concrete and placement of new asphalt concrete on top of the existing aggregate base layer.

**Full depth Reconstruction** is replacement of the existing pavement structure with a new pavement structure and may include construction on compacted or undisturbed subgrade, aggregate or mechanical stabilization, treated subgrade and full depth reclamation (FDR).

# Overlay

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## *Advantages*

- Least expensive
- Increases the structural section
- Relatively quick construction

## *Considerations*

- Affects Grade
  - Drainage
  - Curb Heights
  - PCC Features
  - Crown
  - ADA Requirements
- May provide less protection against reflective cracking

# Inlay

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## *Advantages*

- No change in grade
- Rougher surface – improved bond
- Some structural improvement
- May be more effective than overlay in controlling reflective cracking
  - Particularly effective to rehabilitate top down cracking

## *Considerations*

- More expensive than overlay
- Less structural strengthening than overlay

# Mill and Overlay

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## *Advantages*

- Can incorporate the advantages of both inlay and overlay

## *Considerations*

- Same considerations as both overlay and inlay

# Partial Depth Reconstruction

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## *Advantages*

- No change in grade (or it may be feasible to lower the grade)
- May be feasible to re-profile the street
- Eliminates the potential for reflective cracking
- May be feasible to increase the structural section without increasing the grade

## *Considerations*

- Requires a thick aggregate base section
- Potential for subgrade pumping
- More expensive and slower construction than overlay or inlay

# Full Depth Reconstruction

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## *Advantages*

- No change in grade (or grade can be lowered)
- Street can be re-profiled
- Eliminates the potential for reflective cracking
- Ensures uniform pavement section
- Structural section can be increased

