How to Optimize Your Project With In-Place Recycling?

Western States

Regional In-Place Recycling Conference
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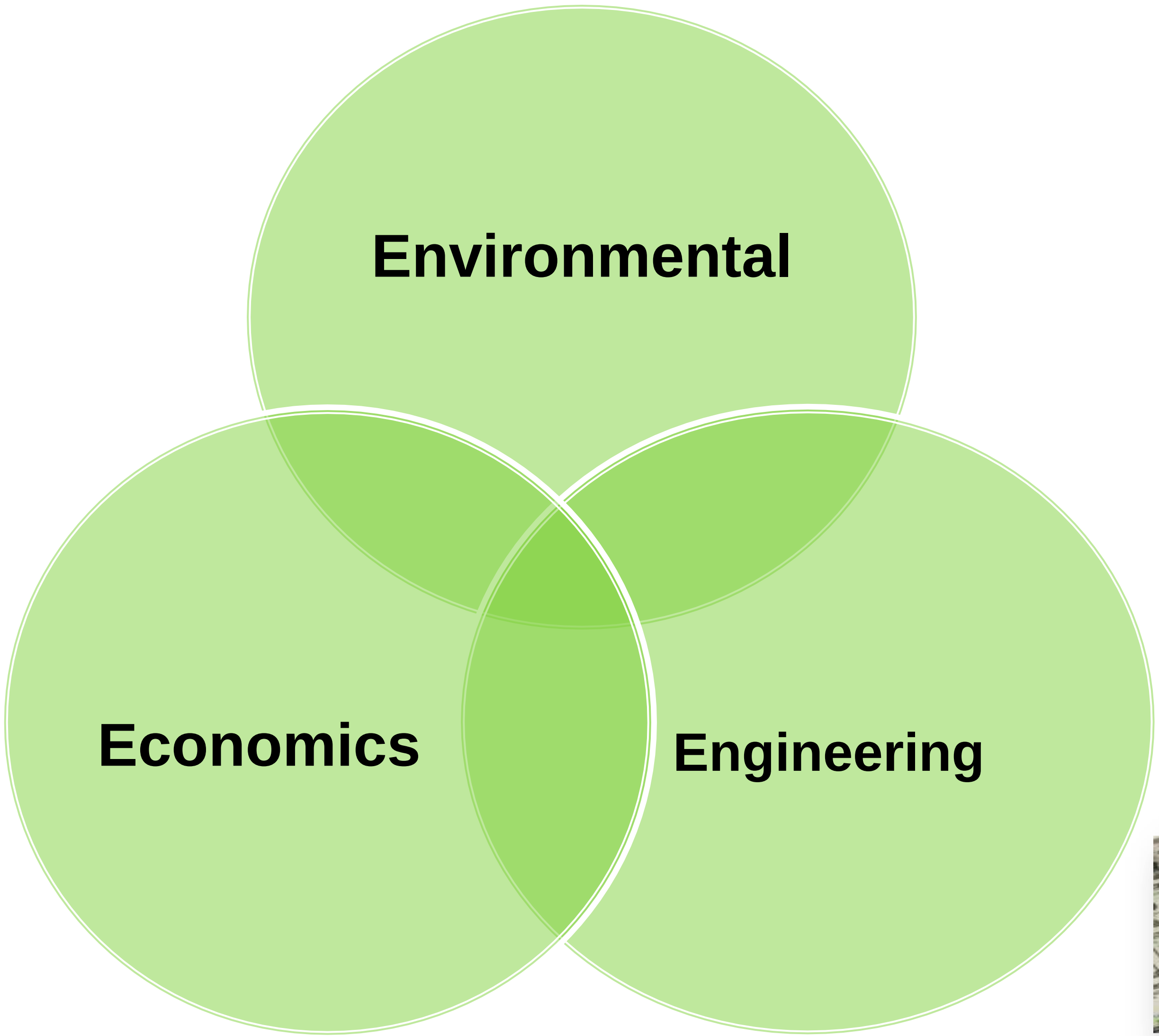
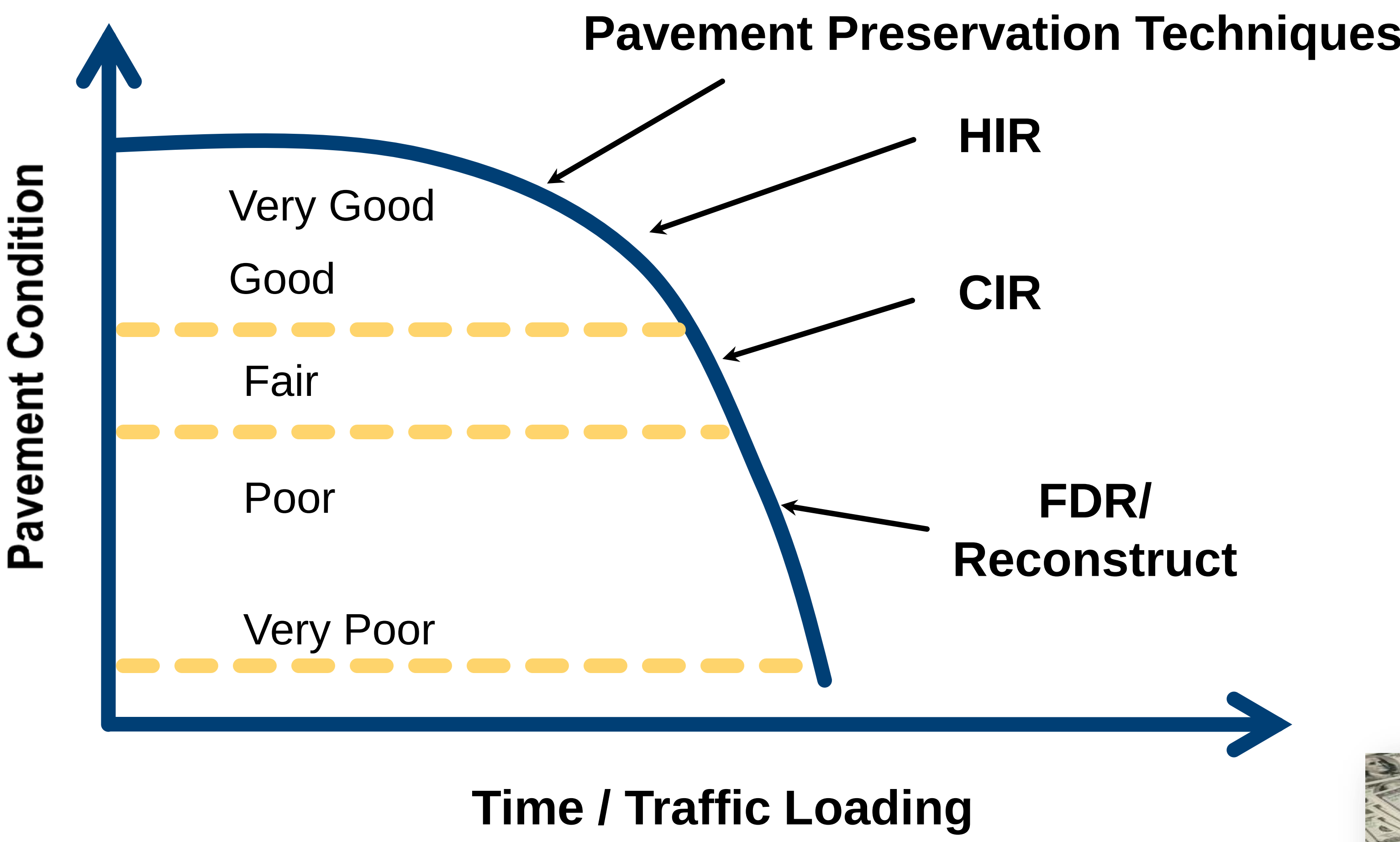
Why In-Place recycling?
Meets the 3E Challenge

