How to Optimize Your Strategy with In-Place Recycling

First Western States Regional
In-Place Recycling Conference
June 3, 2008

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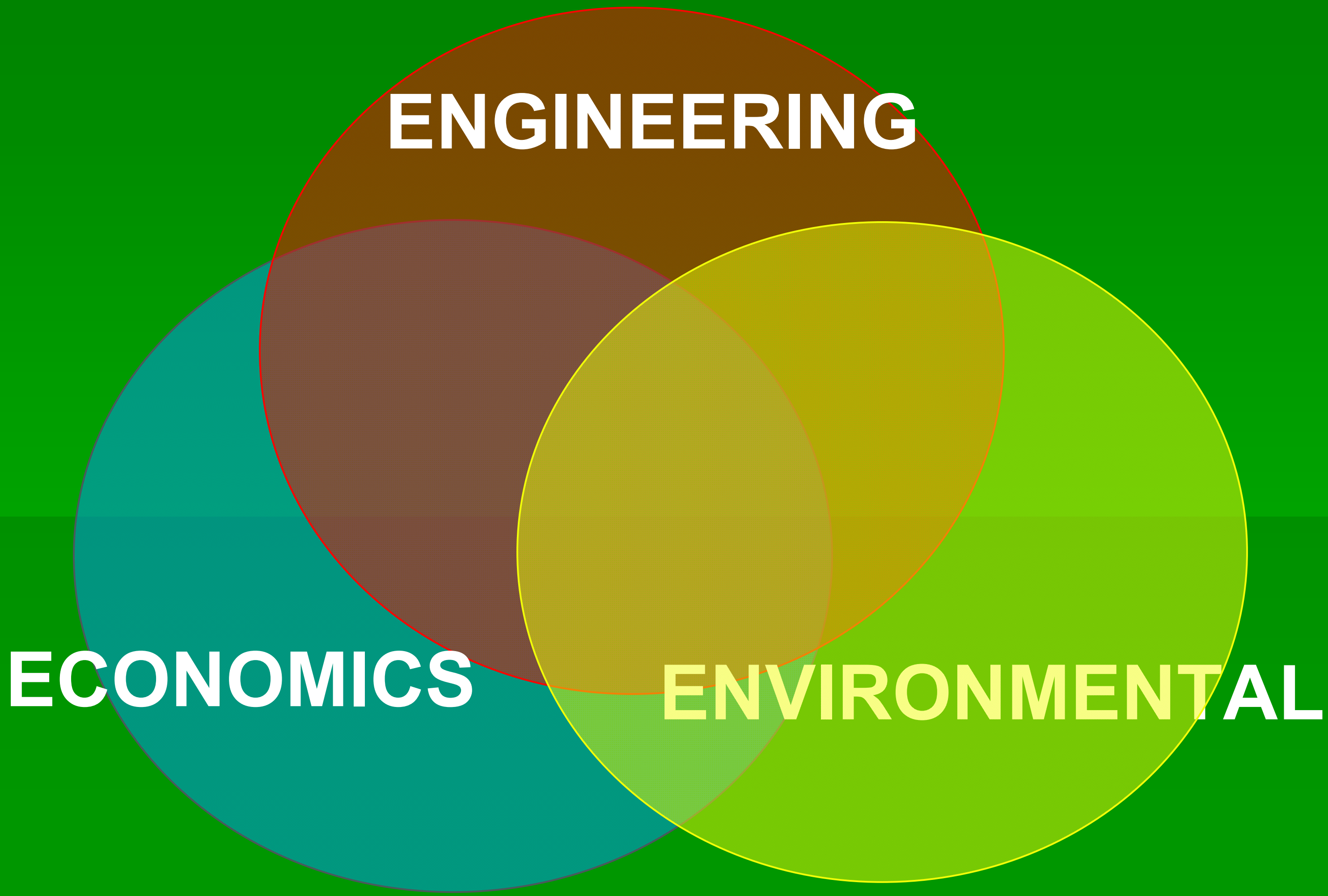
In-Place Recycling Meets the 3E Challenge



In-Place Recycling Facts

- Reduces rehab cost 30 - 70%
- Lasts as long or longer than conventional strategies
- Utilizes 100% in-place materials requiring minimal energy

