

Cost-effectiveness and Performance of Recycling

Webinar In-Place Recycling Workshop
Earth Day
April 22, 2010

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Outline

➤ Why recycle?

- Sustainable
- Cost-effective
- Long-lasting performance

➤ How do you select a project?

➤ How do you construct a successful project?

➤ Conclusions and Recommendations



The Myth!

~~Sustainable means increased costs
or low quality~~



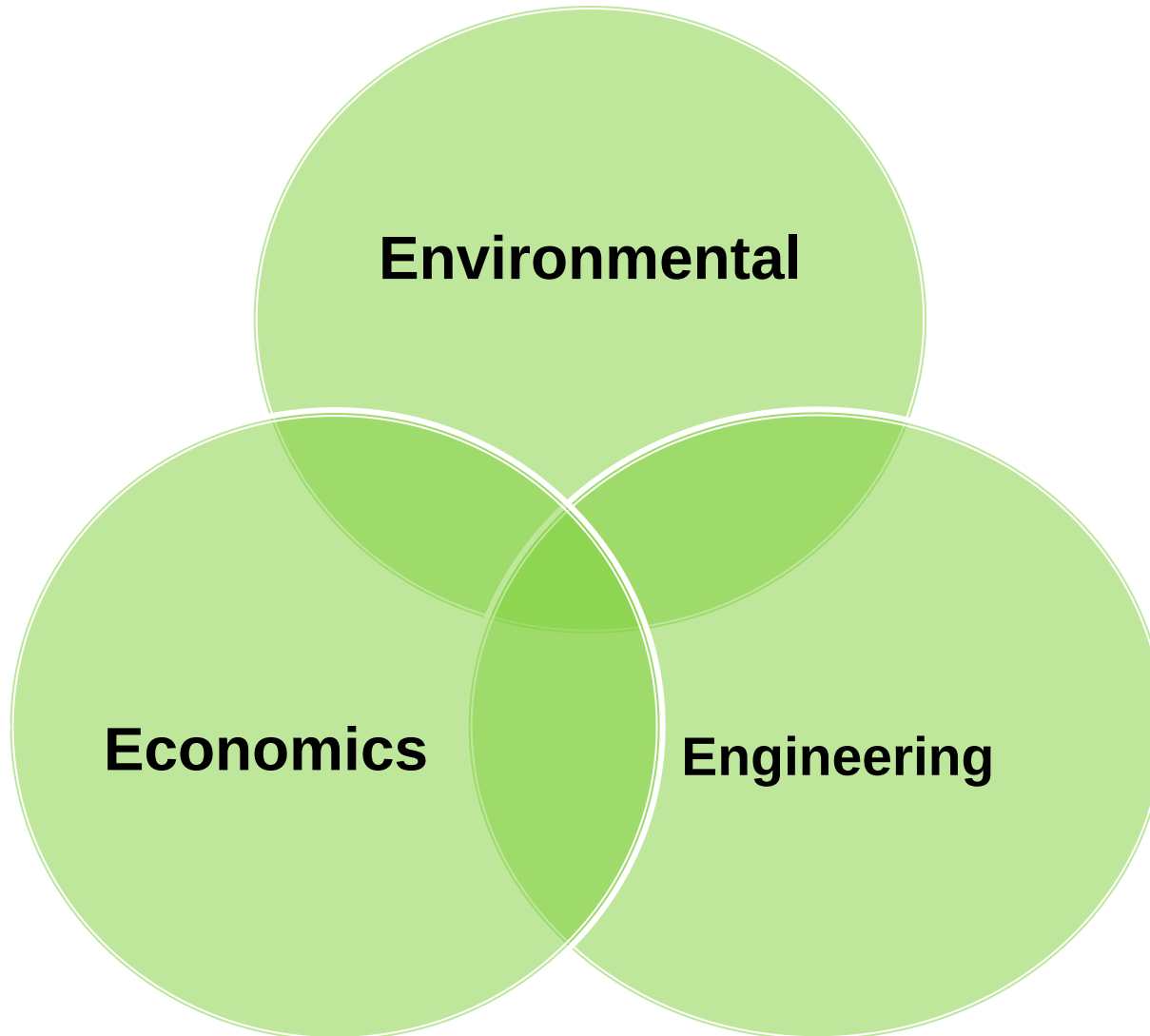
In-Place Recycling Facts

- Up to 40 % reduction in the rehabilitation cost
- Lasts longer than conventional strategies
- Uses 100% in-place materials requiring minimal energy



Why Recycle?

