Project Selection Criteria for In-Place Recycling

Northeast & Mid Atlantic In-Place Recycling Conference
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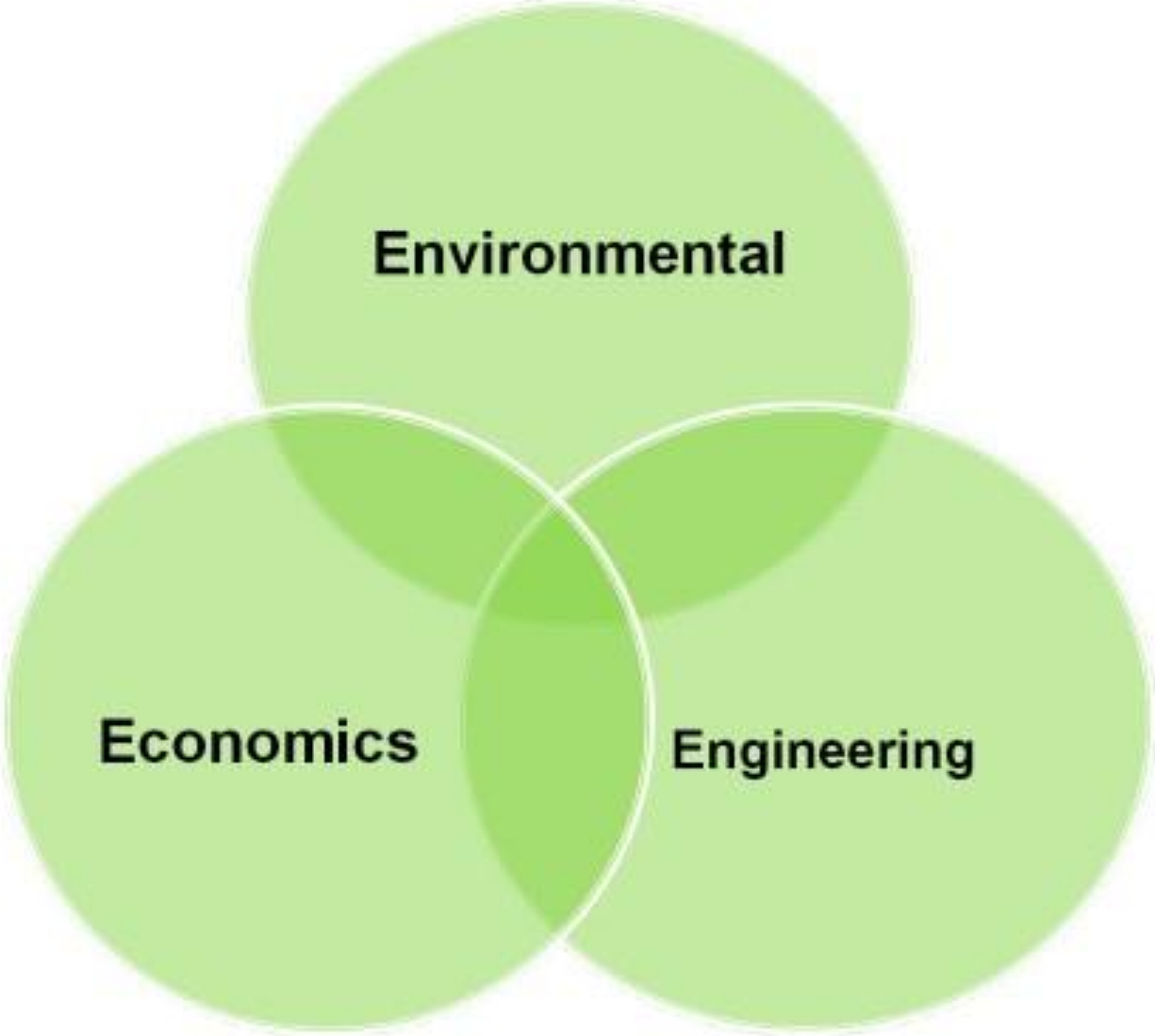
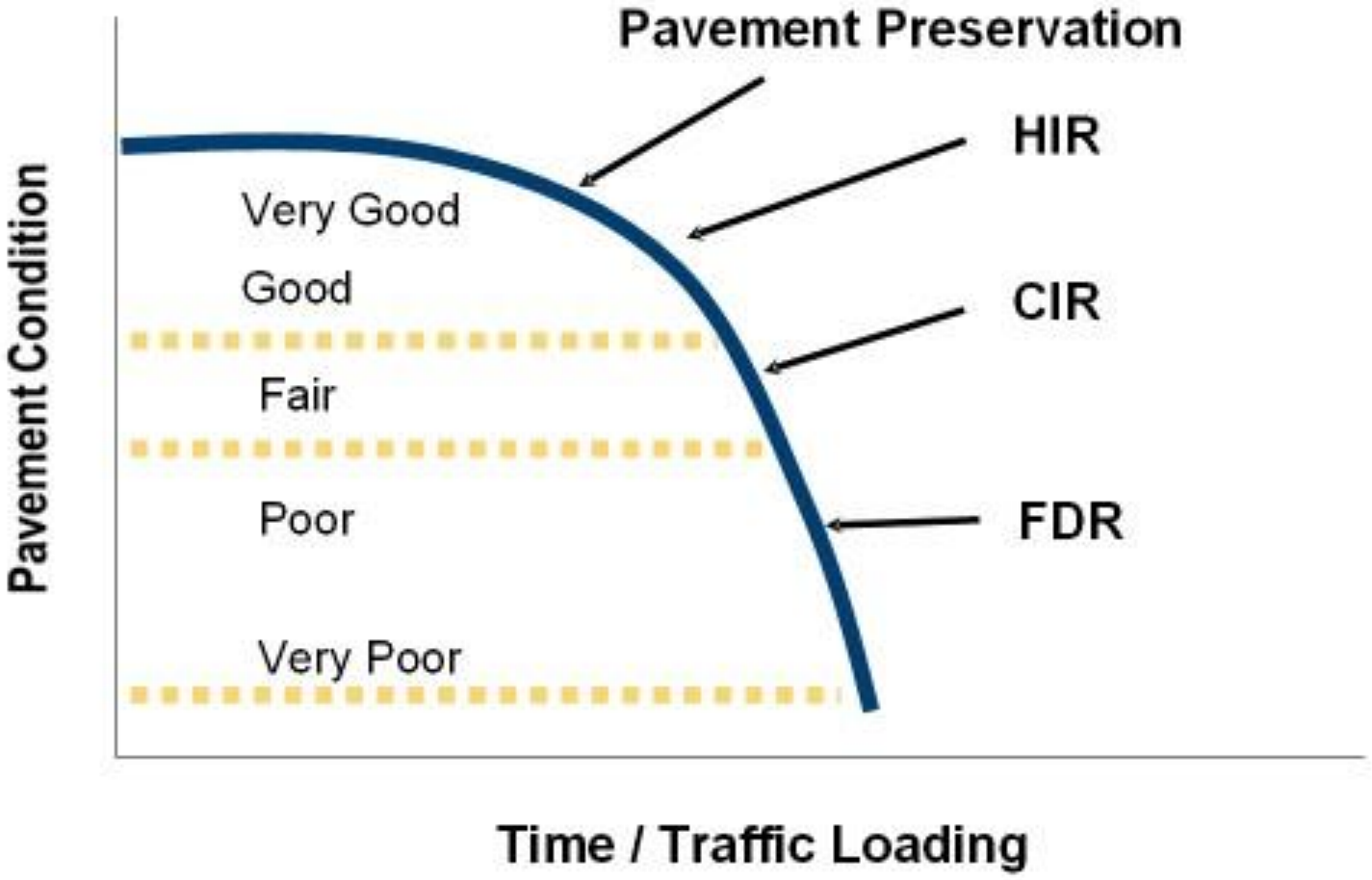
Why In-Place recycling?

