Project Selection Criteria for In-Place Recycling

2nd In-Place Recycling Workshop
Midwest Conference
August 11, 2009

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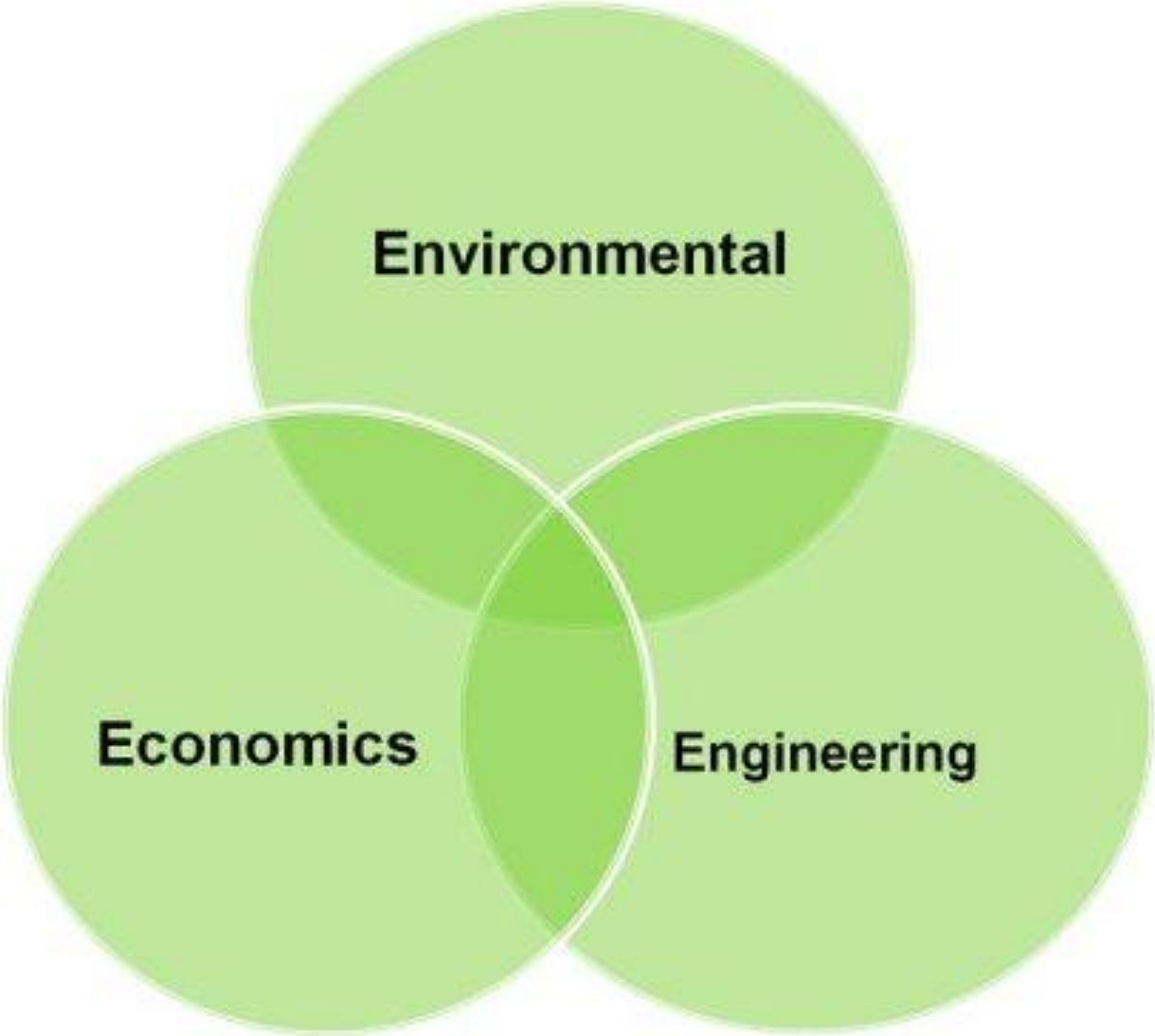
Parsons Transportation Group

Outline

- Why recycle?
- How do you select a project?
  - The right project, the right strategy at the right time
- How do you construct a successful project?
- Additional use of recycled asphalt pavement
- Conclusions

Why recycle?