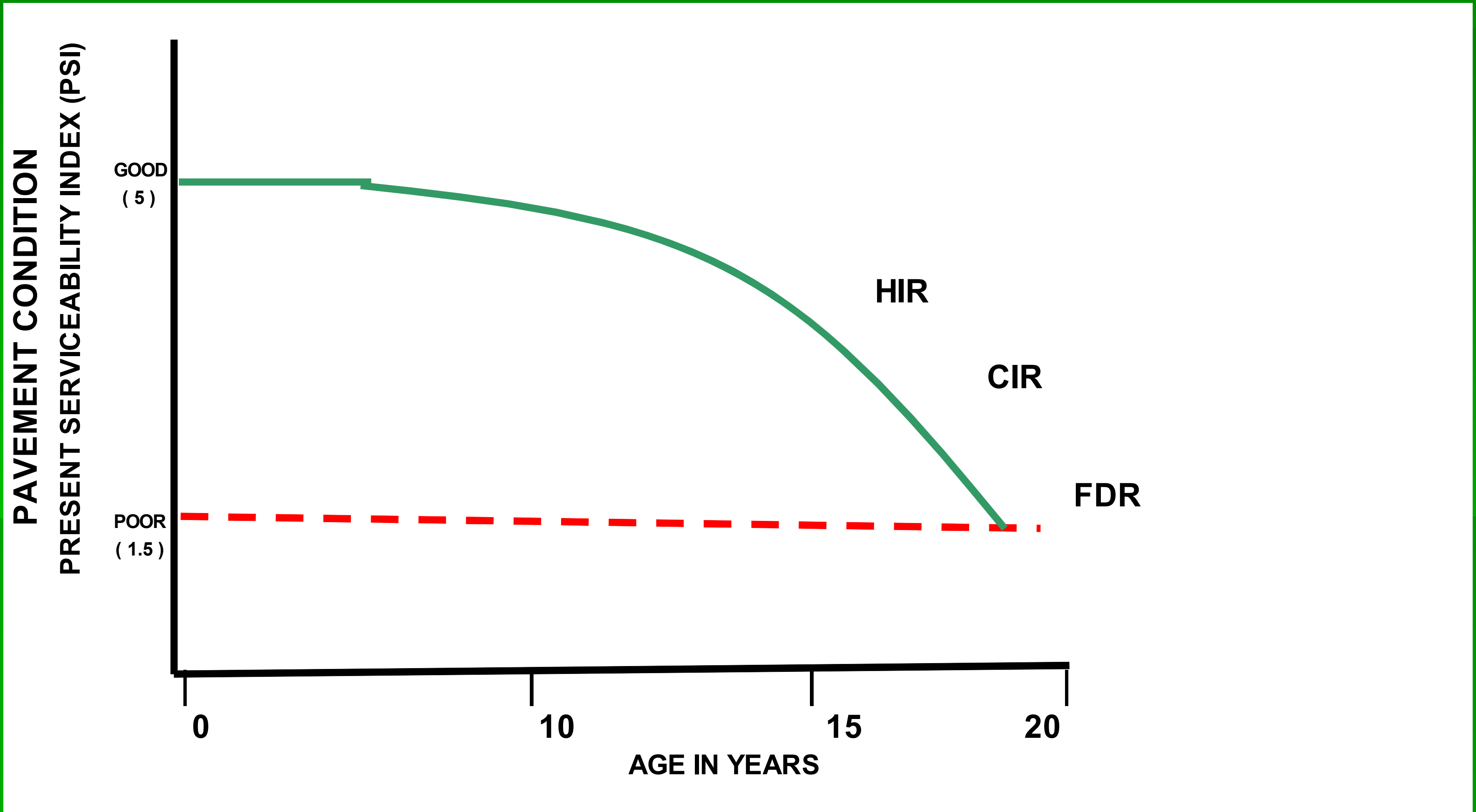
Outline

- Life-Cycle Cost Analysis for Different Types of In-Place Recycling:
  - Hot In-Place (HIR)
  - Cold In-Place (CIR)
  - Full-Depth Reclamation (FDR)
- Case Study Nevada DOT

How to Optimize Your Strategy?

- the right project
- the right strategy
- the right time

Optimum Strategies
for In-Place Recycling



Life-Cycle Cost Analysis

- Initial cost
- Analysis Period (20-35 years)
- Discount rate (4%)
- Determine future rehabilitation over the analysis period
- Convert all costs to present worth

Unit Prices

for Different Strategies

- 2" HMA = $9/sq. yd.
- 2" Mill = $2/sq. yd.
- 2" HIR = $6/sq. yd.
- 3" CIR = $4.50/sq. yd.
- 6" FDR = $13/sq. yd.
- Granular base = $35/ cubic yd.
- Pavement removal = $5/cu. yd.

Structural Number

(SN) for Different Layers

AASHTO Recommended Coefficient	Coefficient used for LCCA
HMA= 0.35-0.44	HMA = 0.44
HIR = 0.35-0.4	HIR = 0.4
CIR = 0.28-0.35	CIR = 0.28
FDR = 0.18-0.28	FDR = 0.28
Base= - 0.1-0.14	Base = 0.1

In-Place Recycling

The Right Strategy

- Hot In-Place (HIR)
- Cold In-Place (CIR)
- Full-Depth Reclamation (FDR)

Pavement Candidates

for HIR

Surface Distress <2”

HIR Train

Train consists of heaters, heater-millers, a mixing machine, and pavers for HIR or a milling machine, crusher, and paver