Meets the 3E Challenge

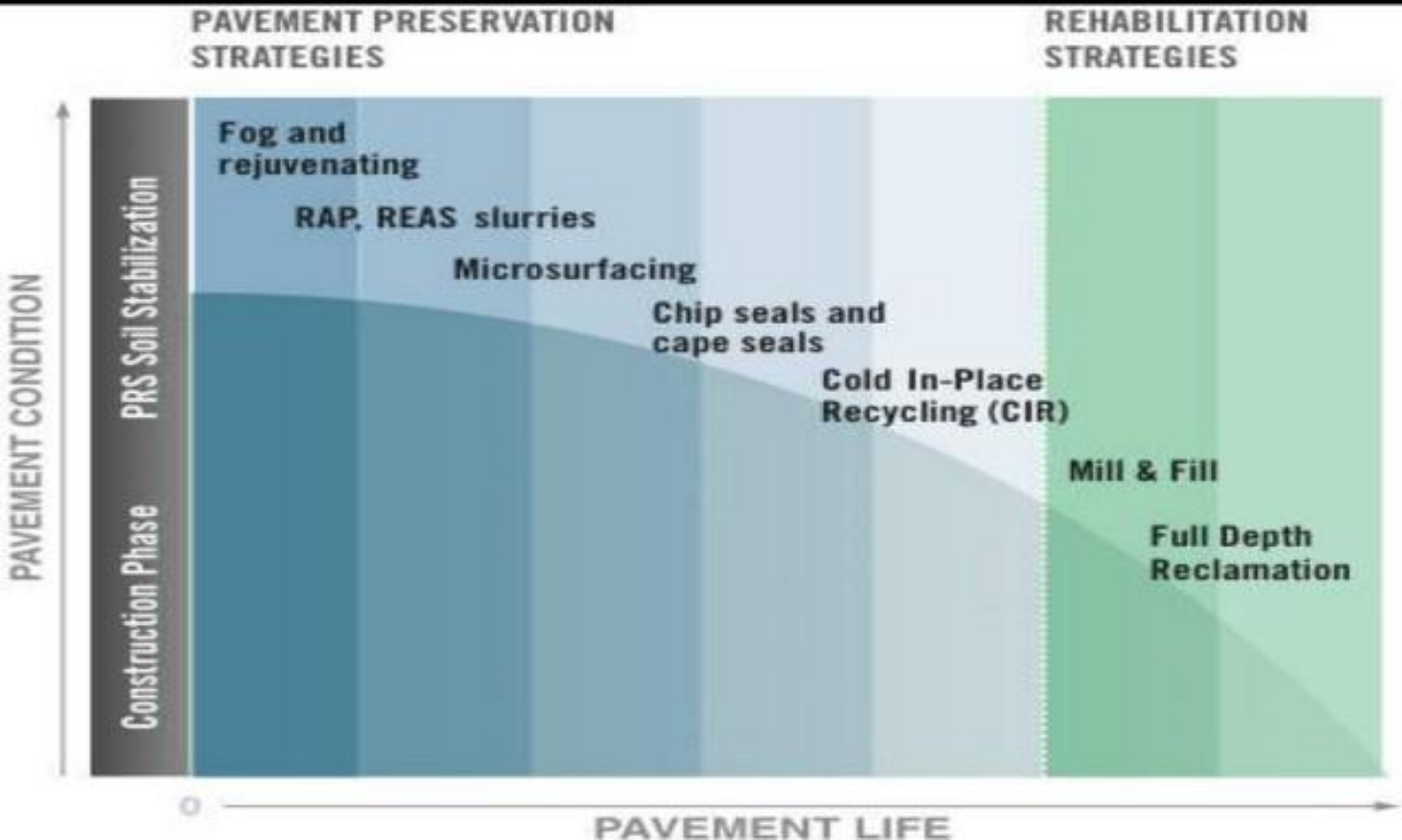


Timing of Rehabilitation Techniques

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



Pavement Preservation



What is a good strategy for surface raveling?

HIR

What is a good strategy for medium and wide transfers and black cracking?

What is a good strategy for alligator cracking?