Meets the 3E Challenge



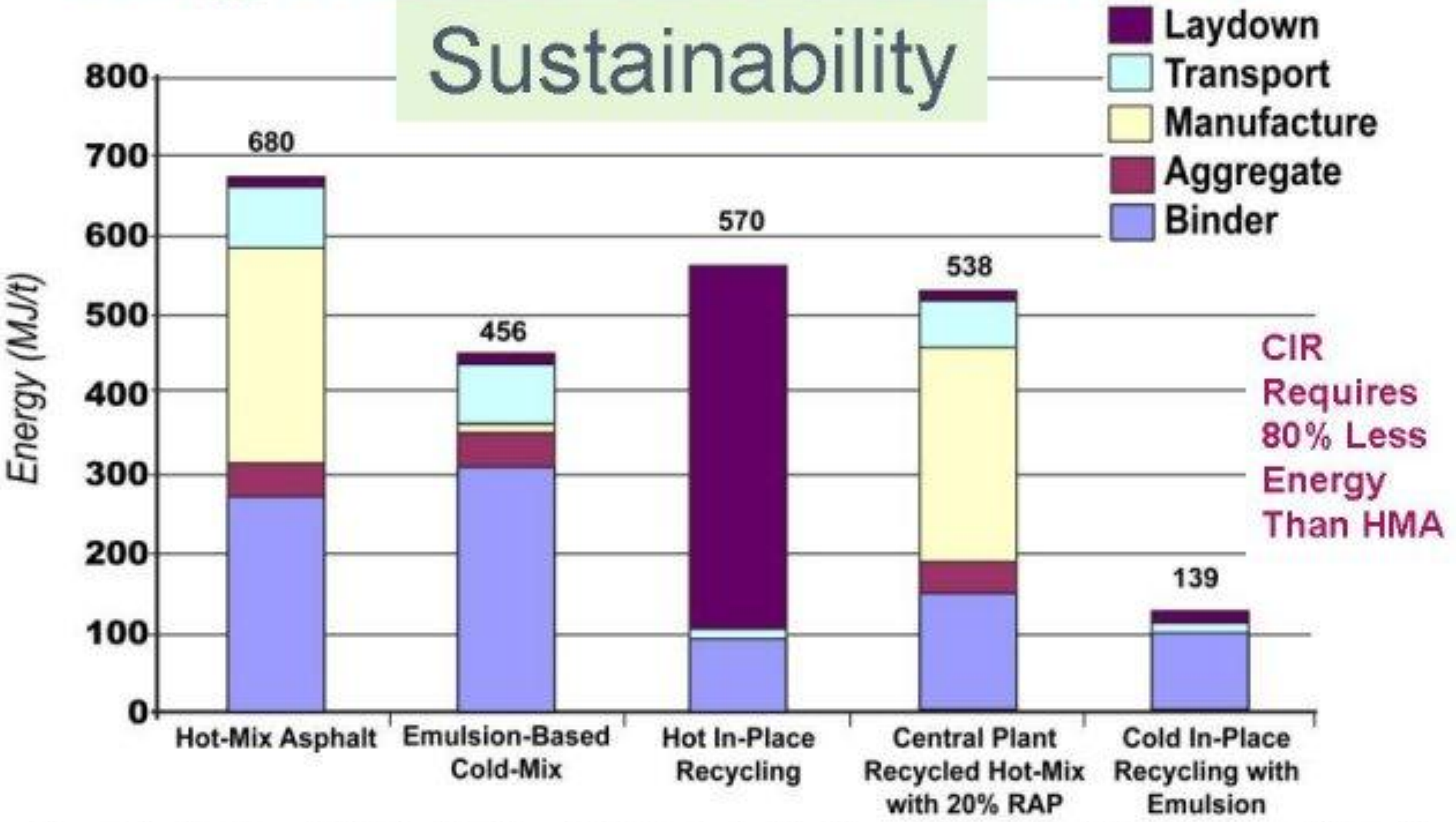
Environmental Challenge

Time, Oct. 1, 2007

Newsweek, April 16, 2007

Energy Use Per Tonne Of Material Laid Down

Sustainability

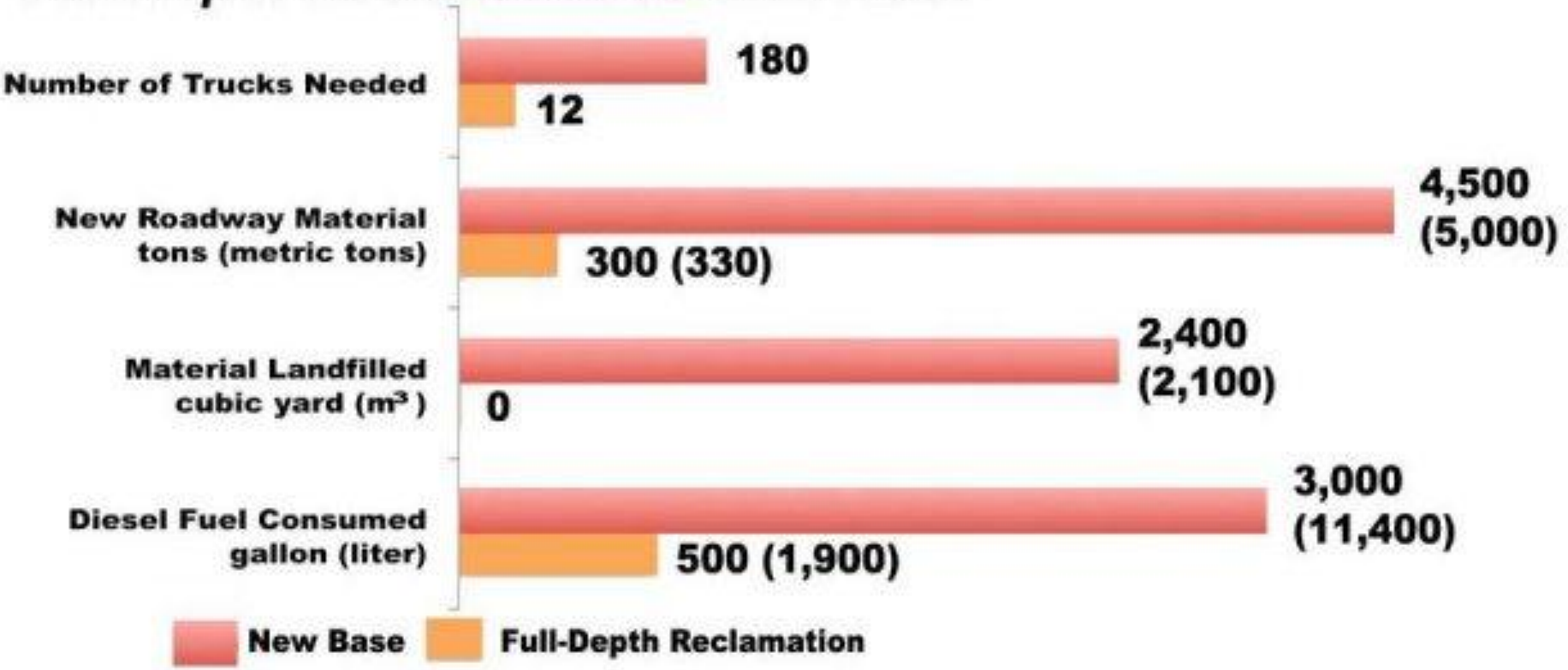


Source: The Environmental Road of the Future, Life Cycle Analysts by Chappat, M. andJulian Bial, Colas Group, 2003. p.34

FDR Energy Savings

Energy Use and Materials

Full-Depth Reclamation vs. New Base



Based on 1 mile (1.6 km)of 24-foot (7.3 m) - wide 2-lane road, 6 inch (150 mm) base

California Nevada Cement Association

Cost-Effectiveness for NDOT

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		

How about MNDOT Cost-Effectiveness?

Granular Equivalent (GE) Factors for MNDOT

Material	Specification	GE Factor
Plant-mixed Bituminous Pavement	2350/2360	2.25
Plant-mixed Bituminous Pavement	2331, 2340 Type 41, 47, 61	2.25
Cold in-Place Recycling	2331	1.50