Meet the 3E Challenge



Sustainable



Time, Oct. 1, 2007

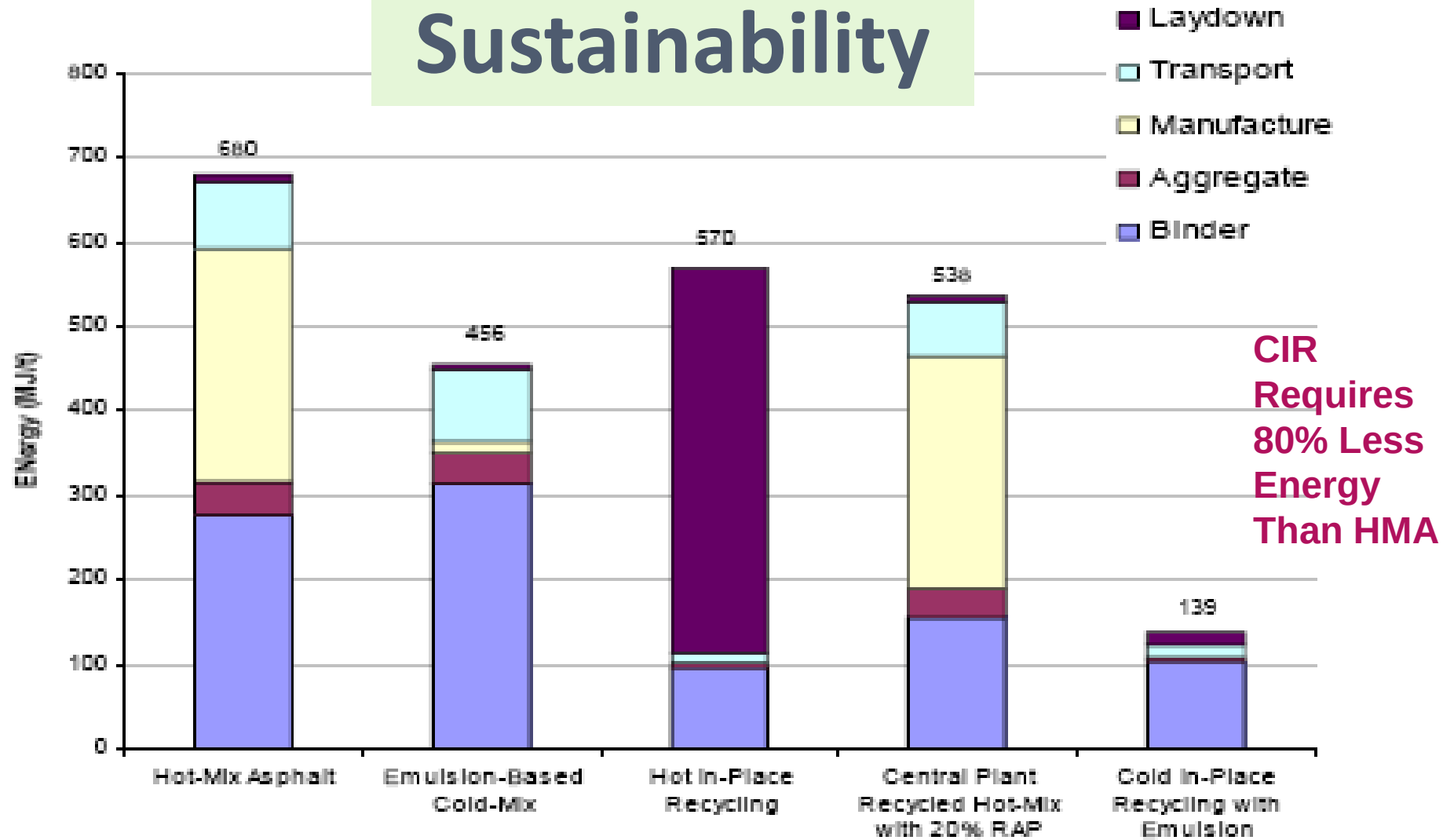


Newsweek, April 16, 2007



Energy Use Per Tonne Of Material Laid Down

Sustainability



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

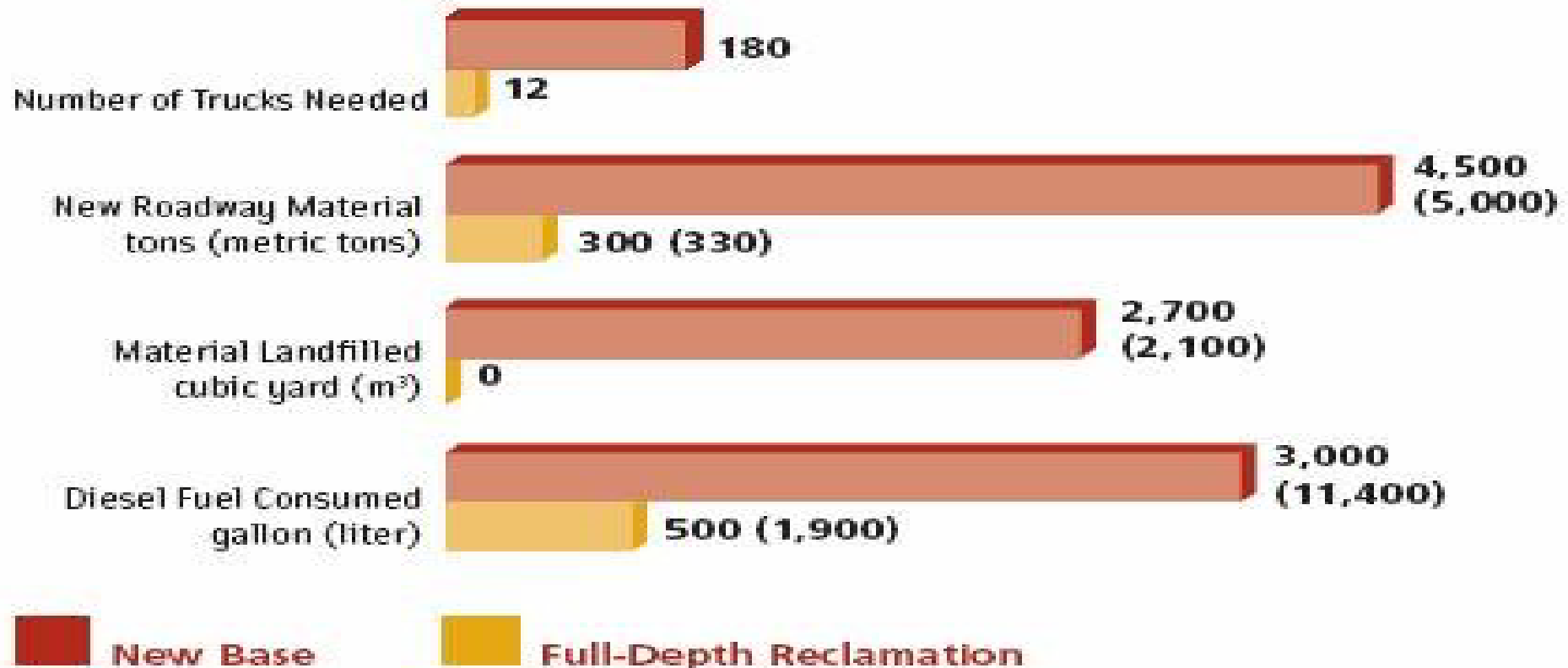
Cost-effective

Full-Depth Reclamation (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

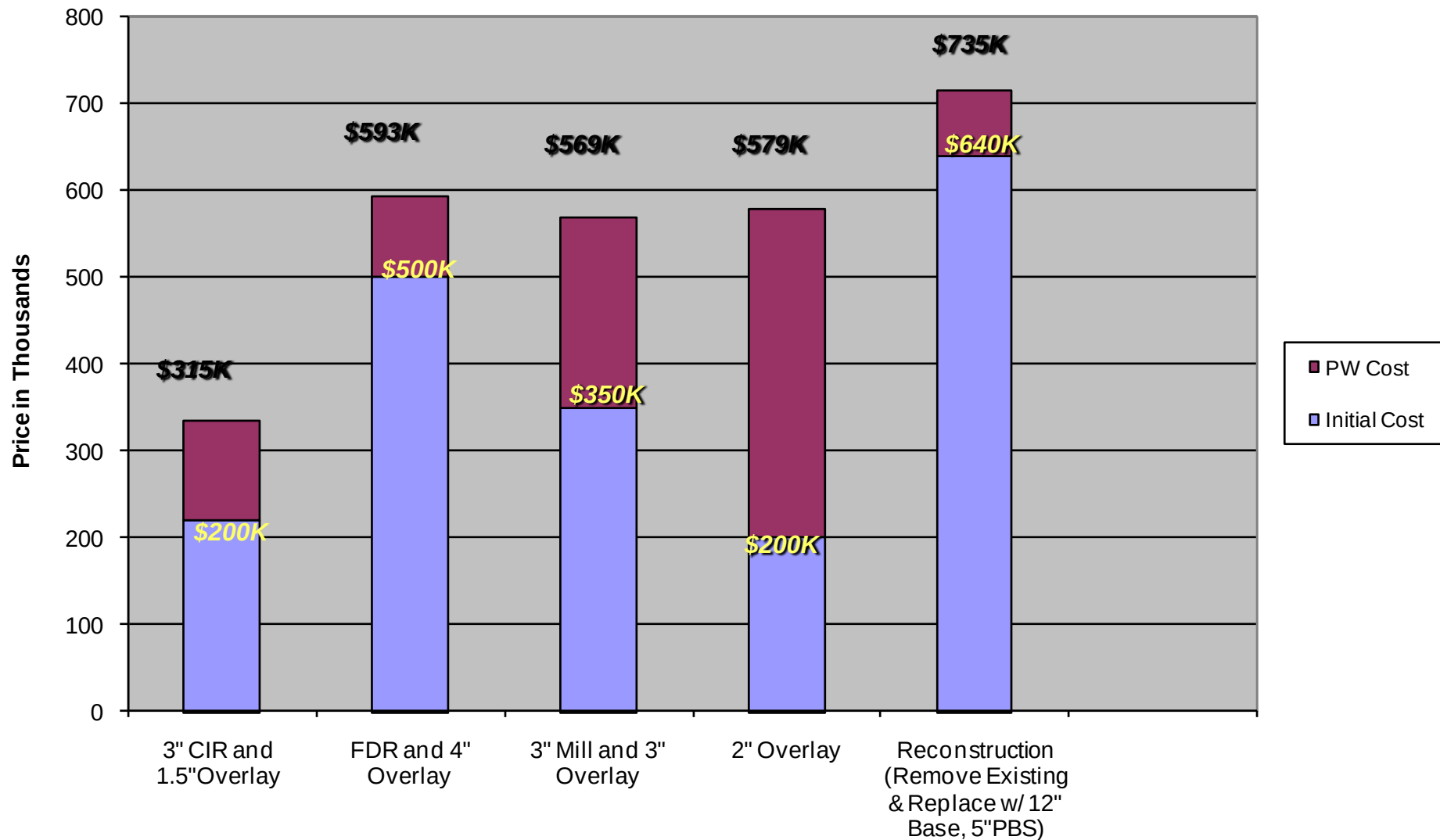
Cost-Effectiveness

	3” CIR & 1.5” HMA	3” Mill & 3” HMA
SN	3(0.3-0.21) + (1.5” x0.42) =0.90	3 x (0.42-0.21) =0.63
Cost	CIR: 50,688 S.Y.@ \$2.30 = \$116,582 Recycling Binder: 196 tons @ \$535 = \$104,860	Rotomill: 50,688 S.Y. @ \$1.50 = \$76,032 HMA: 8,781 tons @ \$95.00 = \$834,195
	1.25 inch HMA Overlay 3,659 tons @ \$95.00 = \$347,605	
	TOTAL: \$570K	TOTAL: \$910K
	CIR & HMA provides 37% less cost Save \$341,180 43% increase in SN Unit Prices form Caltrans	