## *Considerations*

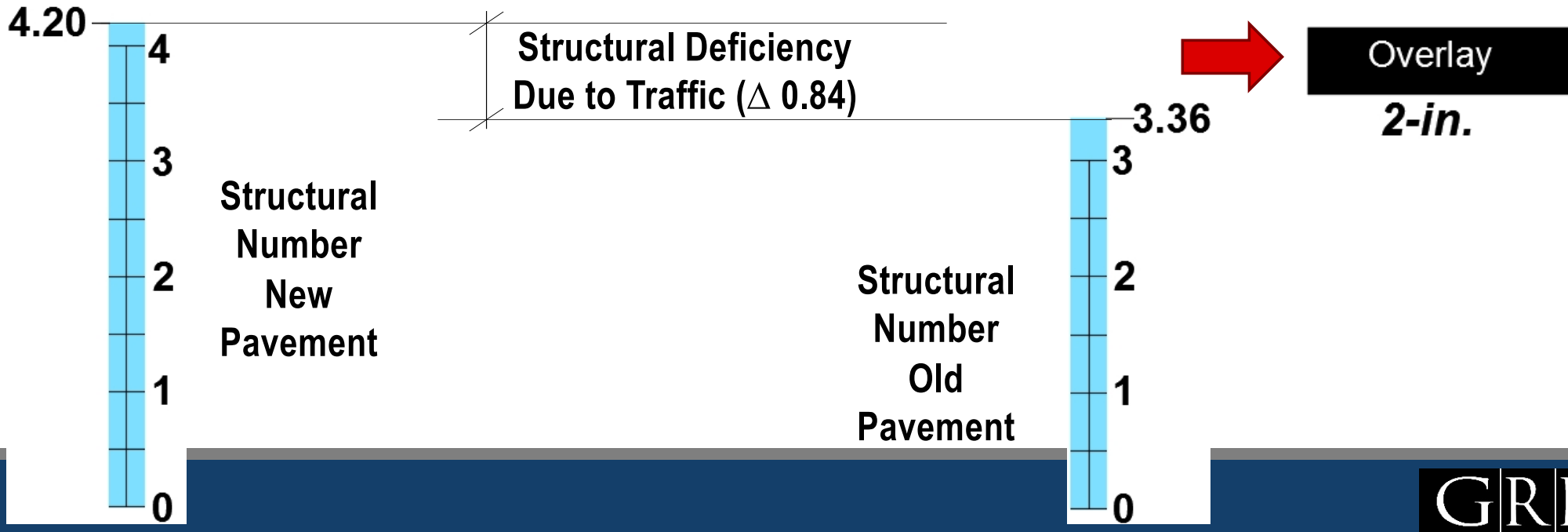
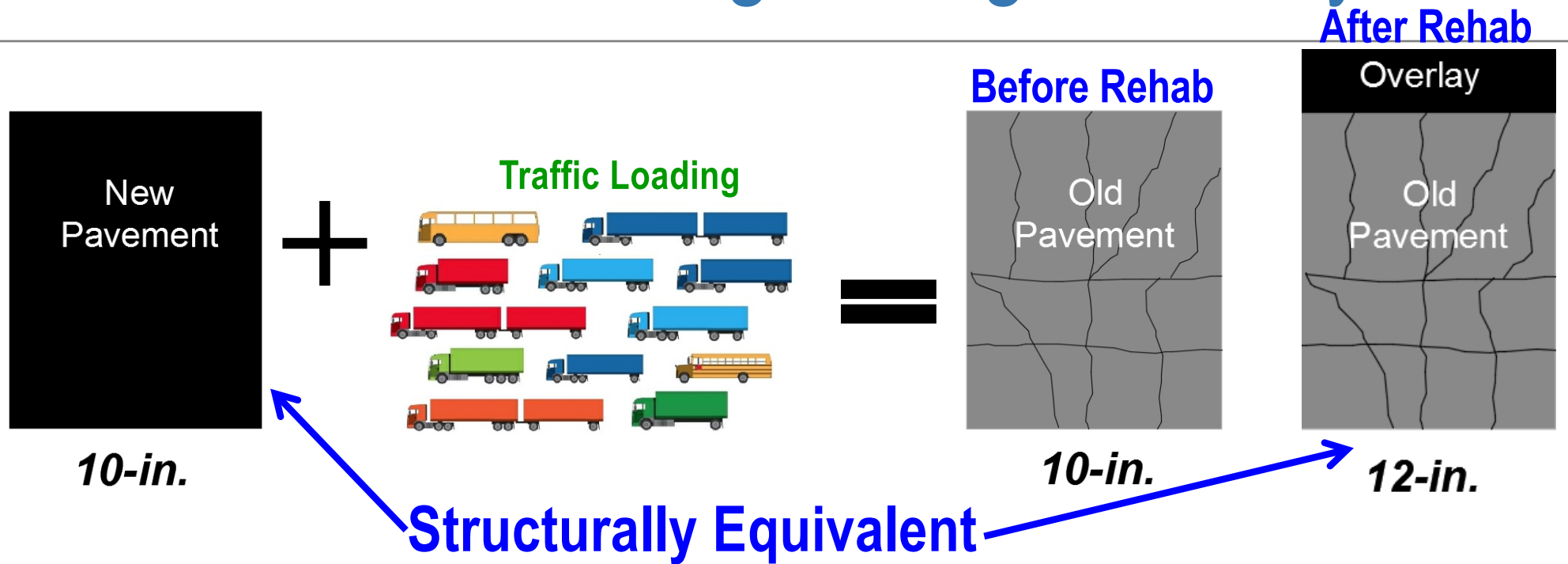
- Most expensive option
- Weather dependent
- Slowest rehabilitation option