Cost-Effectiveness for MNDOT

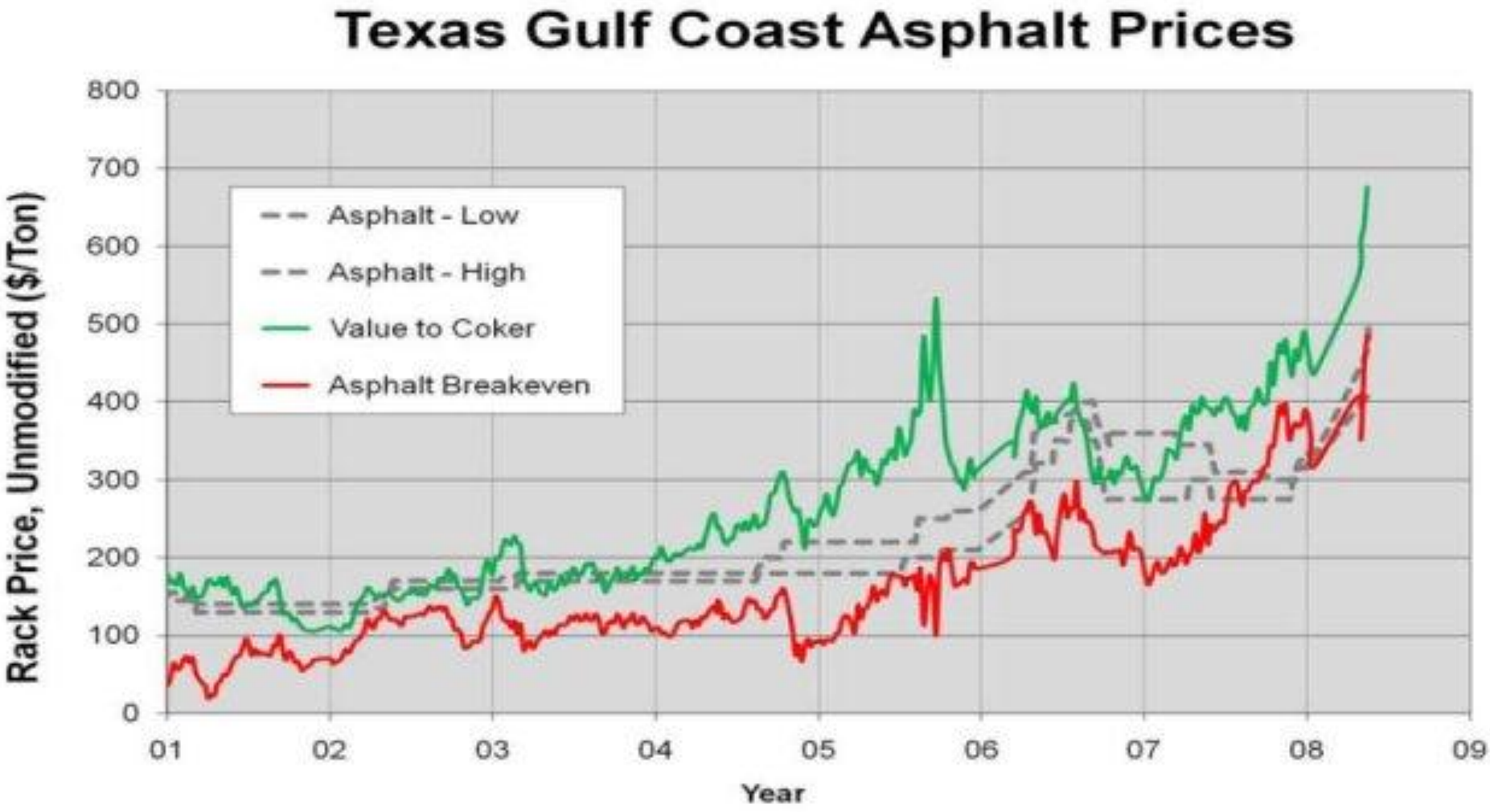
	3" CIR & 1.5" HMA	3" Mill & 3" HMA
GF	3(1.5 – 1.25) + (1.5" x2.25) = **4.125**	3 x (2.25-1.25) = **3**
Cost	CIR: 50,688 S.Y.@ $2.30 = $116,582 Recycling Binder: 196 tons @ $535 = $104,860 1.25 inch HMA Overlay 3,659 tons @ $95.00 = $347,605 TOTAL: **$569,047**	Rotomill: 50,688 S.Y. @ $1.50 = $76,032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

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

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

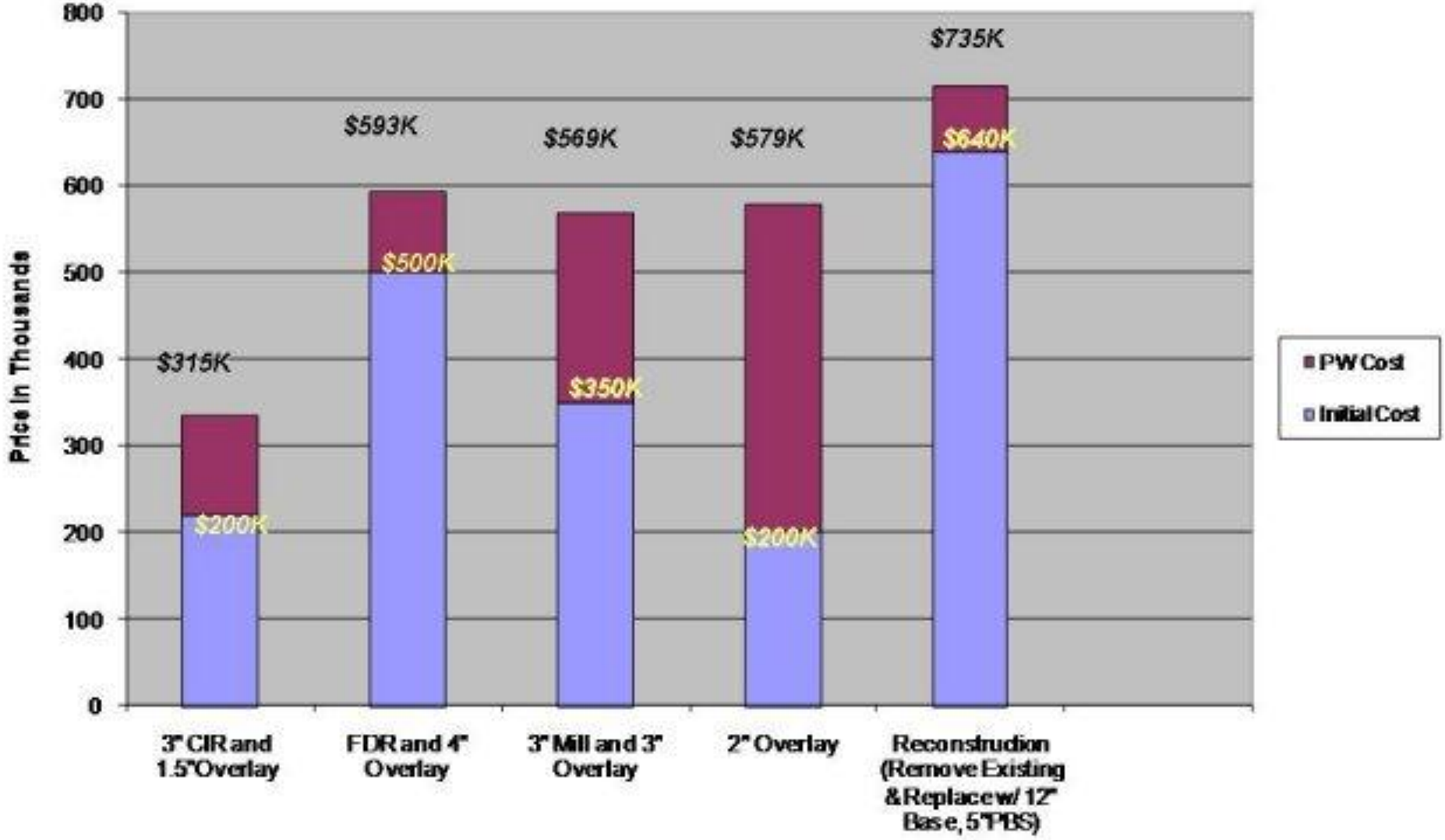
GF for MNDOT
New HMA = 2.25
CIR = 1.5
Existing HMA = 1.25

