How to Optimize Your Project With In-Place Recycling?

Southeastern States

In-Place Recycling Conference
August 30, 2011

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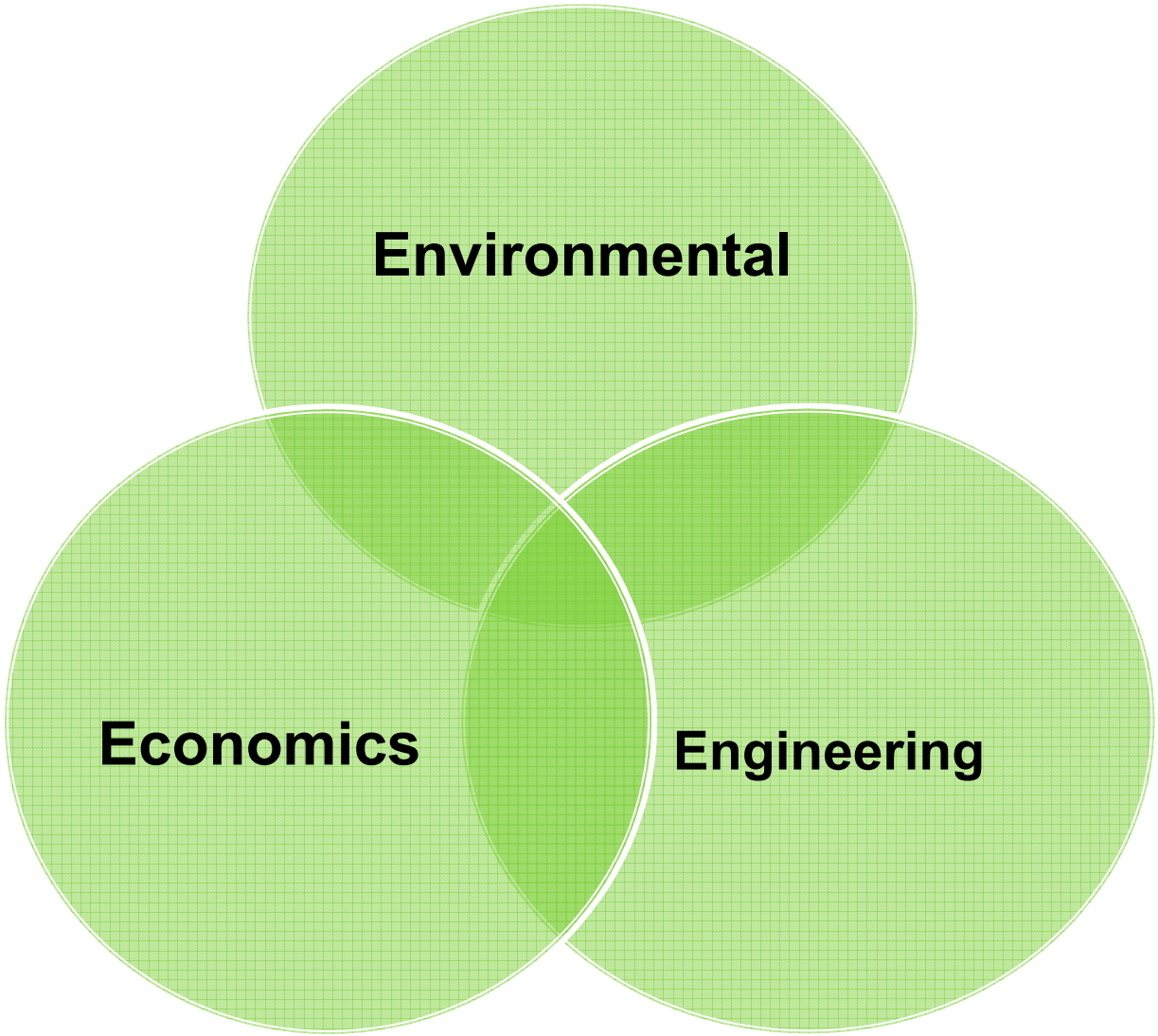
Parsons Transportation Group