# Factors Affecting Pavement Rehabilitation

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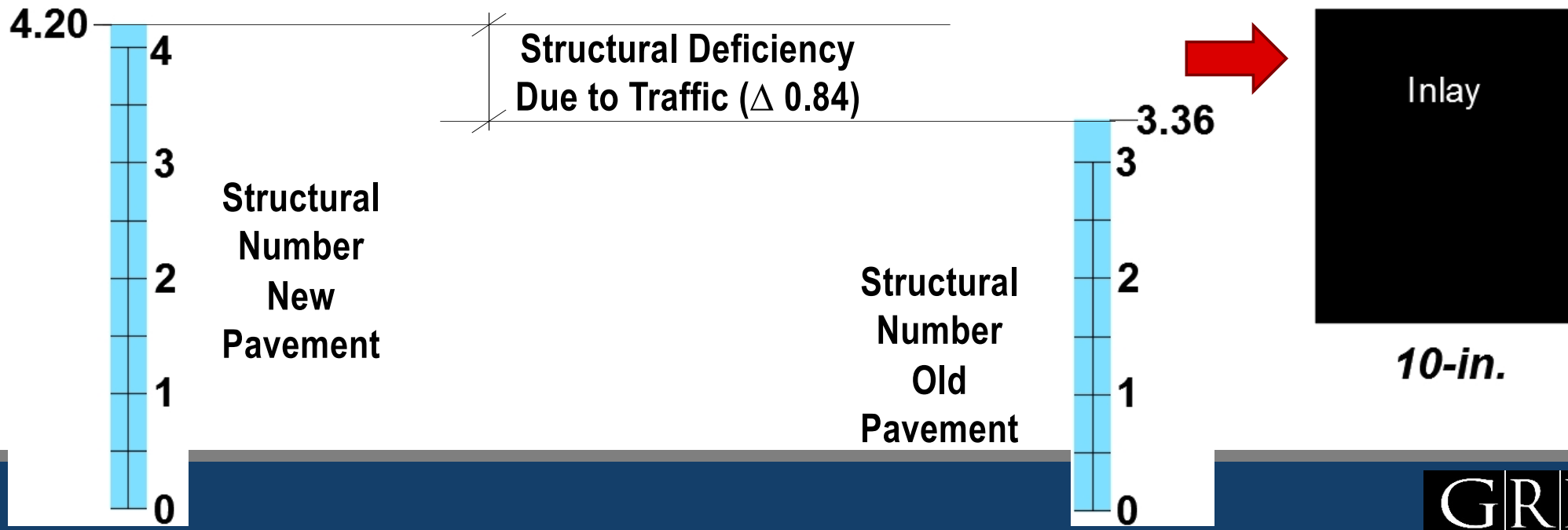
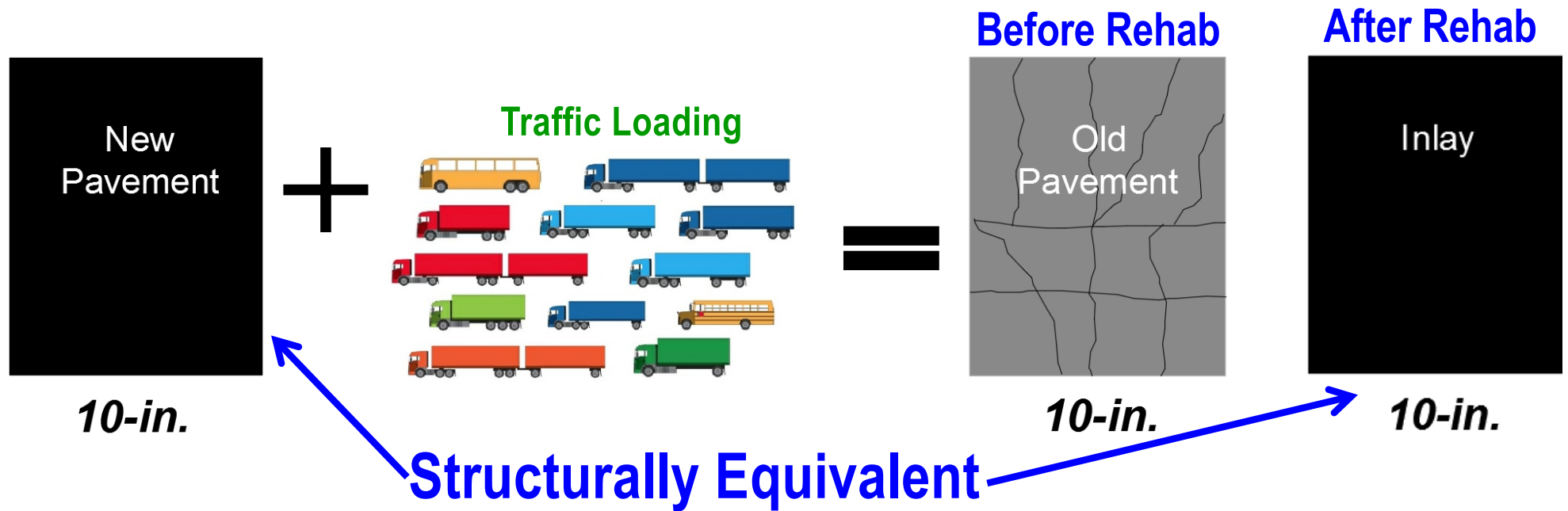
- *Structural Strengthening Requirements*
- *Grade Constraints*
- *Reflective Cracking*