Asphalt Pavement Industry Overview



http://www.pavementpreservation.org/recyclingworkshop

Life-cycle Cost Analysis-Present Worth for Pavement Rehabilitation
State-of-the-Practice on CIR and FDR Projects
NDOT, Nov. 21, 2005



Engineering Challenge

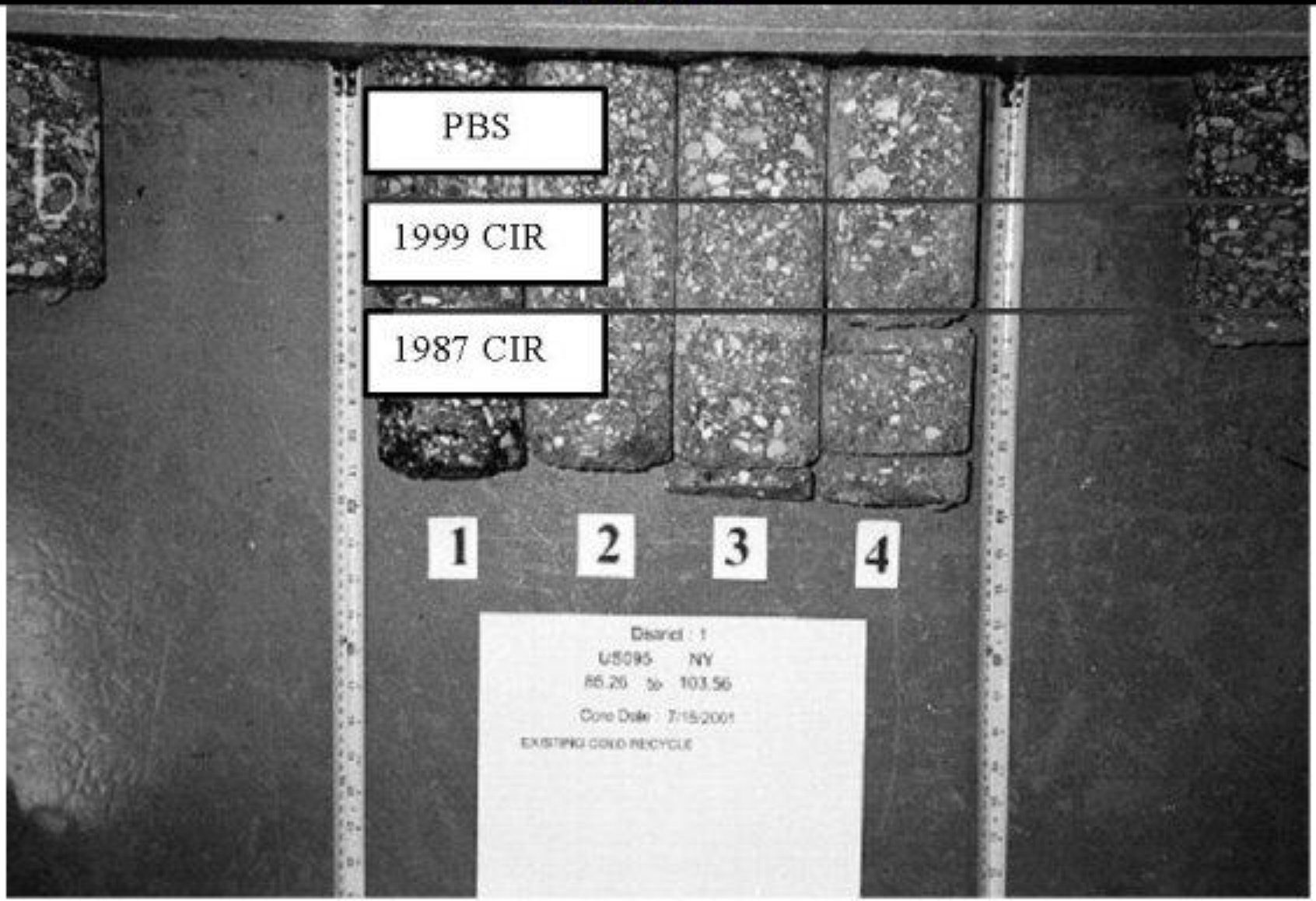
7-year Performance

CIR and 2” Overlay Section, Reno, Nevada

Engineering Challenge

20-year Performance

US-95 NV



CIR Train SR 207 NV

February 2007

PASS R CIR Project

Ventura County, CA, June 25, 2009

Breaking down & compacting mix with 1 pass of vibrating steel drum and 3 passes of the RTR