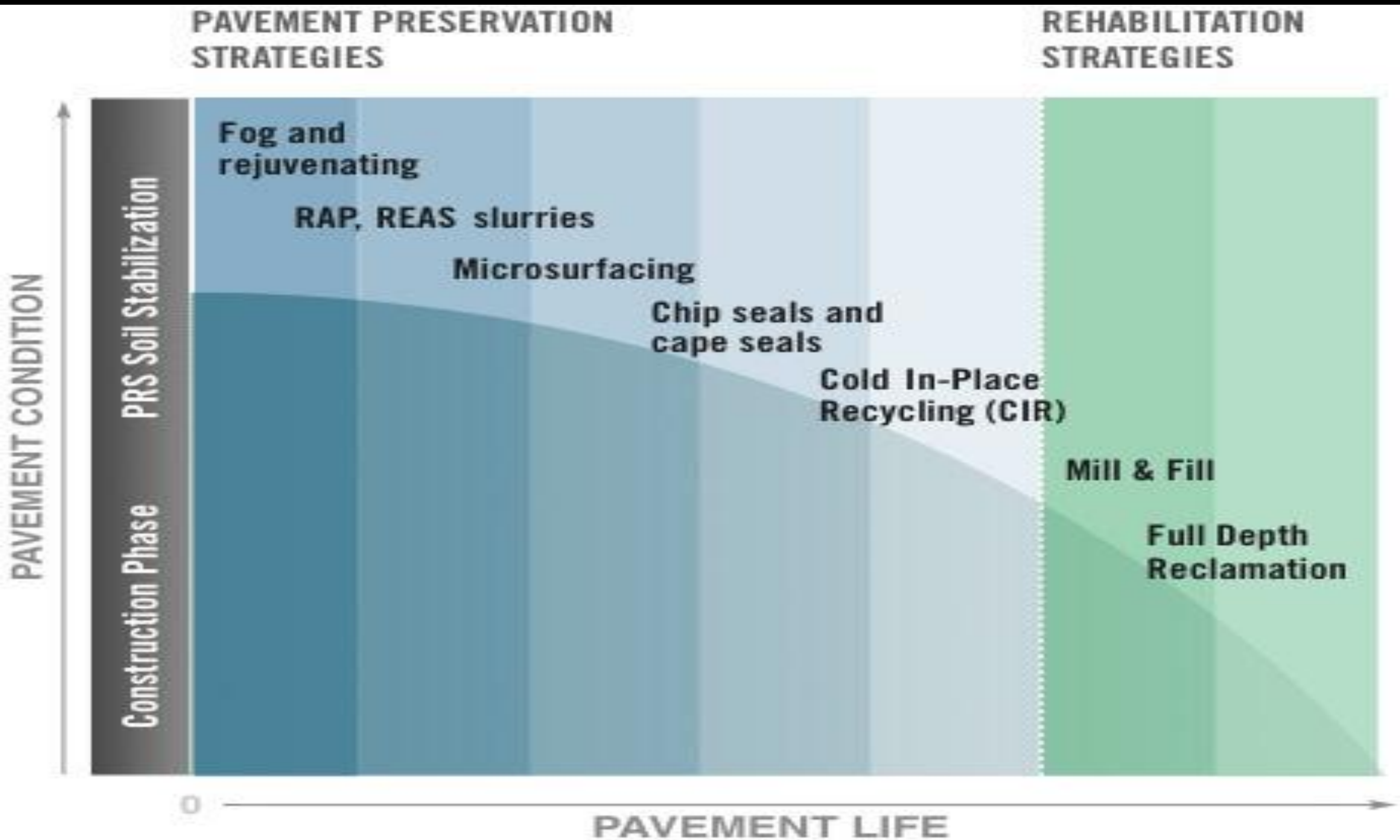


Timing of Rehabilitation Techniques

(The Right Project, at The Right Time, and The Right Strategy)



Pavement Preservation & Rehabilitation Tool Box



What is a good strategy for surface raveling?

HIR

www.betterroads.com

What is a good strategy for medium and wide transverse and block cracking?

What is a good strategy for alligator cracking?