Life-cycle Cost Analysis-Present Worth for Pavement Rehabilitation

State-of-the-Practice on CIR and FDR Projects

NDOT, Nov. 21, 2005



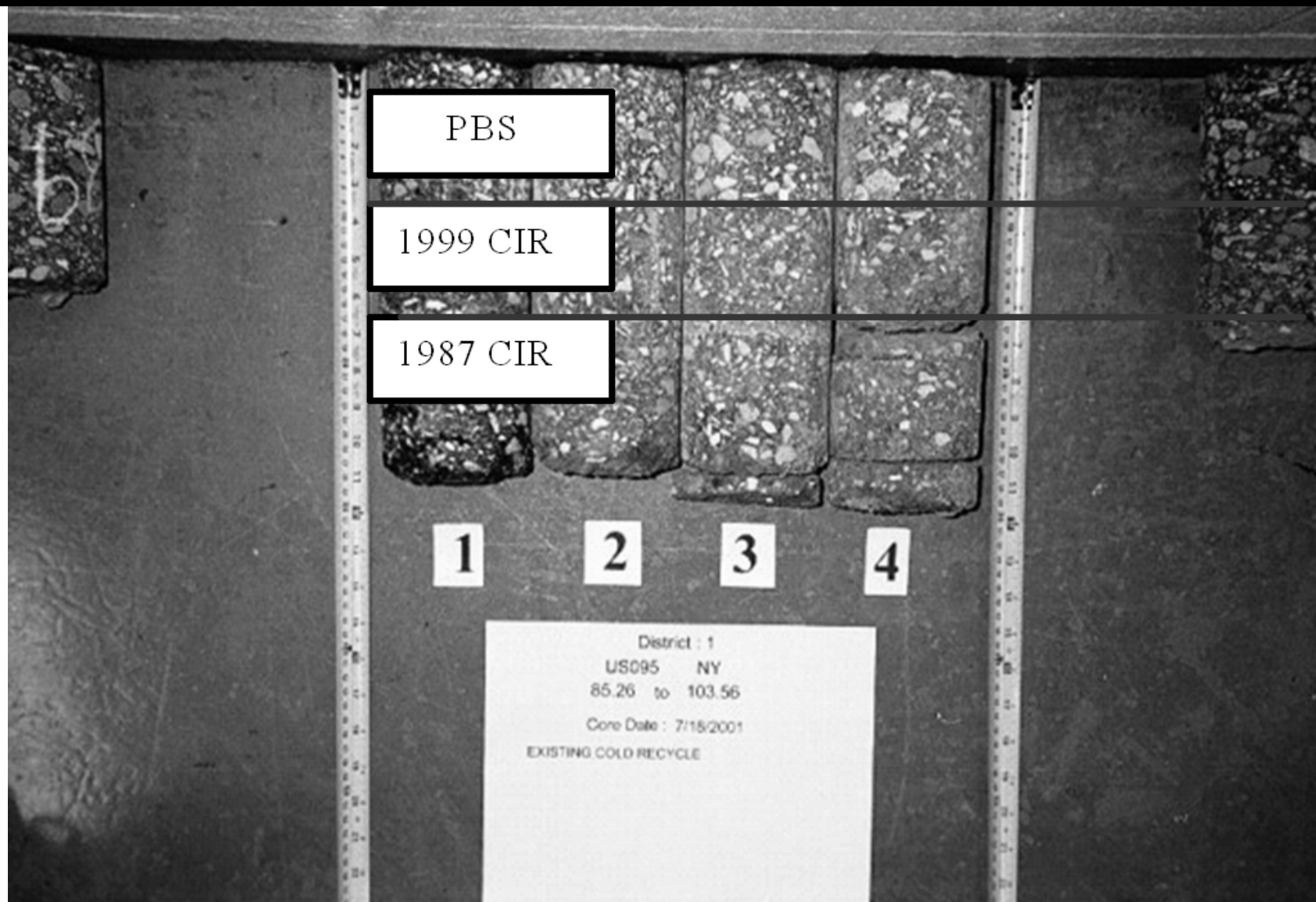
Long-lasting Performance

Cold In-Place Recycling (CIR) and 2" Overlay Section, 6 years, Reno, NV



Long-lasting Performance

20 years, US-95 NV



First California CIR Project

20 Years +



U.S. Department of Transportation
Federal Highway Administration
Federal Lands Highway Division

First California CIR Project



U.S. Department of Transportation
Federal Highway Administration
Federal Lands Highway Division

Grand Canyon Center Rd Project

California , 15 Years +



U.S. Department of Transportation
Federal Highway Administration
Federal Lands Highway Division

Mendocino Pass

California, 12 Years +



U.S. Department of Transportation
Federal Highway Administration
Federal Lands Highway Division