Mat is supporting heavy static traffic within an hour

PASS R CIR Project

Ventura County, CA, June 25, 2009

Fog seal of PASS R, 1:1 at .1 GPSY is applied with light sanding at end of day

Very little raveling before a 1" overlay placed 7-10 days later

CIR Project

Ventura County, CA, June 25, 2009

CIR Project

Ventura County, CA, June 25, 2009

CIR Project

Ventura County, CA, June 25, 2009

20 Miles of CIR ($35.5M contract)

I-80 NV

2007 & 2008

20 Miles of CIR

I-80 NV

2007 & 2008

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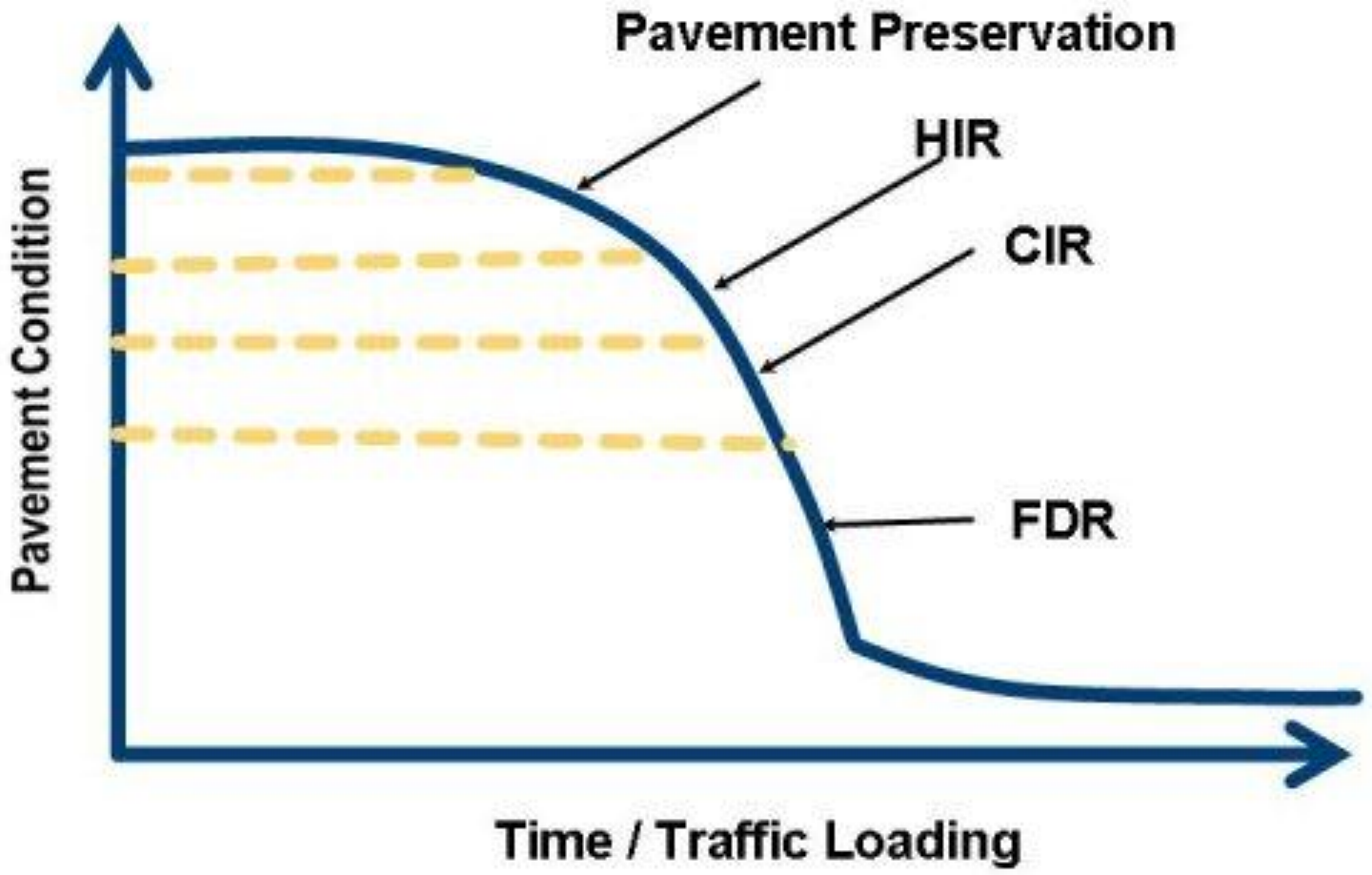
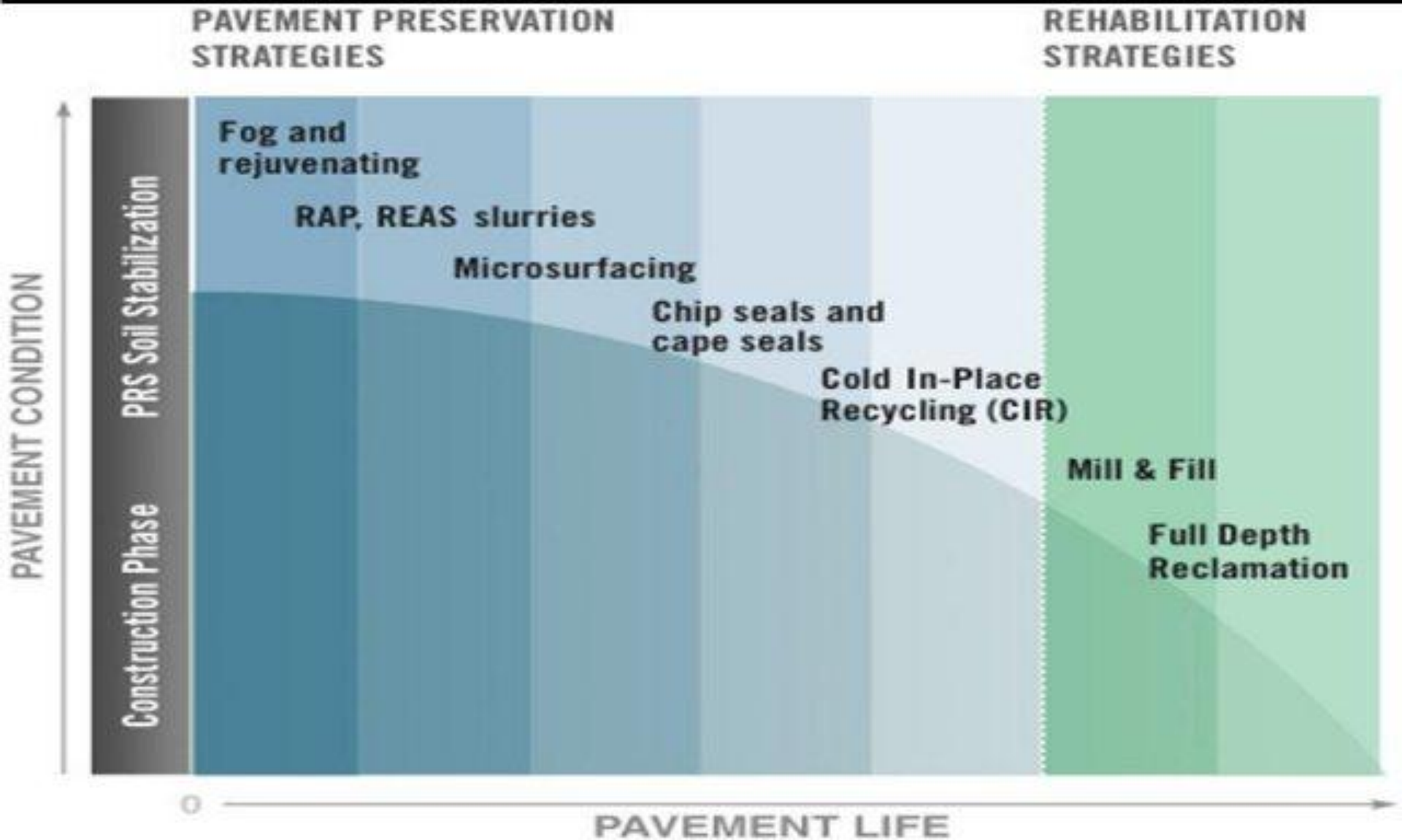
How to Select a Project

The right project, the right strategy at the right time

Timing of Rehabilitation Techniques



Pavement Preservation



Project Selection Criteria

- Existing pavement condition
  - Type and severity of distress
  - Cause of distress
  - Type of subgrade
- Environmental condition
- Future projected loading

Factors to Consider

(continued)

- Initial funding constraint
- Life-cycle cost
- Contractors availability
- Project length (at least 4 miles or more for HIR or CIR)
- Geometric improvements

Engineering Considerations

Visual Analysis:

Geometrics:

- Existing profile/cross slope recycled material swells
- Do you have room for excess material?
- Choked section (dike or guardrail)
- Roadway configuration (width, curves, supers)
- How many passes with recycling train?