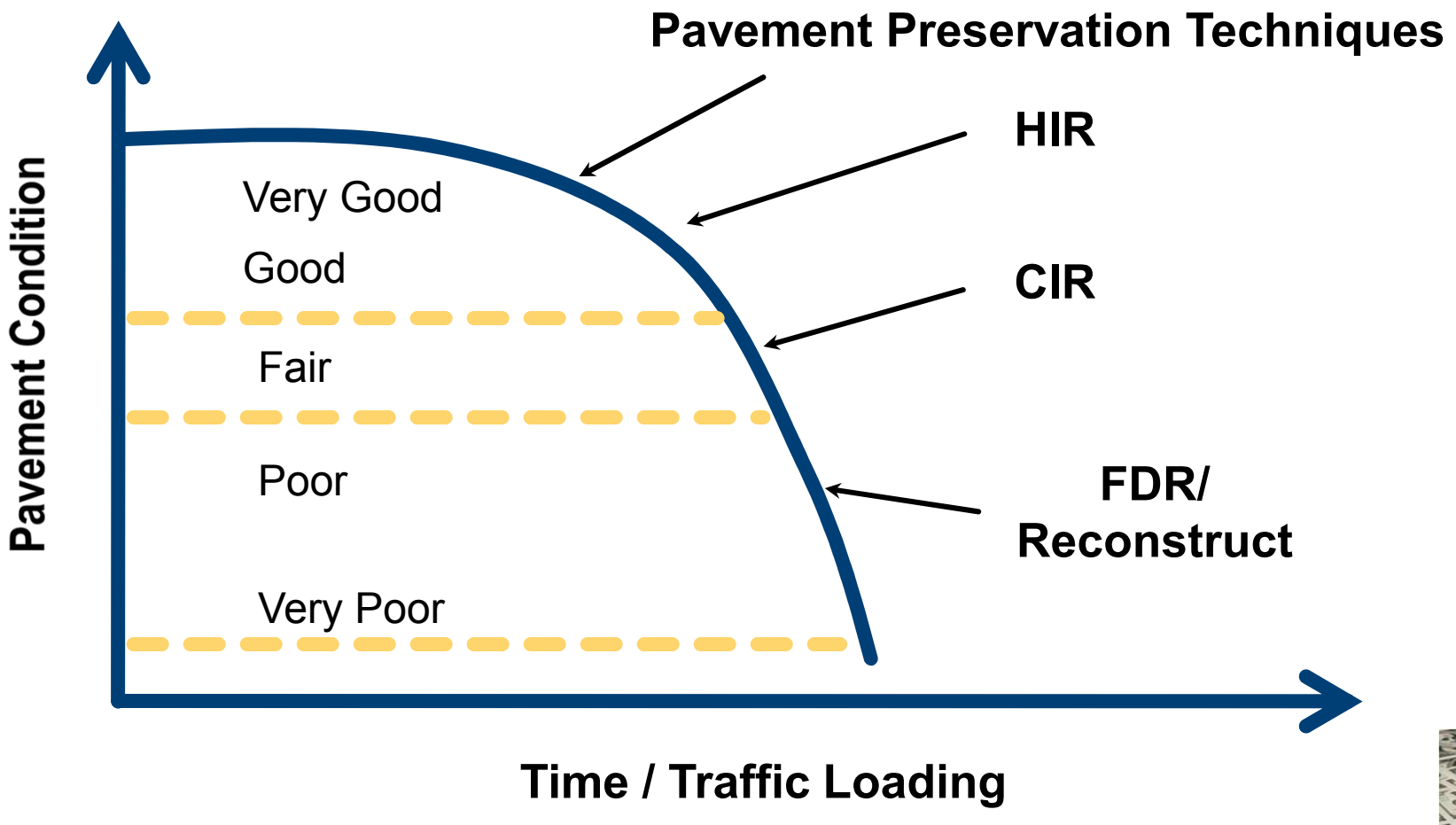
Why In-Place recycling?