Project Selection Criteria

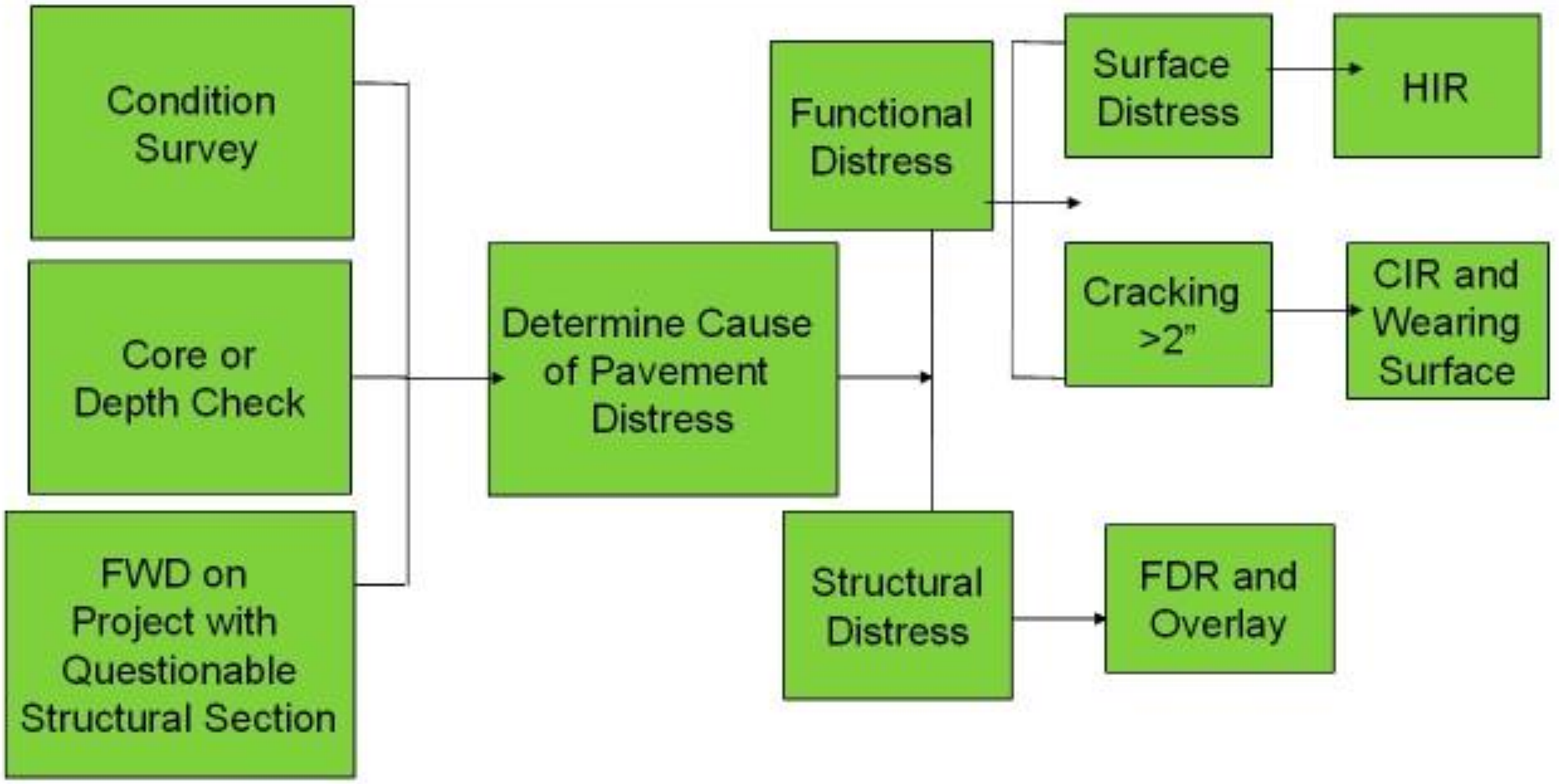
1. Existing pavement condition and design
   - Distress type, level, and extent
   - Traffic Loading
1. Environmental condition
2. Roadway geometry
3. Project site consideration

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

- Using 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 want to make it too high strength
- Calculate projected traffic loading for the design life