# Structural Strengthening - Overlay

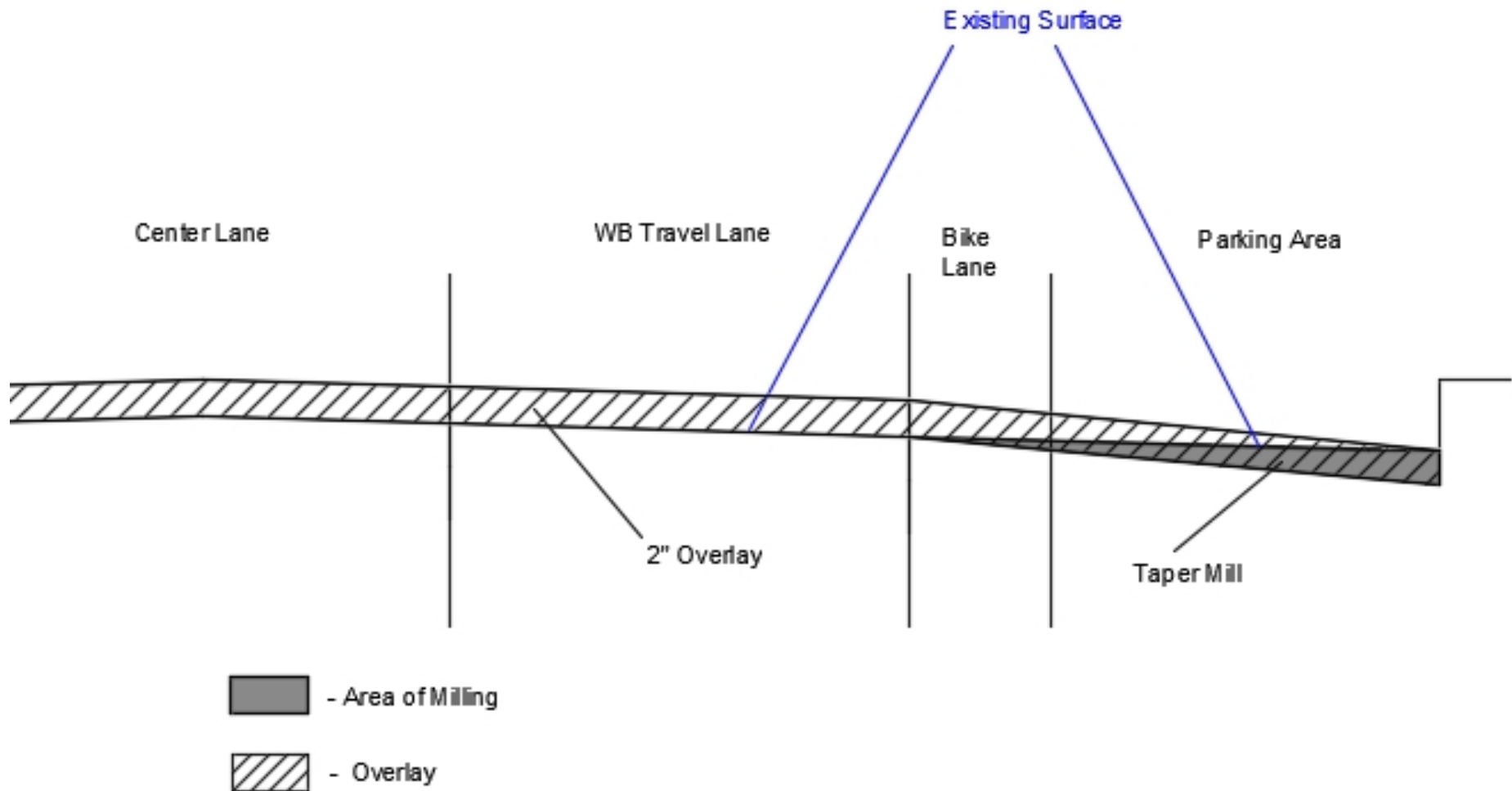




# Structural Strengthening - Inlay



# Grade Constraints



# Grade Constraints



Curbs and Driveways

# Grade Constraints



**Curb and gutter**

# Grade Constraints



Curb and gutter

# Grade Constraints



PCC bike lanes

# Grade Constraints



**Bridges**

# Grade Constraints



Curb ramps



# Grade Constraints



**Excessive crown**

# Grade Constraints



# Grade Constraints



**Guardrail height**

25