Surface conditions:

Crack seal, surface seal, % distress, cracking patterns, utilities, existing shoulder material

Joe Peterson, Caltrans, 2008 In-Place Recycling Presentation

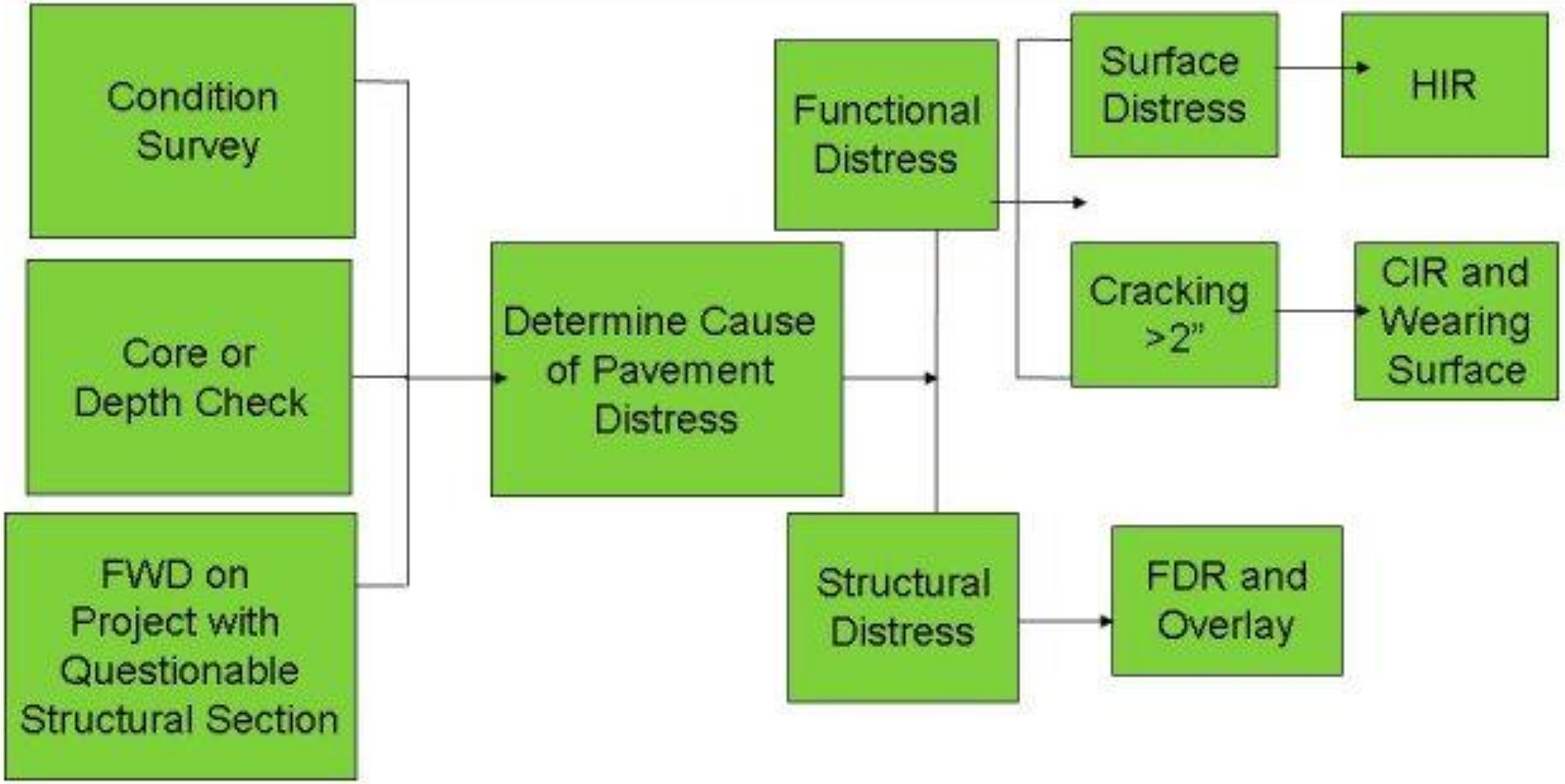
Other Factors

- Design life-expectancy
- Conservation of natural resources and energy
- Environmental concerns
- Traffic Control
- Future Traffic Disruption

How to Avoid/ Minimize Premature Failure

Joe Peterson, Caltrans, 2008 In-Place Recycling Presentation

Pavement Evaluation & Testing



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

How Do You Design the Project?

- 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
- CIR should not very high modulus

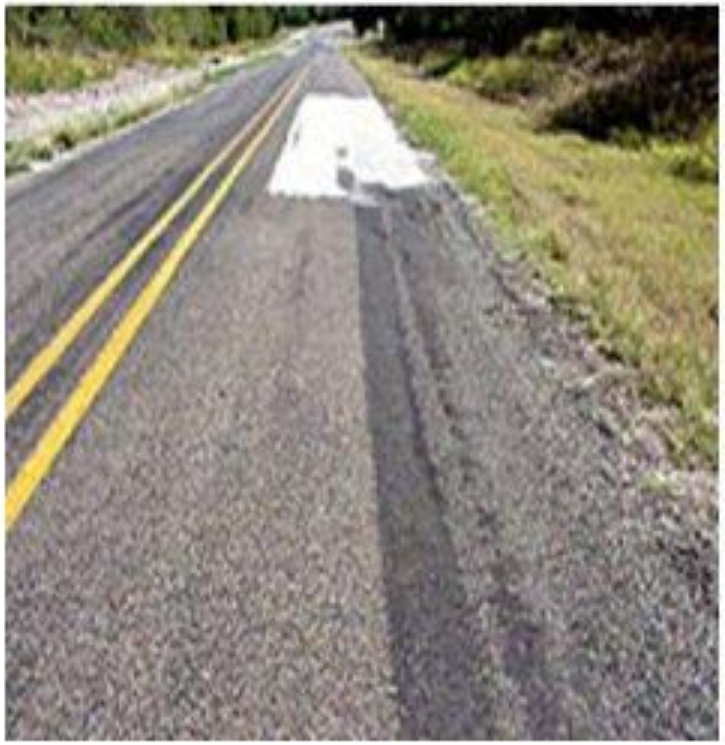
Structural Guidelines

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

What is a good strategy for surface raveling?