Meets the 3E Challenge

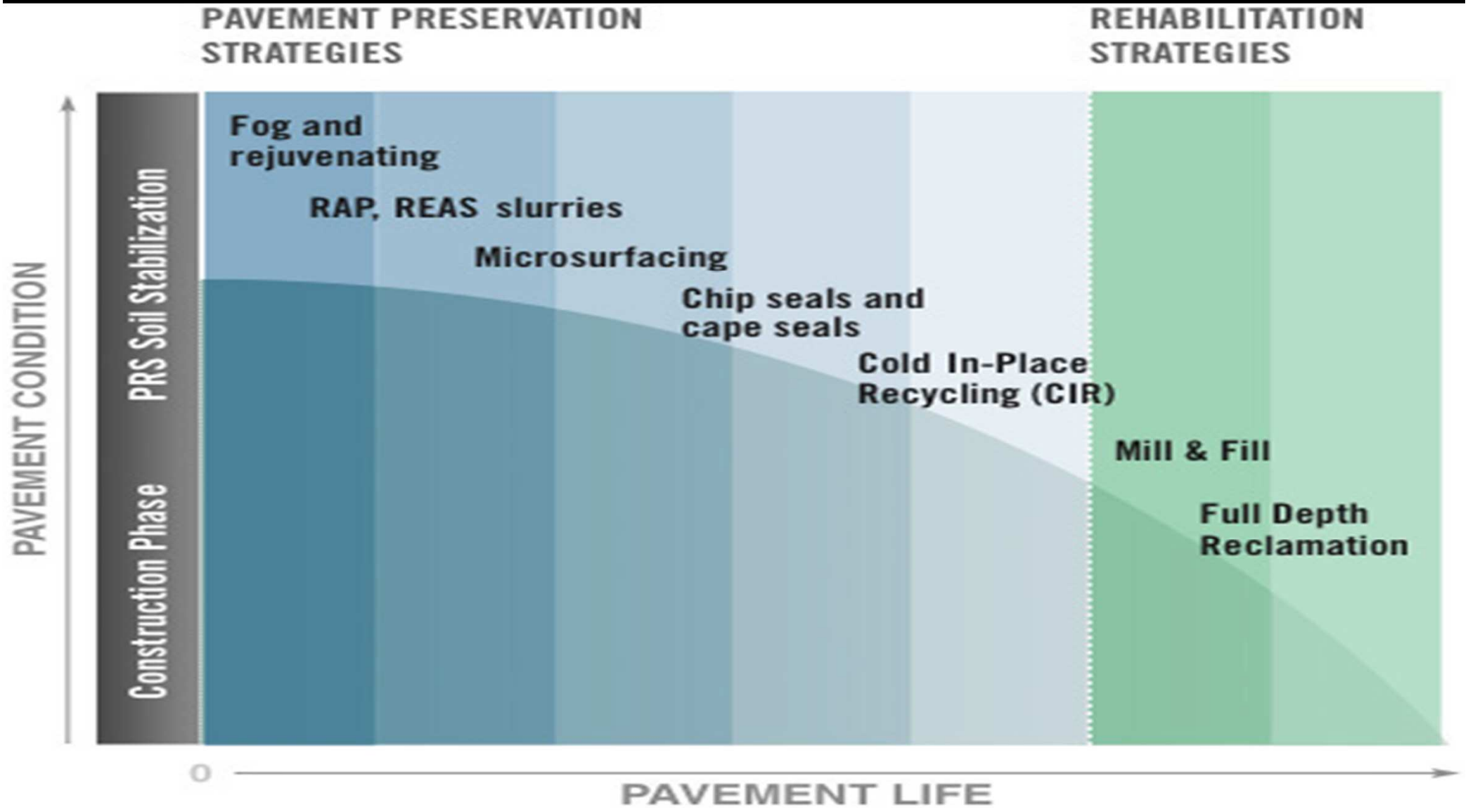


Timing of Rehabilitation Techniques

(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

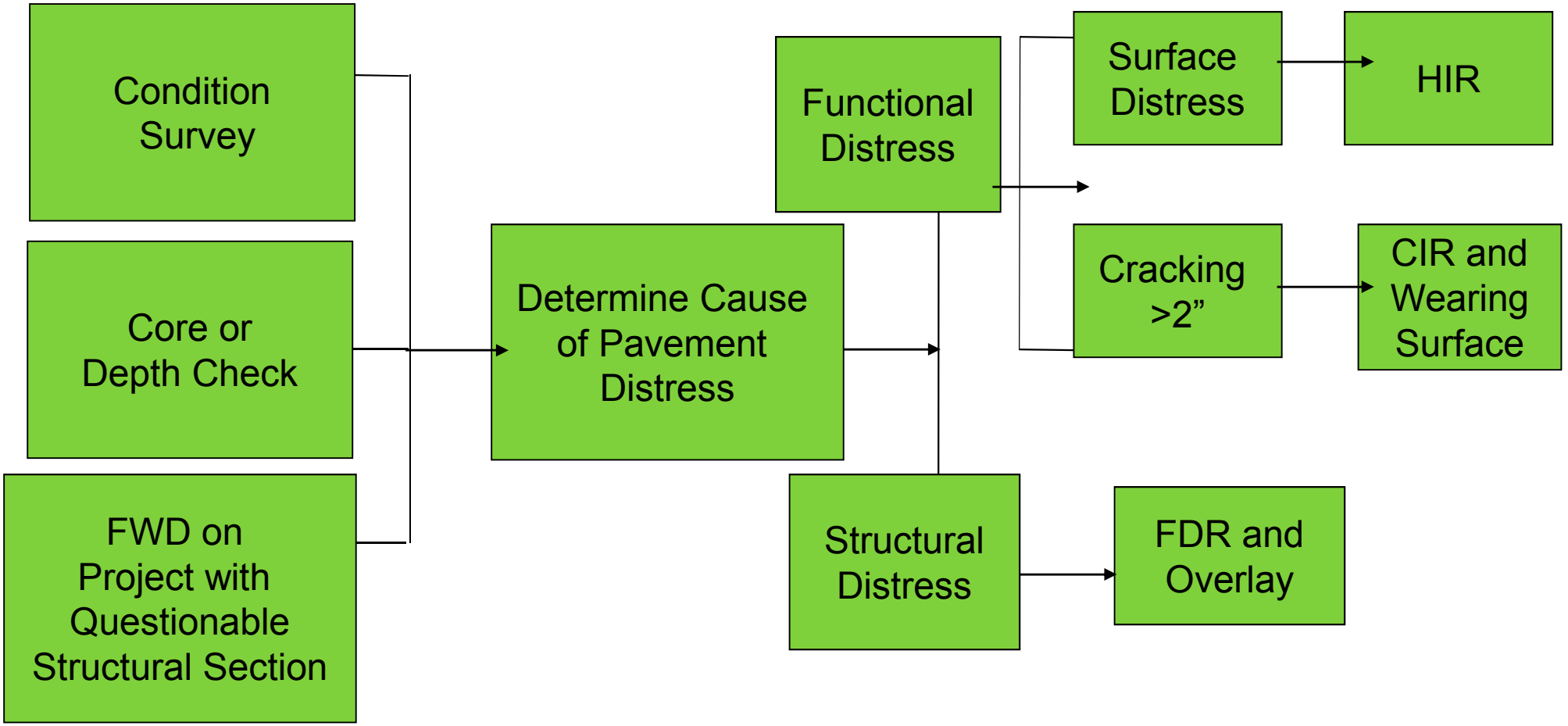
1. Existing pavement condition and design
   - Distress type, level, and extent
   - Traffic Loading
2. Environmental condition
3. Roadway geometry
4. Project site consideration

Additional Factors to Consider

(continued)