# Grade Constraints



# Grade Constraints



# Grade Constraints



Possible to taper  
over the bike lane

# Grade Constraints



**A better candidate  
for a taper mill**

# Grade Constraints





# Reflective Cracking



GRI Project No. 5829

B-14

# Reflective Cracking



GRI Project No. 5829

B-16

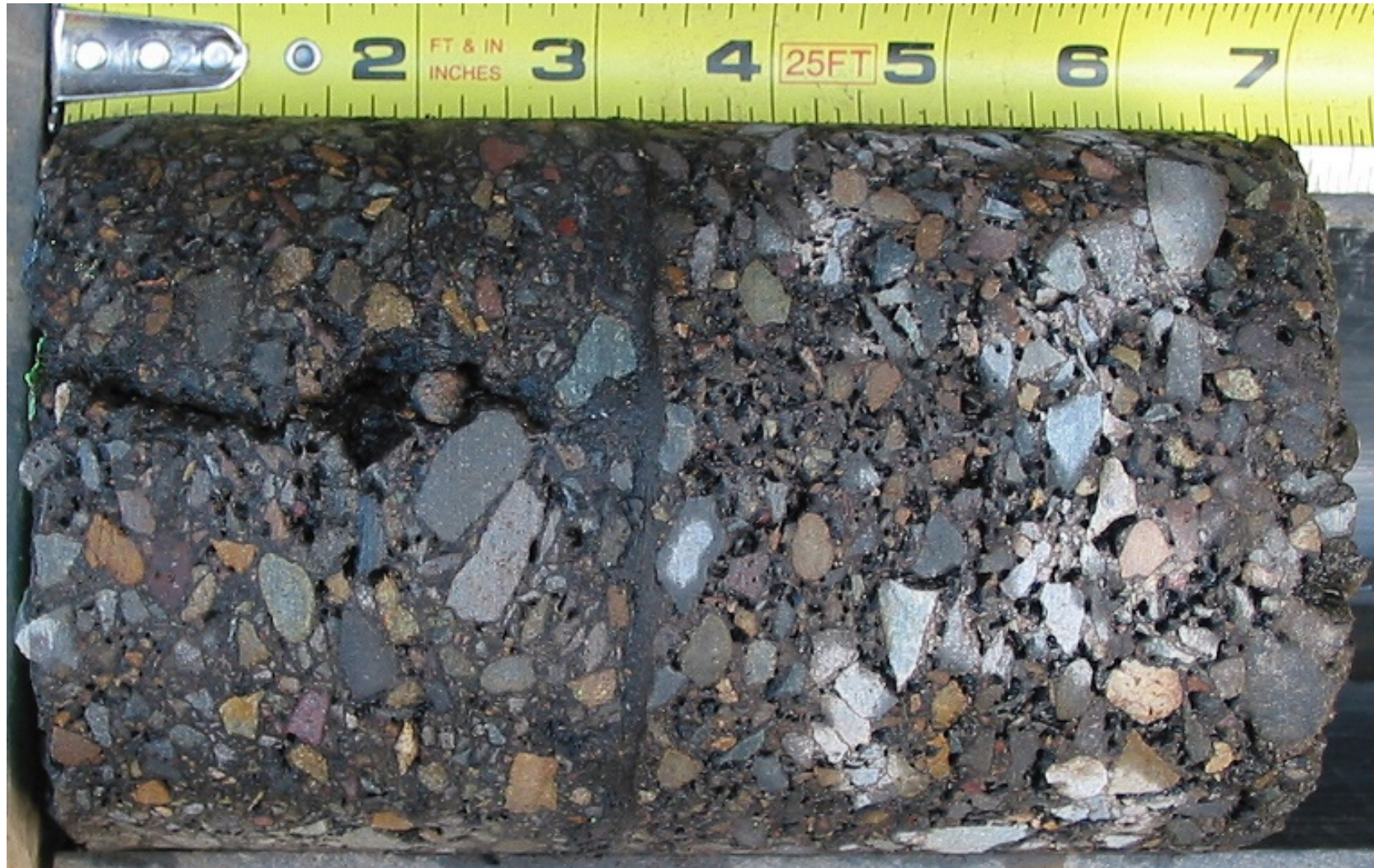
# Reflective Cracking



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# Reflective Cracking

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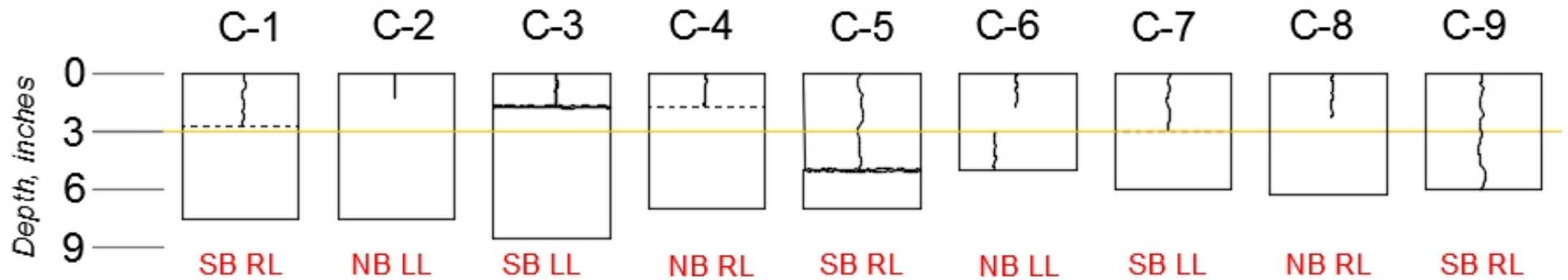