26/05/2008

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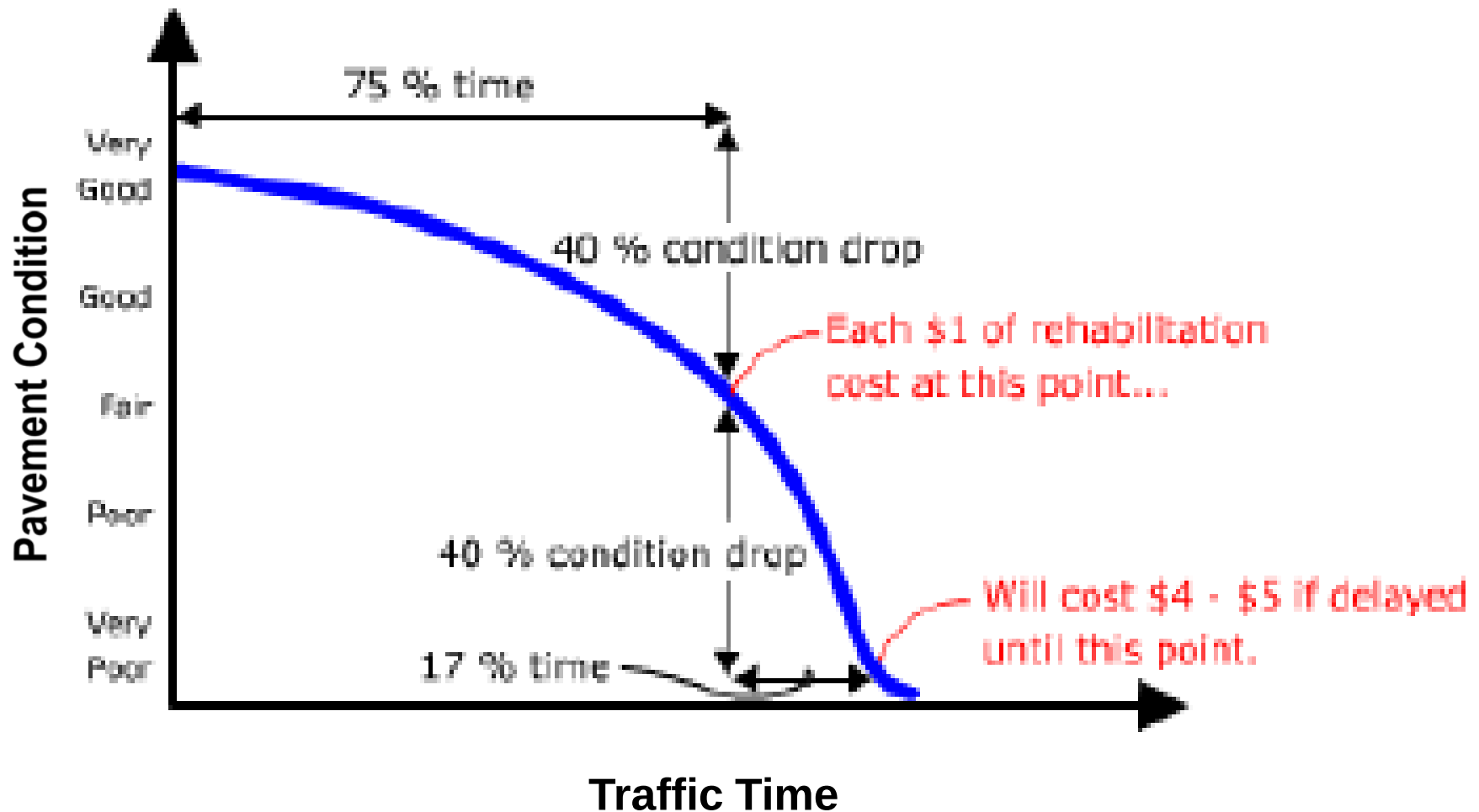
Project Selection

- Investigate existing pavement condition
- Environmental condition
- Future projected loading
- Contractors availability