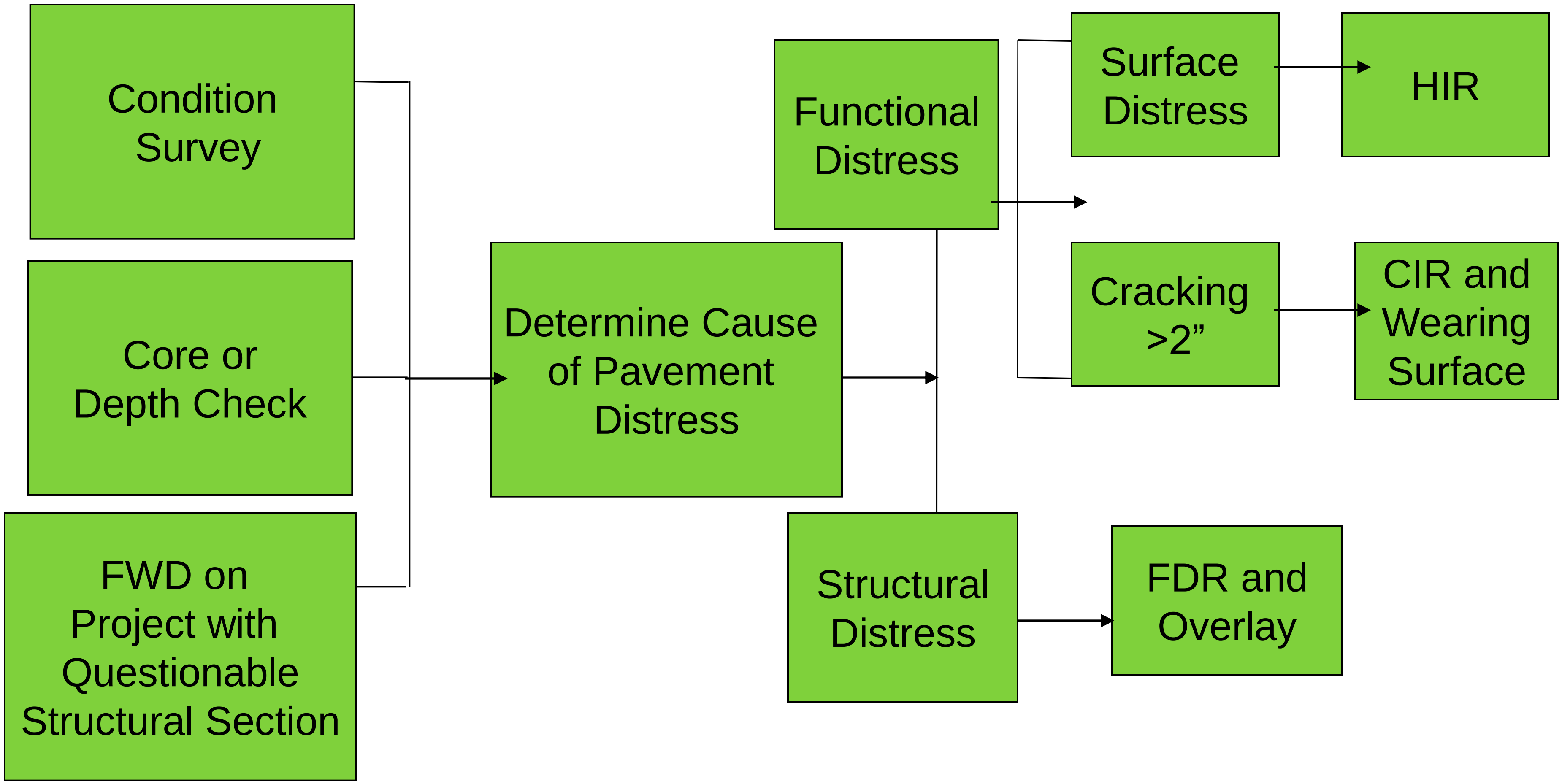
Project Selection Criteria

1. Existing pavement condition and design
   - Distress type, level, and extent
   - Traffic Loading
2. Environmental condition
3. Roadway geometry
4. Project site consideration

Additional Factors to Consider
(continued)

5. Initial funding constraint
6. Life-cycle cost based on long-term performance
7. Traffic Control

1. Existing Pavement Evaluation



Engineering Requirements

- Subsurface Investigation:
  - Coring to determine pavement thickness

Coring Plan

- Look for lift locations
- Digout thickness
- Deep lifts of asphalt concrete
- fabric

Joe Peterson, Caltrans, 2008 In-Place Recycling Presentation

Pavement Thickness Design

- Use either MEPDG or 1993-AASHTO Design Guide
- Use structural number 0.28-0.35 for CIR
- MR for CIR varies from low 200's to 1 M
- Do not make the recycle d material too stiff
- Calculate projected traffic loading for the design life