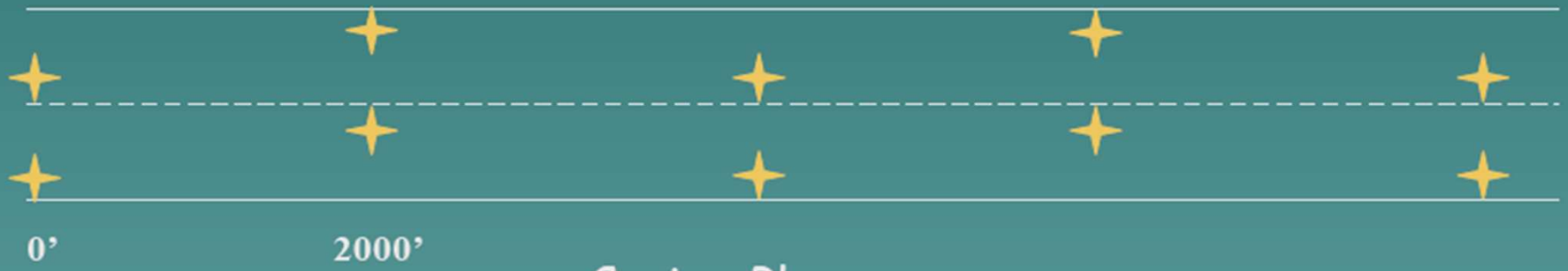
5. Initial funding constraint
6. Life-cycle cost based on long-term performance
7. Traffic Control

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 H20 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


Gyratory Compactory


Marshall Stability


Raveling Test


RAP Preparation

Project Selection Criteria

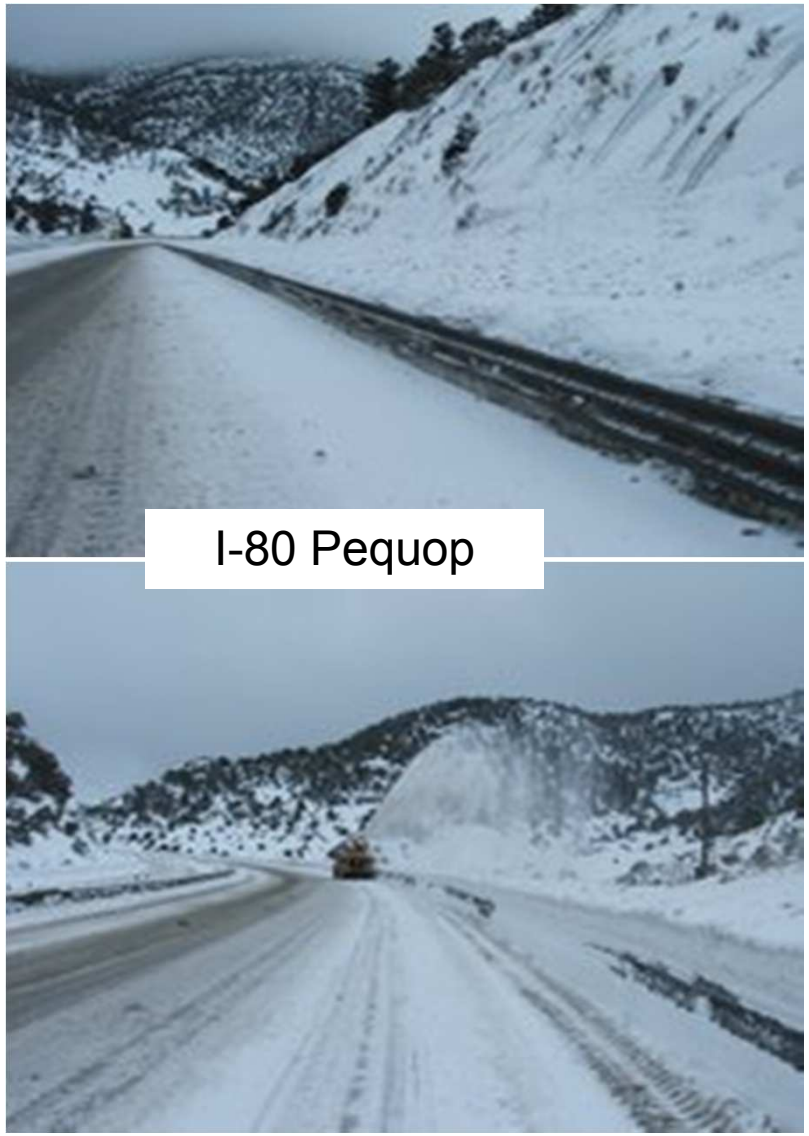
1. Existing pavement condition and design
   - Distress type, level, and extent
   - Traffic Loading
2. Environmental condition
3. Roadway geometry
4. Project site consideration