HIR



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

CIR Process

SR447, Nevada

What is a good strategy for alligator cracking?

FDR Process

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

Outline

- Why recycle?
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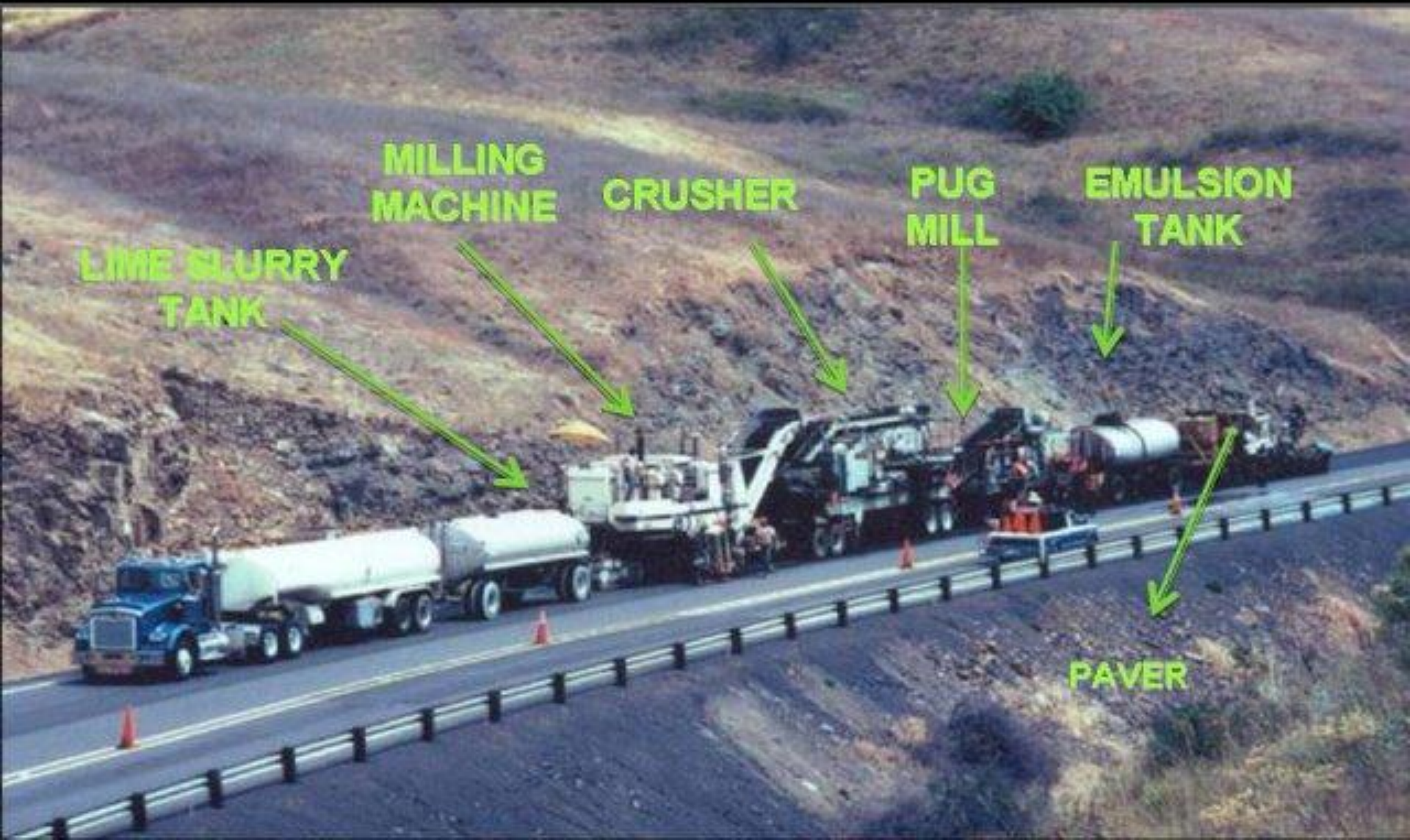
How to Construct a Successful Project

Construct a Successful Project

- Input from contractors and material suppliers
- Contact ARRA and AEMA for list of local suppliers and contractors
- Use performance-based specifications
- Develop checklist for inspectors
- Pre- and post-construction meetings are a must!
- Require contractor to perform mix design
- Successful projects are based on win-win strategy

CIR Train

US095A



CIR Train


MILLING MACHINE
CRUSHER
PUG MILL
EMULSION TANK
Use the paver to place the millings
Location: Southern CA
Subcontractor: Pavement Recycling