Structural Layer Coefficient

FDR Method	Minimum Thickness of Riding Surface	Typical Structural Coefficient
Mechanical	2" HMA	0.10 – 0.12
Bituminous	Surface Treatment or Structural HMA	0.20 – 0.28
Cement	Surface Treatment or Structural HMA	0.15 – 0.20

Mike Voth, FHWA, 2008 In-Place Recycling Presentation

Mix Design Process

1) RAP: Cores or Grindings from Project	Cores or Milling are crushed to passing 1”
2) Mixing	3 emulsion contents and H2o content are made
3) Compaction	Use Gyratory Compactor
4) Curing of Specimens	48 hours
5) Cured Specimens Measurements	2 sets: dry and soaked
6) Mix Design Selection	Determine optimum emulsion content

Mix Design Process

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2. Environmental Condition

(Climate conditions must be considered when selecting in-place recycling)

Factors to consider

- Good drainage is a MUST
- Type and thickness of the wearing surface (slurry seal, double chip seal, hot mix overlay, and friction course)
- PG grade binder

NCHRP Synthesis 40-13

Ranking of climates that can influence the choice of in-place recycling processes

Climate	HIR	CIR	FDR
Cold/Wet	Fair	Good	Very Good
Hot/Wet	Good	Good	Very Good
Cold/Dry	Good	Very Good	Very Good
Hot/Dry	Very Good	Very Good	Very Good

Project Selection Criteria

1. Existing pavement condition and design
   - Distress type, level, and extent
   - Traffic Loading
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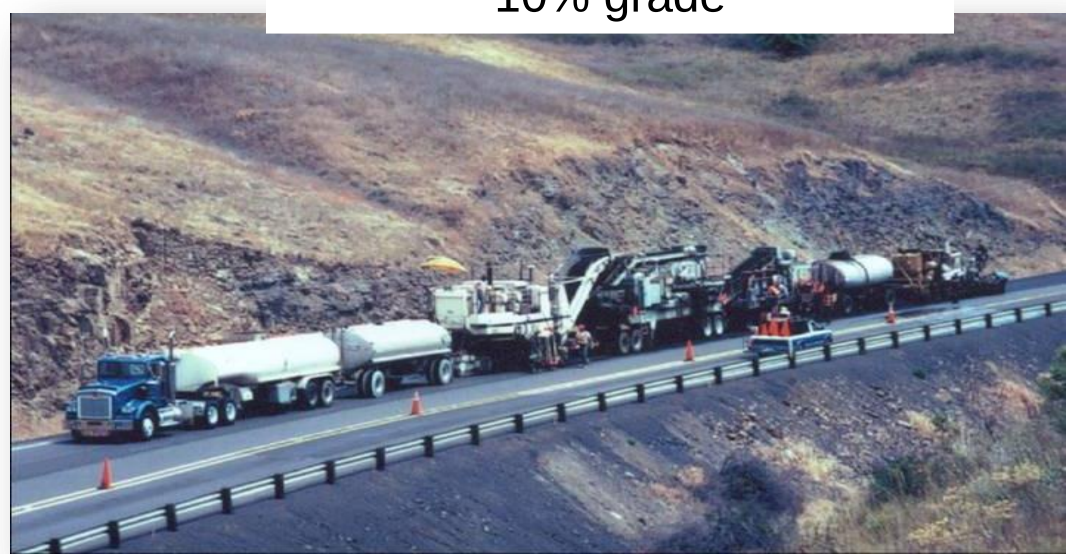
3. Roadway Geometry

- Profile grade
- Drainage ditches
- Guard rail
- Overhead
- Cross slope

Kingsbury Grade, Nevada
10% grade



Project Selection Criteria

1. Existing pavement condition and design
   - Distress type, level, and extent
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4. Project Site Consideration

- Contractors availability
  - Contact ARRA - www.arra.org
- Project length
  - At least 4 miles for HIR and CIR
- Construction season

Additional Factors to Consider
(continued)

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7. Traffic Control

Mill & Overlay vs. CIR & Overlay

93-AASHTO Design

3" Mill & 3" HMA

- Existing HMA (SN-0.2/inch)
- New HMA (SN-0.42/inch)

- Total SN-
- (3"*0.42)-3*0.2=0.66

3" CIR & 1.5" HMA

- 0.3-CIR (SN-0.3/inch)
- 0.42 New ACP (SN-0.42/inch)

- Total SN-
- (3*(0.3-0.2)+0.42*1.5=0.93

40% Increase in SN value

Cost Comparison

3" MILL & 3" OVERLAY

- 3" Milling-$1.5/ Sq. Yd.
- 3" HMA- $18/ Sq.Yd.