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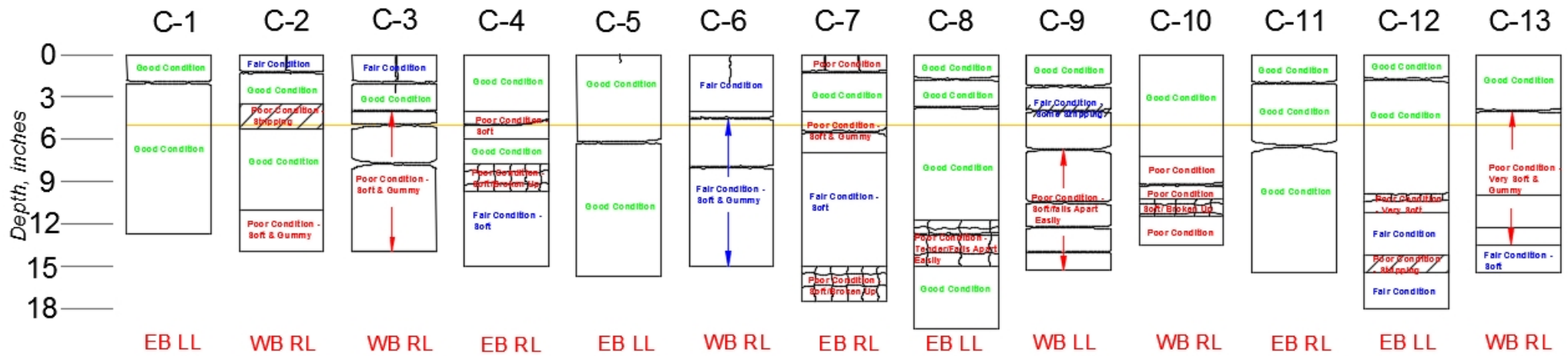




# Reflective Cracking



# Reflective Cracking



# Partial Depth Reconstruction



# Full Depth Reconstruction



# Full Depth Reconstruction



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# Full Depth Reconstruction

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# Treatment Types, Uses & Design

## Questions?

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