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



I-80 Pequop

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
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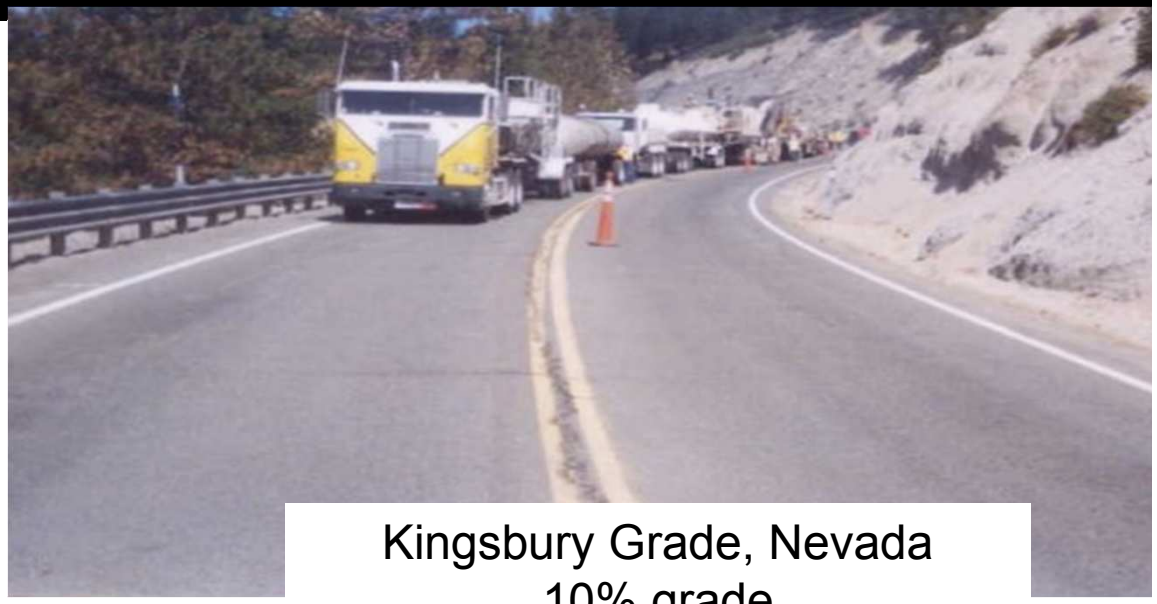
3. Roadway Geometry

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



Kingsbury Grade, Nevada
10% grade

Additional Factors to Consider

(continued)

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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