SR-892
Well-Coated Material

2005

Example of CIR Project in Nevada

I-80 at Pequop

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

I-80 Pequop

Winter 2008

FDR with Cement

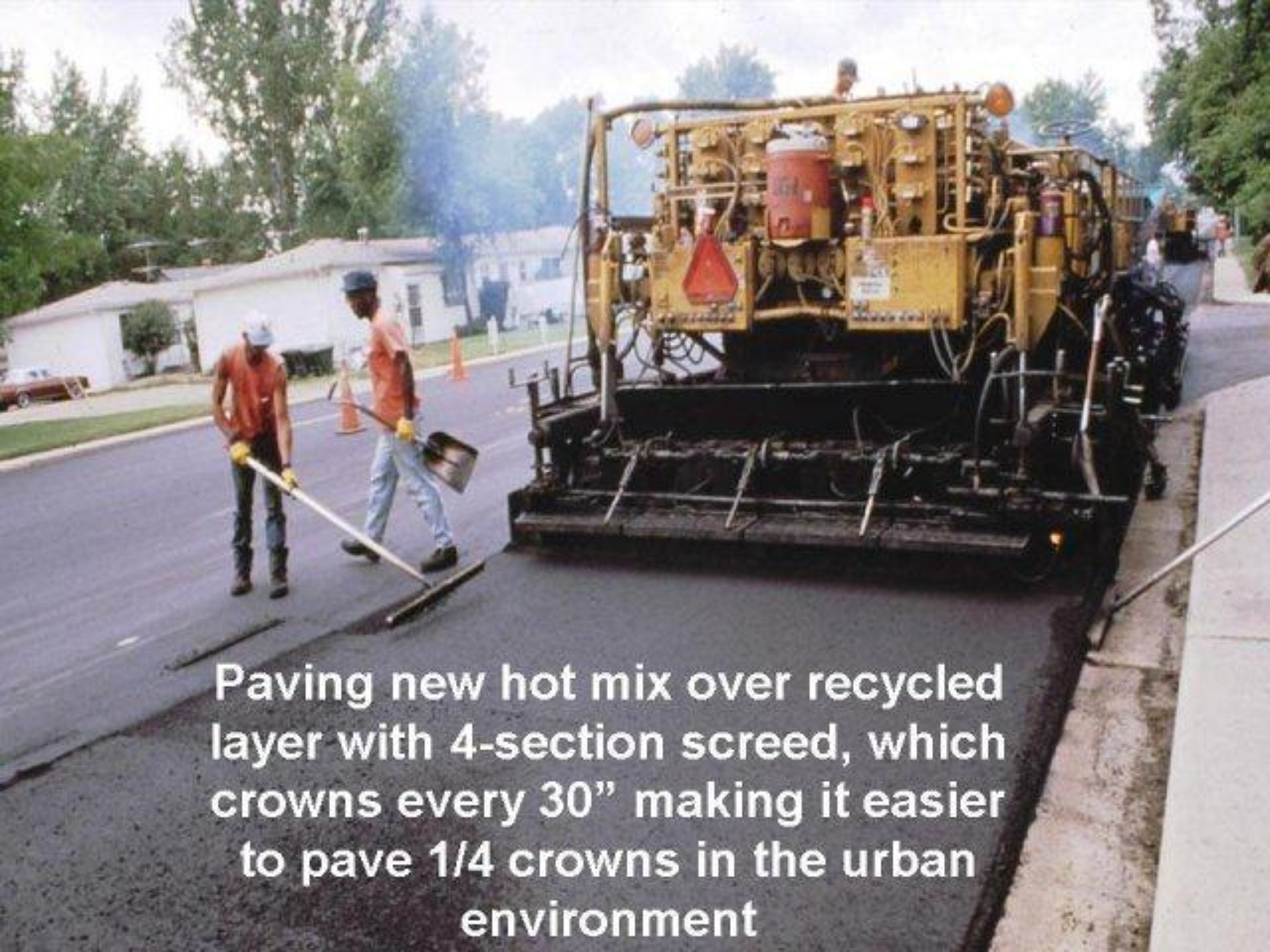
Reno, NV

California Nevada
Cement Association

After FDR with Cement

2005 CAPA Award Recipient

HIR on SH 6 Grand Junction, CO



Paving new hot mix over recycled layer with 4-section screed, which crowns every 30” making it easier to pave 1/4 crowns in the urban environment

I-Drive Orlando, FL
Compacting the recycled and new HMA together to form a 2” combined surface: 1” of recycled and 1” of new HMA


HIR
I-Drive Orlando, FL
Final Product

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Recycled Asphalt Pavement

- Milled and stockpiled existing parking lot
- Use a breaker to crush the large pieces of asphalt
- Mix RAP with 3% engineered emulsion in a pug mill
- Paved back the parking lot with 100% RAP
- 2-day cure time, re-roll, tack and pave with 0.10' hot asphalt overlay

Project Length:
600,000 sq ft of existing parking lot processed and paved on-site

Location: Modesto, CA

Contractor: Pavement Recycling

Recycled Asphalt Pavement

Location: Modesto, CA
Contractor: Pavement Recycling
October 2008

RAP as Chip Seal

Location: LA County, CA
Contractor: Pavement Recycling
Fall 2008

Chip Seal Placement

Pavement Section:
Scrub seal
5/16" RAP chip seal
No fog seal

Location: Modesto, CA
Contractor: Pavement Recycling
October 2008

Final product with RAP Chip Seal

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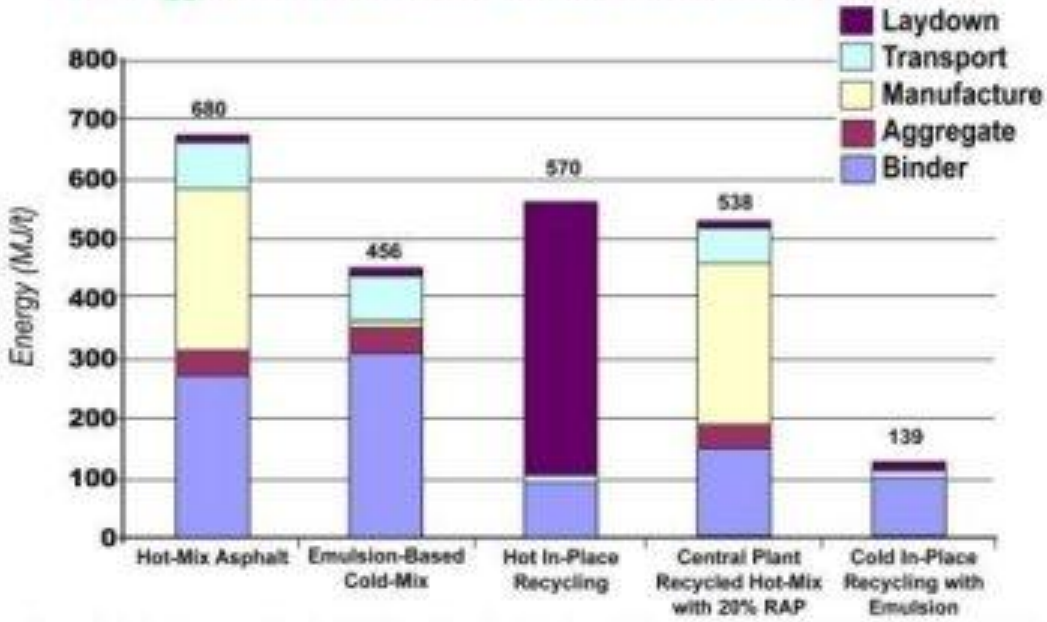
Conclusions

HIR, CIR and FDR Meet the 3E Challenge

Sustainability

Energy Use Per Tonne Of Material Laid Down



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Ontario

Ministry of Transportation
Ministère des Transports

20-Yr CIR Performance

$600M Cost-Saving with CIR and FDR

Websites with More Information

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

2009 Recycling Facts

NDDOT 14 lane miles

WY (National Park Service) 14 lane miles

WADOT 28 lane miles

ODOT 24 lane miles

Idaho (FHWA) 30 lane miles

MDOT 32 lane miles

Nevada recycled over 170 lane miles

Caltrans recycled over 270 lane miles

HOW MANY MILES DID YOUR AGENCY RECYCLE THIS YEAR?

Let's Create a Sustainable Future!

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