- Total cost for one mile (32' wide)= $370 K

3" CIR & 1.5" OVERLAY

- 3" CIR-$4.5
- 1.5" HMA- $9/ Sq.Yd.

- Total cost for one mile (32' wide)= $253K

30% Cost decrease

5. Initial Funding Constraint

(Nevada DOT Cost Comparison)

Category	ESALs	Strategy	Total structural number	Strategy Cost	Reduced Cost/ Mile	Change in SN
LOW	< 1 Million	2" Mill &fill	2"(0.35-0.18)= 0.34	625K	63%	(12%)
		3" CIR Double Chip Seal	3(0.28-0.18) =0.30	230K		
MEDIUM	> 1 Million < 3 Million	3" Mill 3" HMA	3"(0.35-0.18)=0.51	910K	37%	60%
		3" CIR 1.5" HMA	3" (0.28-0.18) +1.5" *0.35=0.82	570K		
HIGH	> 3 Million	3" Mill 6" HMA	(6")(0.35)-(3")(0.18)=1.56	1.82 M	28%	10%
		3" CIR 4" HMA	3(0.28-0.18) +4(0.35)=1.70	1.3 M		

Additional Factors to Consider

(continued)

5. Initial funding constraint
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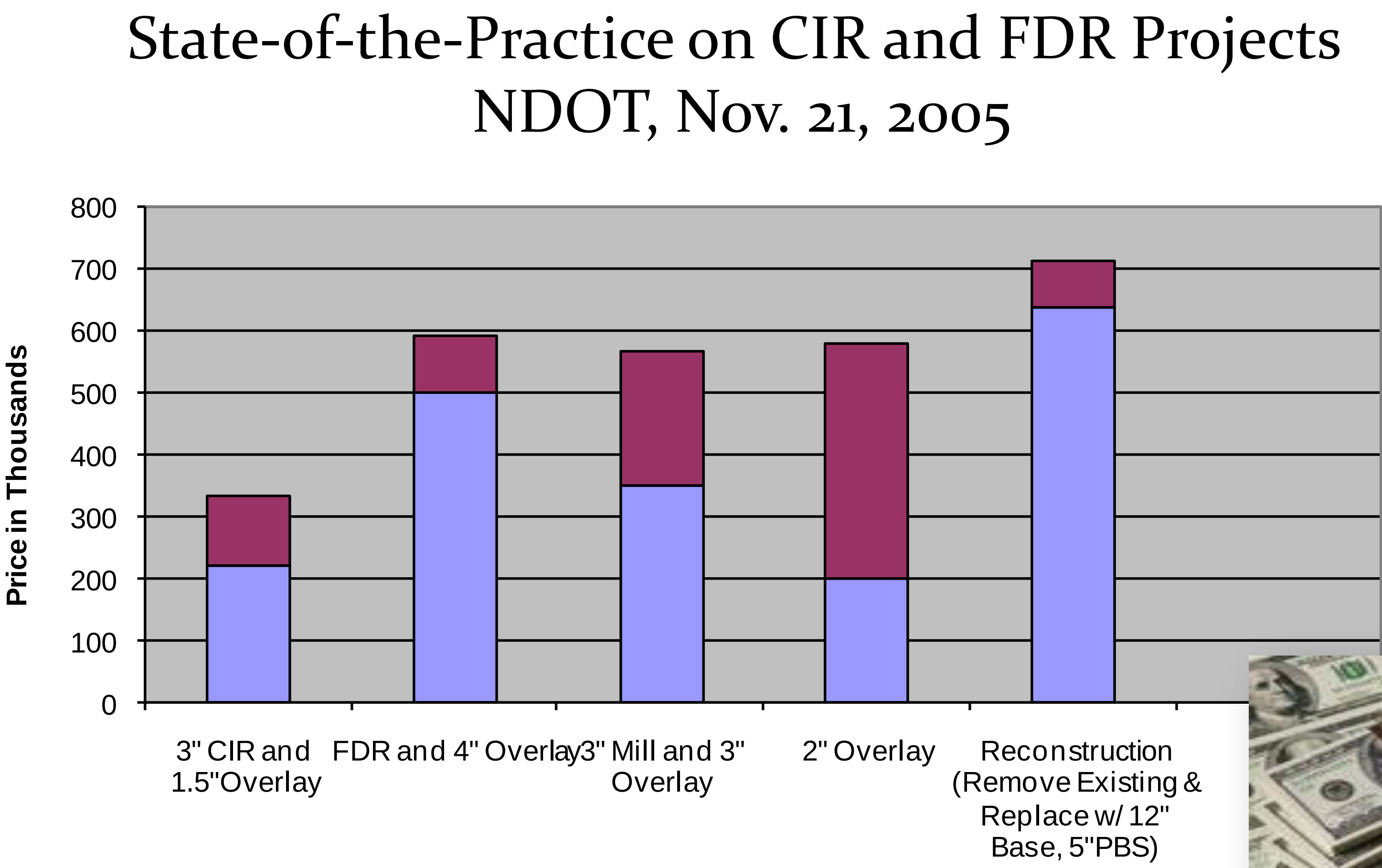
6. Life-cycle Cost Analysis