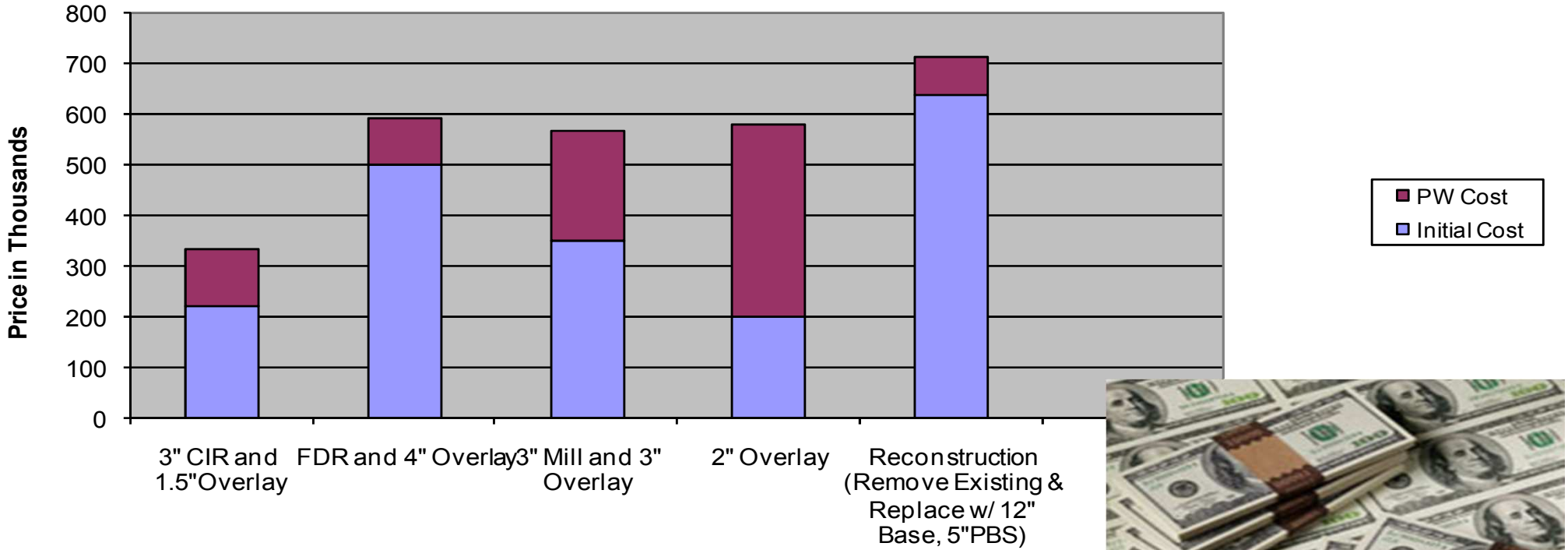
(continued)