Structural Layer Coefficient

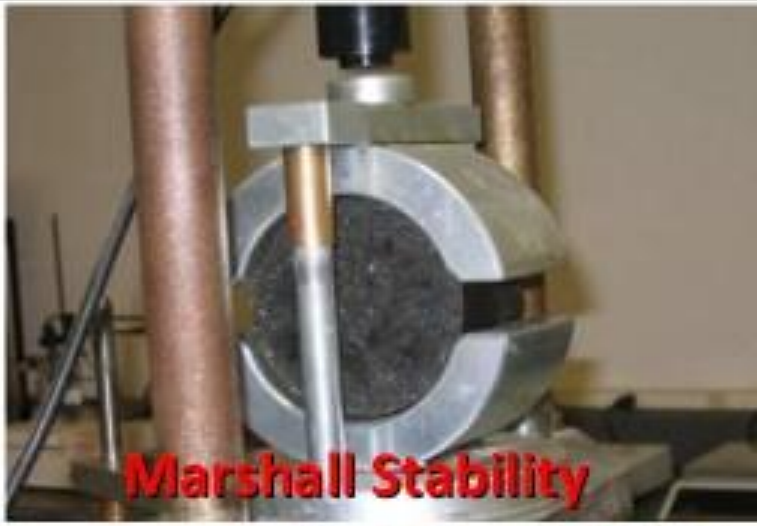
FDR Method	Minimum Thickness of Riding Surface	Typical Structural Coefficient
Mechanical	2" HMA	0.10 – 0.12
Bituminous	Surface Treatment or Structural HMA	0.20 – 0.28
Cement	Surface Treatment or Structural HMA	0.15 – 0.20

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



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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 which 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

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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
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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)

5. Initial funding constraint
6. Life-cycle cost based on long-term performance
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5. Initial Funding Constraint

In-place recycling can meet both initial and life cycle cost constraint

	3" CIR & 1.5" HMA	3" Mill & 3" HMA
GF	3(1.5 – 1.25) + (1.5" x2.25) = **4.125**	3 x (2.25-1.25) = **3**
Cost	CIR: 50,688 S.Y.@ $2.30 = $116,582 Recycling Binder: 196 tons @ $535 = $104,860 1.25 inch HMA Overlay 3,659 tons @ $95.00 = $347,605 TOTAL: **$569,047**	Rotomill: 50,688 S.Y. @ $1.50 = $76,032 HMA: 8,781 tons @ $95.00 = $834,195 TOTAL: **$910,227**

CIR & HMA provides **37% less cost**

Save $341,180 **37% increase in SN**

GF for MNDOT
New HMA = 2.25
CIR = 1.5
Existing HMA = 1.25

5. Initial Funding Constraint

(Nevada DOT Cost Comparison)

Category	ESALs	Strategy	Total GRAVEL FACTOR Numbers	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)

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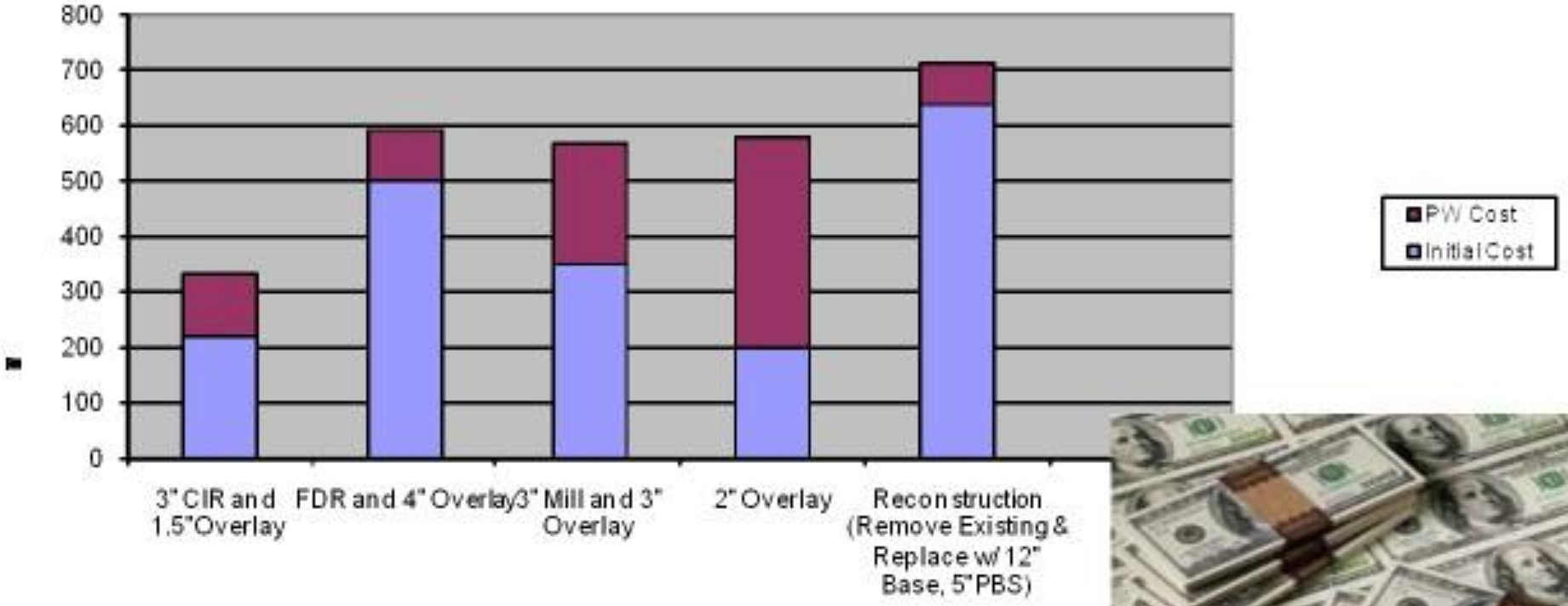
6. Life-cycle Cost Analysis