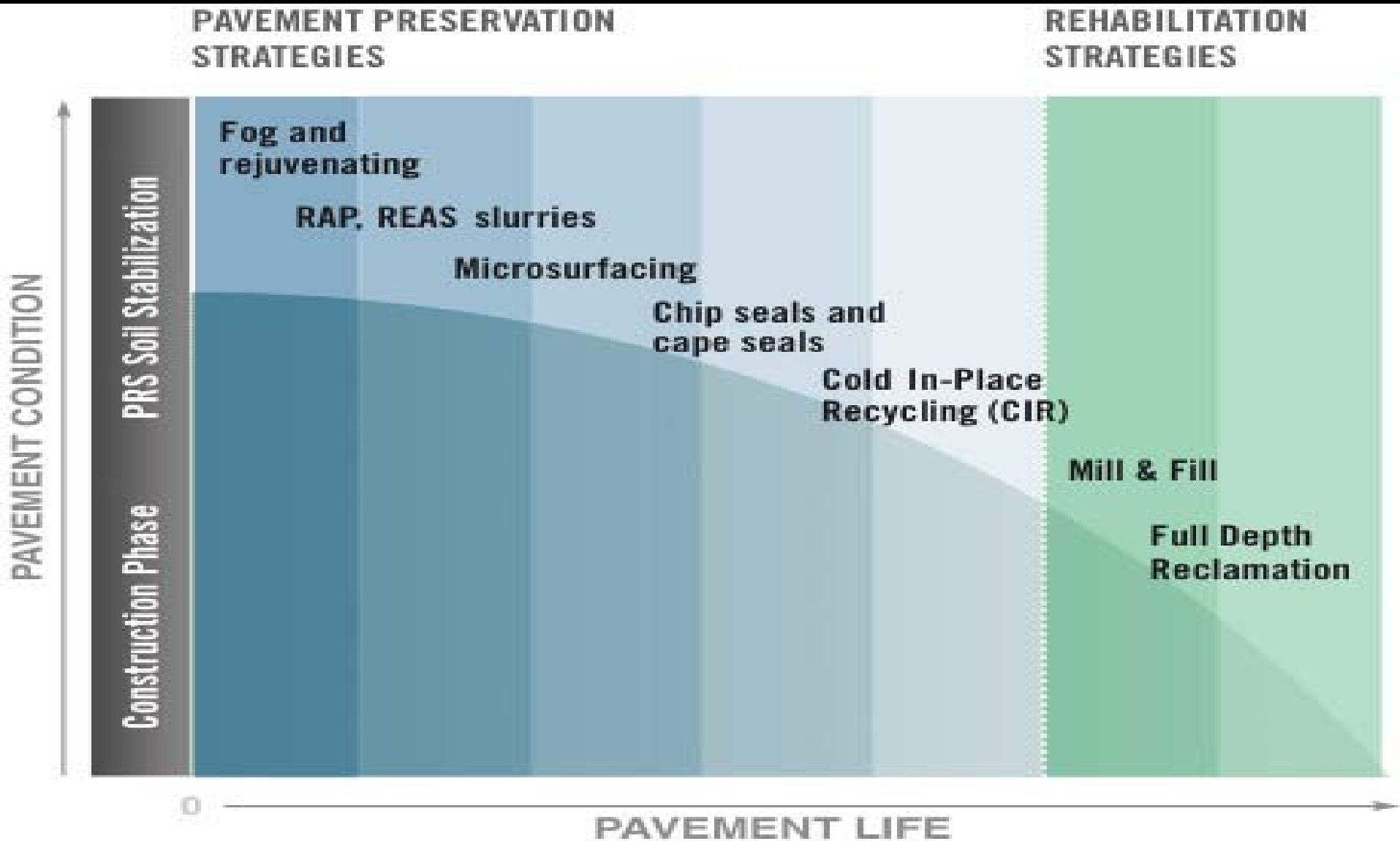


Pavement Performance

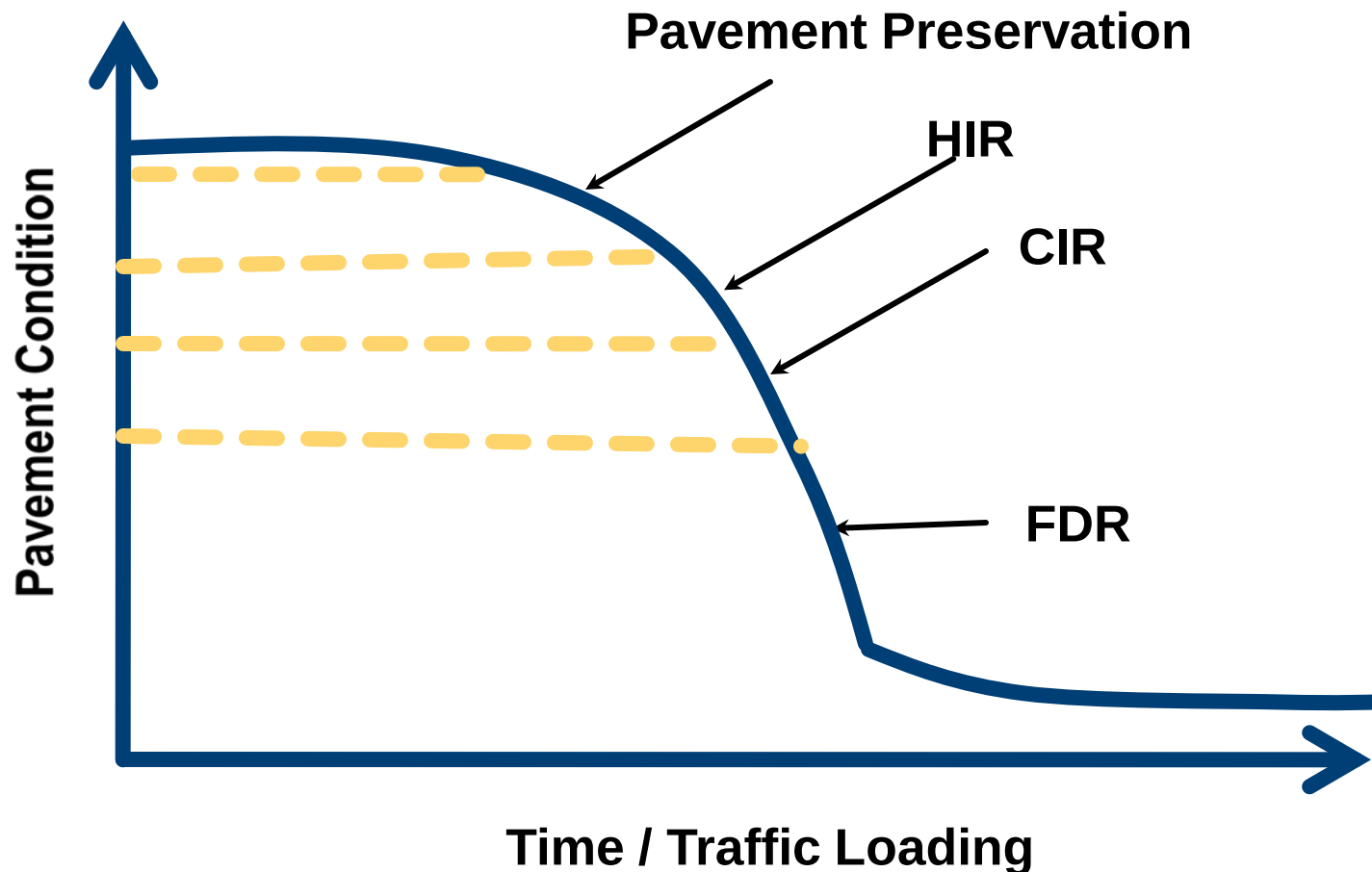
No Preservation or Rehabilitation



Pavement Preservation



Timing of Rehabilitation Techniques



Hot In-Place Recycling (HIR)