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

6. Life-cycle Cost Analysis

Present Worth for Pavement Rehabilitation

State-of-the-Practice on CIR and FDR Projects
NDOT, Nov. 21, 2005



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

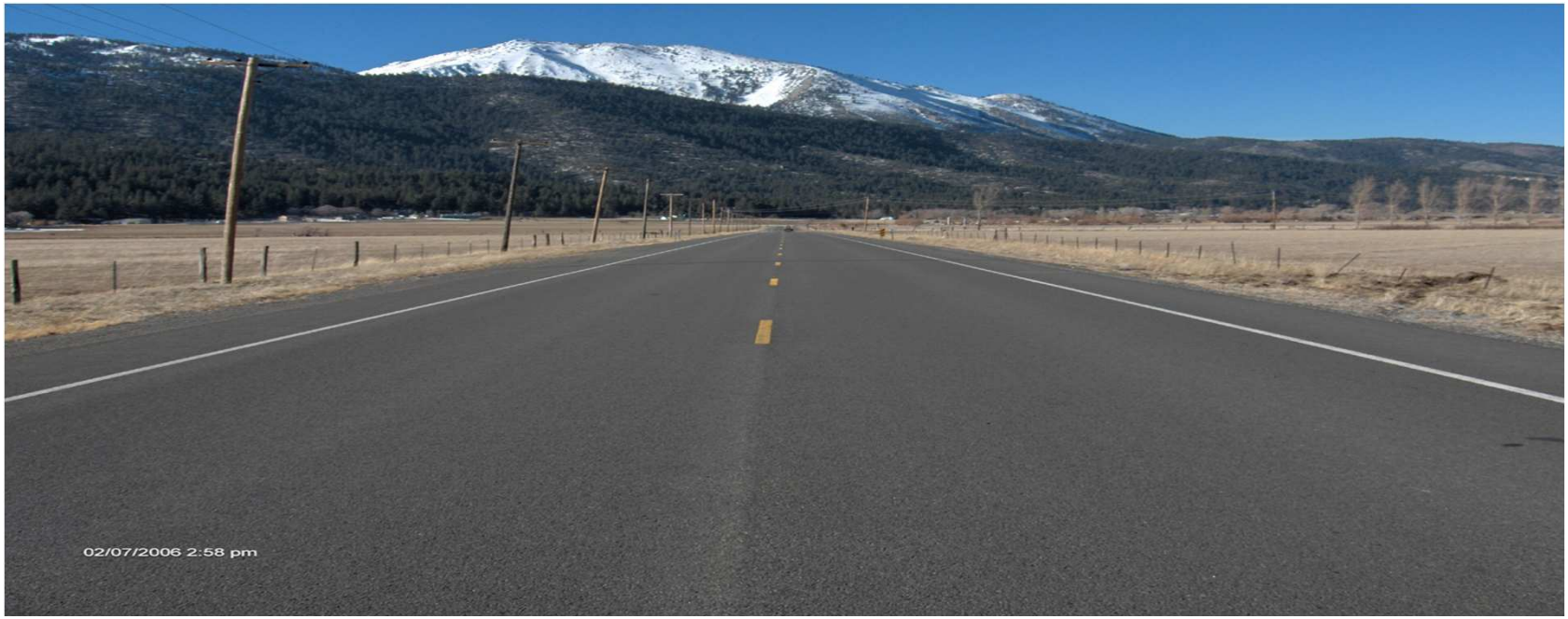
I-80 at Pequop

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

Lake Almanor, Caltrans Project-2011

Recommendations

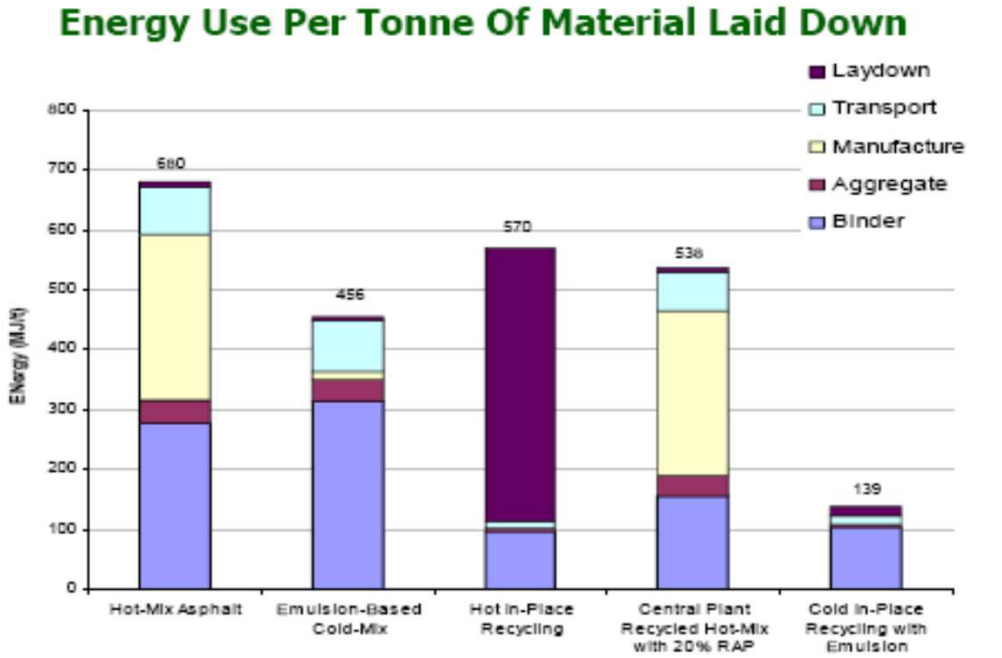
- Agencies should consider adding HIR, CIR, and FDR rehabilitation strategies to their tool box
- Start slowly and get contractors involved early
- Continue improving the process



Conclusions

HIR, CIR and FDR Meet the 3E Challenge

Sustainability



Source: *The Environmental Road of the Future, Life Cycle Analysis* by Chappat, M. and Julian Bilal. Colas Group, 2003, p.34

Ontario

Ministry of Transportation
Ministère des Transports

20-Yr CIR Performance

$600M Cost-Saving with CIR and FDR

Let's Create a Sustainable Future!

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