Present Worth for Pavement Rehabilitation



Long-Term Performance

9-year Performance

CIR and 2” Overlay Section, Reno, Nevada

Long-Term Performance

20-year Performance

US-95 NV

Additional Factors to Consider

(continued)

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7. Traffic Control

7. Traffic Control

Extremely Important

Factors to consider:

- Day time vs. night time construction
- ADT and type of traffic (cars vs. trucks)
- Opening to traffic
- Intersections and other stop and go
- Access to local business

CIR on I-80 in Nevada

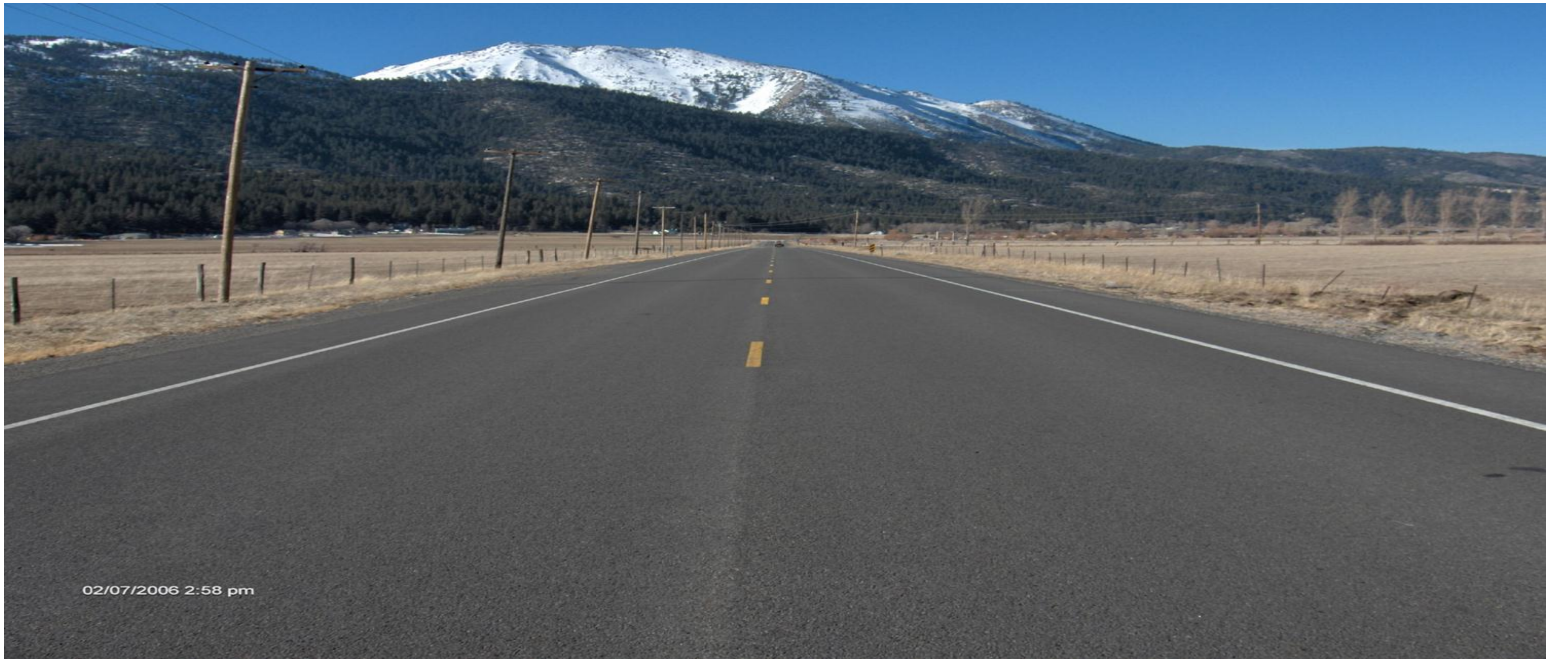
I-80 at Pequop