Present Worth for Pavement Rehabilitation

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



Long-Term Performance

7-year Performance

CIR and 2" Overlay Section, Reno, Nevada

Additional Factors to Consider

(continued)

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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

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

In-Place Recycling Websites

- www.greenroads.us
- www.fhwa.dot.gov/
- www.pavementpreservation.org/video/index.
- www.dot.ca.gov/hq/esc/Translab/ope/CIPR.h
- www.transportation.org/
- www.fp2.org/
- www.pavementrecycling.com

Recommendations

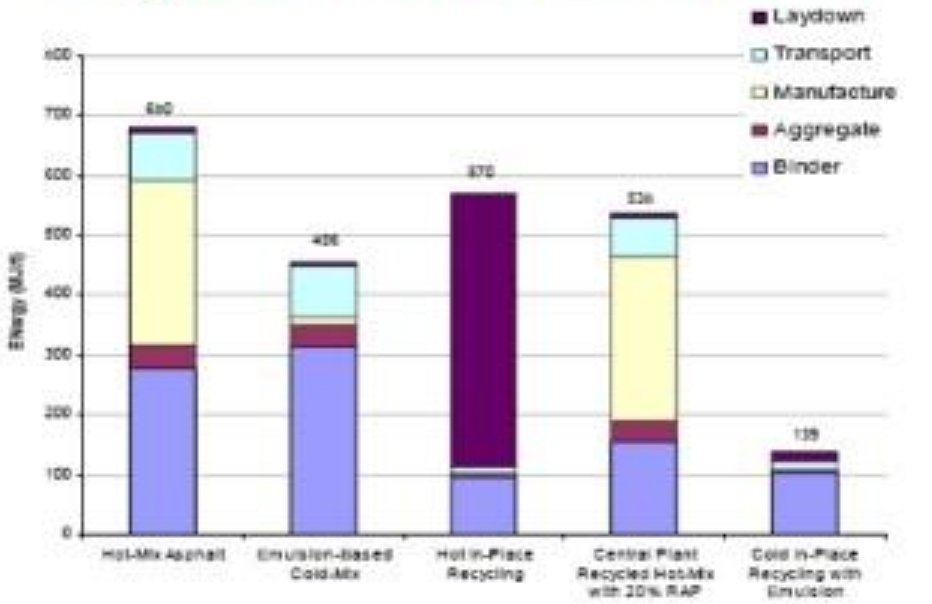
- Agencies should consider HIR, FDR and CIR in their tool box
- Start slowly and get contractors involved early
- Continue improving the process

Conclusions

HIR, CIR and FDR Meet the 3E Challenge

Sustainability

Energy Use Per Tonne Of Material Laid Down



Source: *The Environmental Road of the Future, Life Cycle Analysis* by Chaggar, 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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