Candidate and Process



www.betterroads.com

KDOT recycles up to 3 million sq. yd. annually

Medium and Wide Transfers Cracking

Good CIR Candidate



CIR Process

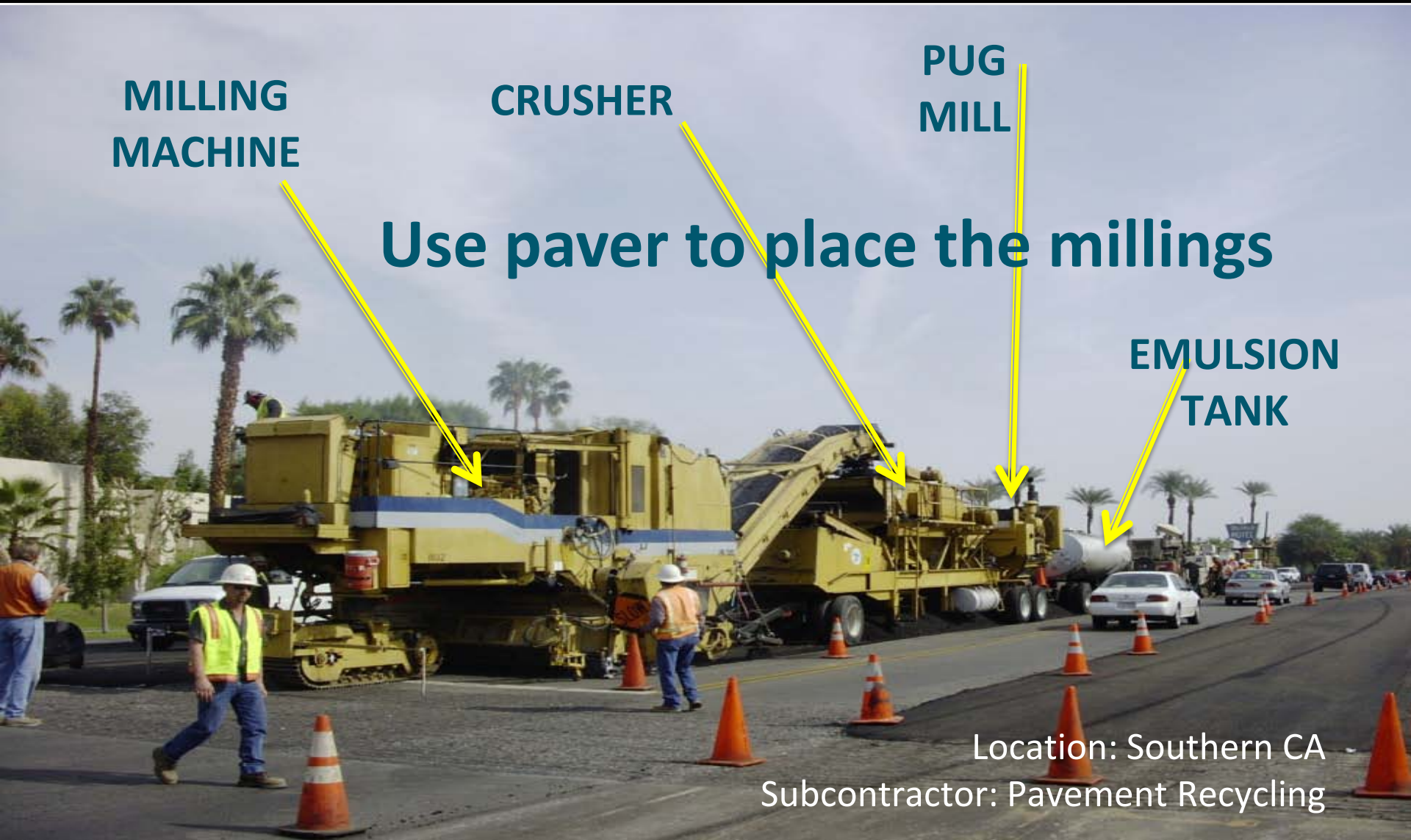
MILLING
MACHINE

CRUSHER

PUG
MILL

Use paver to place the millings

EMULSION
TANK



Location: Southern CA
Subcontractor: Pavement Recycling

FDR

Candidate and Process



FDR with Cement



Before



After

Outline

- Why recycle?
- How do you select a project?
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How to Construct a Successful Project