Agency: NDOT District 3
Contractor: Road & Highway Builders
Subcontractor: Valentine Surfacing
2007-2008

Lake Almanor, Caltrans Project-2011

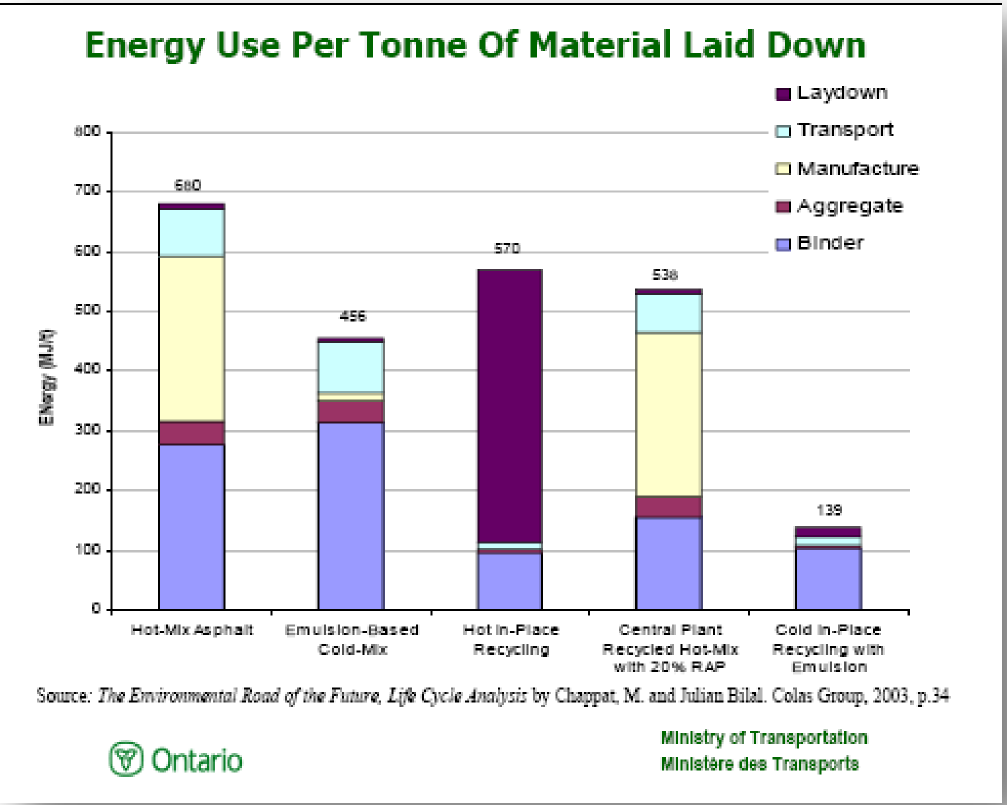
Recommendations

- Agencies should consider adding HIR, CIR, and FDR rehabilitation strategies to their tool box
- Start slowly and get contractors involved early
- Continue improving the process



Conclusions
HIR, CIR and FDR Meet the 3E Challenge

Sustainability



20-Yr CIR Performance

$600M Cost-Saving with CIR and FDR

Let's Create a Sustainable Future!

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