- Input from contractors & 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

Construction of a Successful Project



CIR Train

SR447, Nevada



CIR Project

I-80 Pequop, NV



2008 Award: Roads & Bridges Magazine
Year: 2007-2008
Cost: \$33.7 Million
Length: 20 miles

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

HIR Project

Final Product I-Drive Orlando, FL



Mix Design Process



**Gyratory
Compactor**



Marshall Stability



Raveling Test



RAP Preparation

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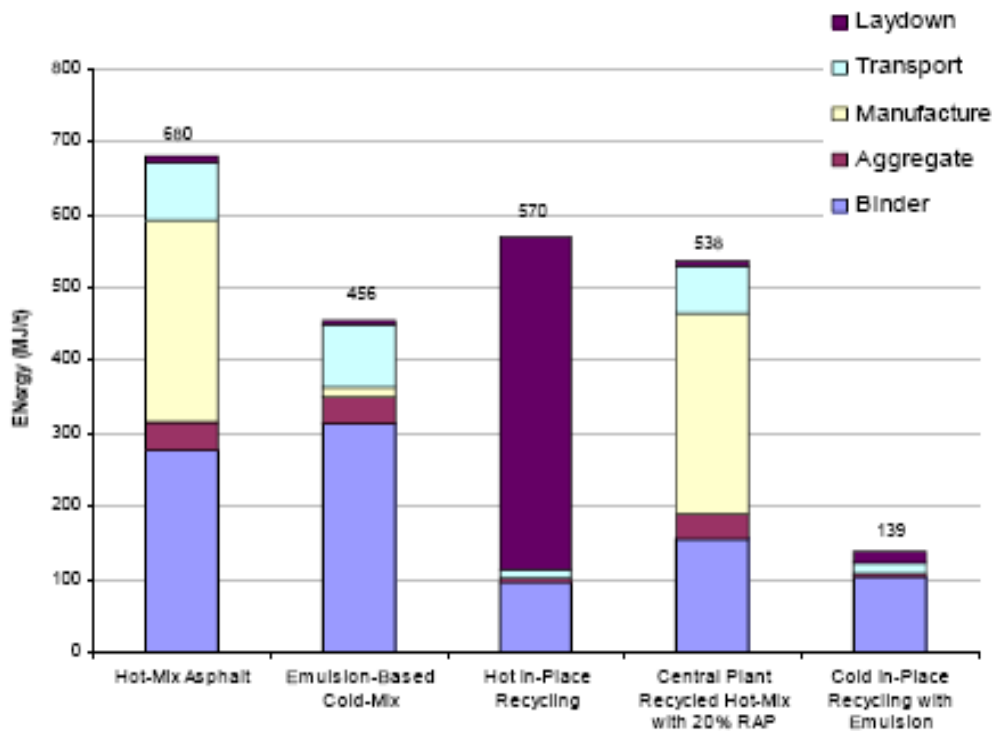


Conclusions

Recycling Meet the 3E Challenge

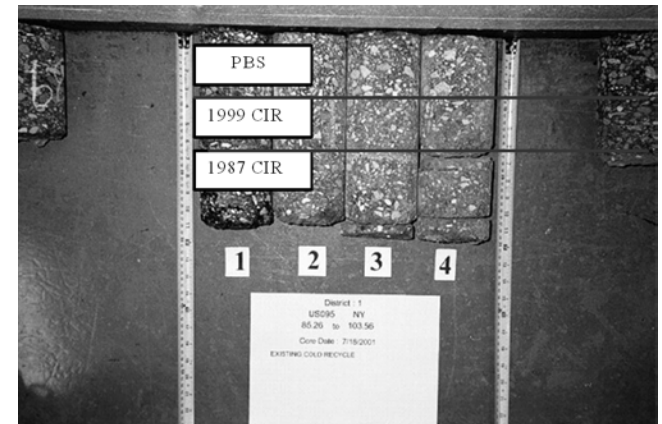
Sustainability

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20-Yr Performance

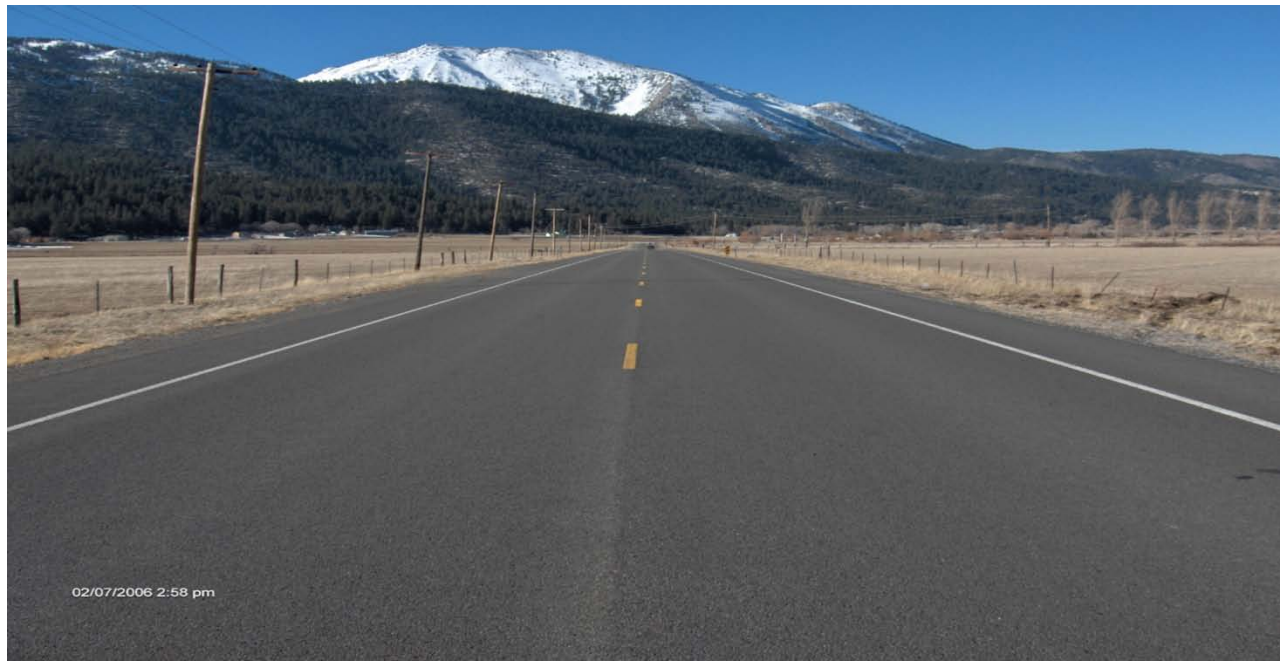


\$600M Cost-Saving



Recommendations

- Agencies should add all types of in-place recycling to their tool box
- Start slowly, get contractors involved early
- Continue improving the process



Websites with More Information

- www.fhwa.dot.gov
- www.fp2.org
- www.arra.org
- www.pavementpreservation.org
- www.dot.ca.gov
- www.transportation.org
- www.pavementrecycling.com
- www.greenroads.us

Let's Create a Sustainable Future!

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