Taken from USDOT, FHWA, Public Roads Magazine, *Recycled Roadways* , Jason Harrington, Jan /Feb 2005, Vol. 68., No. 4

HIR Addresses Surface Improvements

- Typical depth: ¾” to 2”
- Surface distress: raveling, rutting, bleeding, surface cracking
  - Surface Recycling
  - Remixing
  - Repaving

LCCA for Conventional vs. HIR Strategy

0

2” Mill & Fill
SN = 0.44

12

2”Mill

& Fill

20

Salvage
Value =
$ 4/12 of last
strategy

0

2” HIR
SN = 0.40

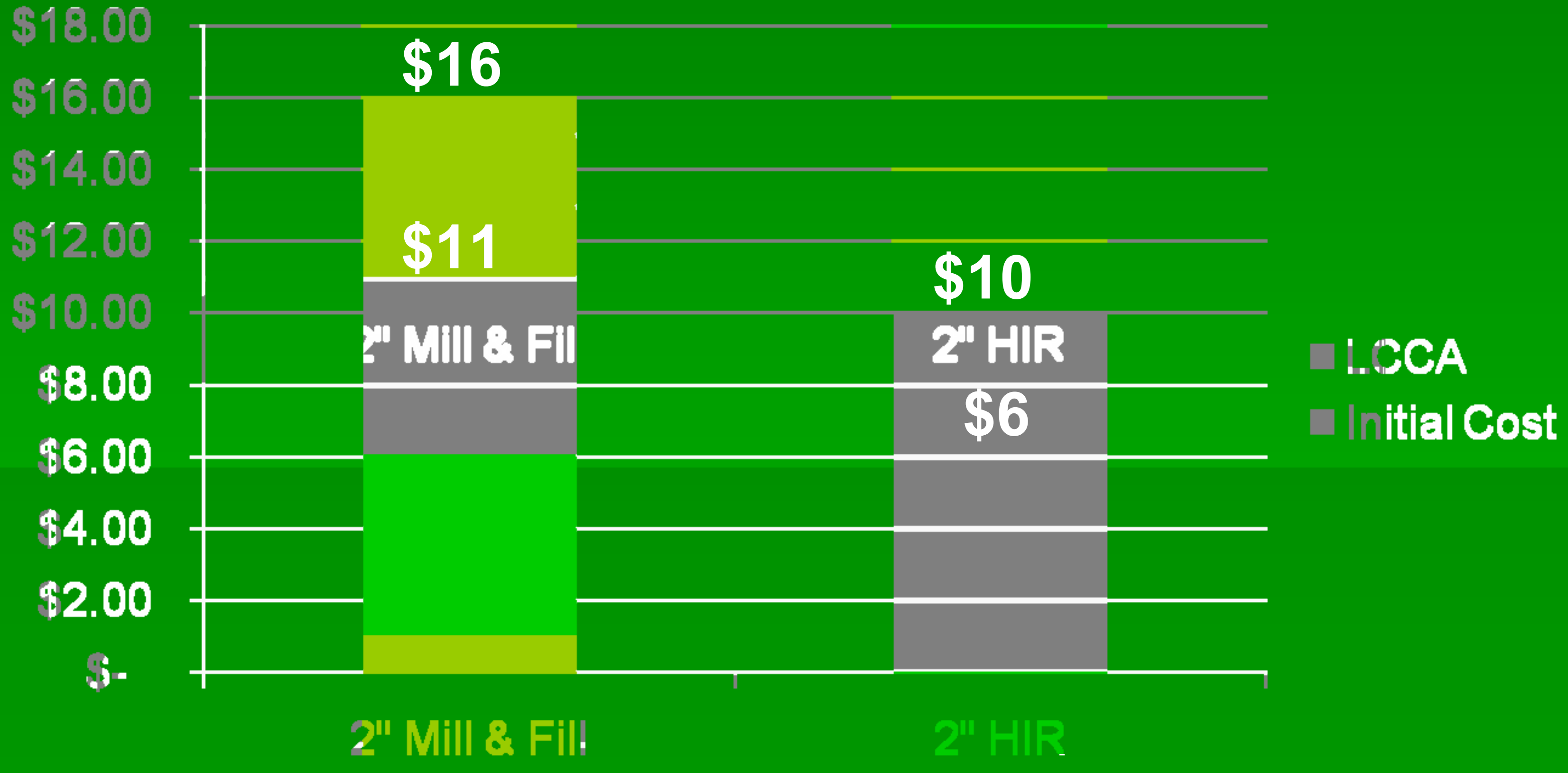
10

2” HIR

20

Salvage
Value = $ 0

≈ 40% Less Cost with HIR



In-Place Recycling

The Right Strategy

Pavement Candidates

for CIR

Pavement is Structurally Sound

I-80 Pequop Project

CIR Train


LIME SLURRY TANK
MILLING MACHINE
CRUSHER
PUG MILL
EMULSION TANK
PAVER

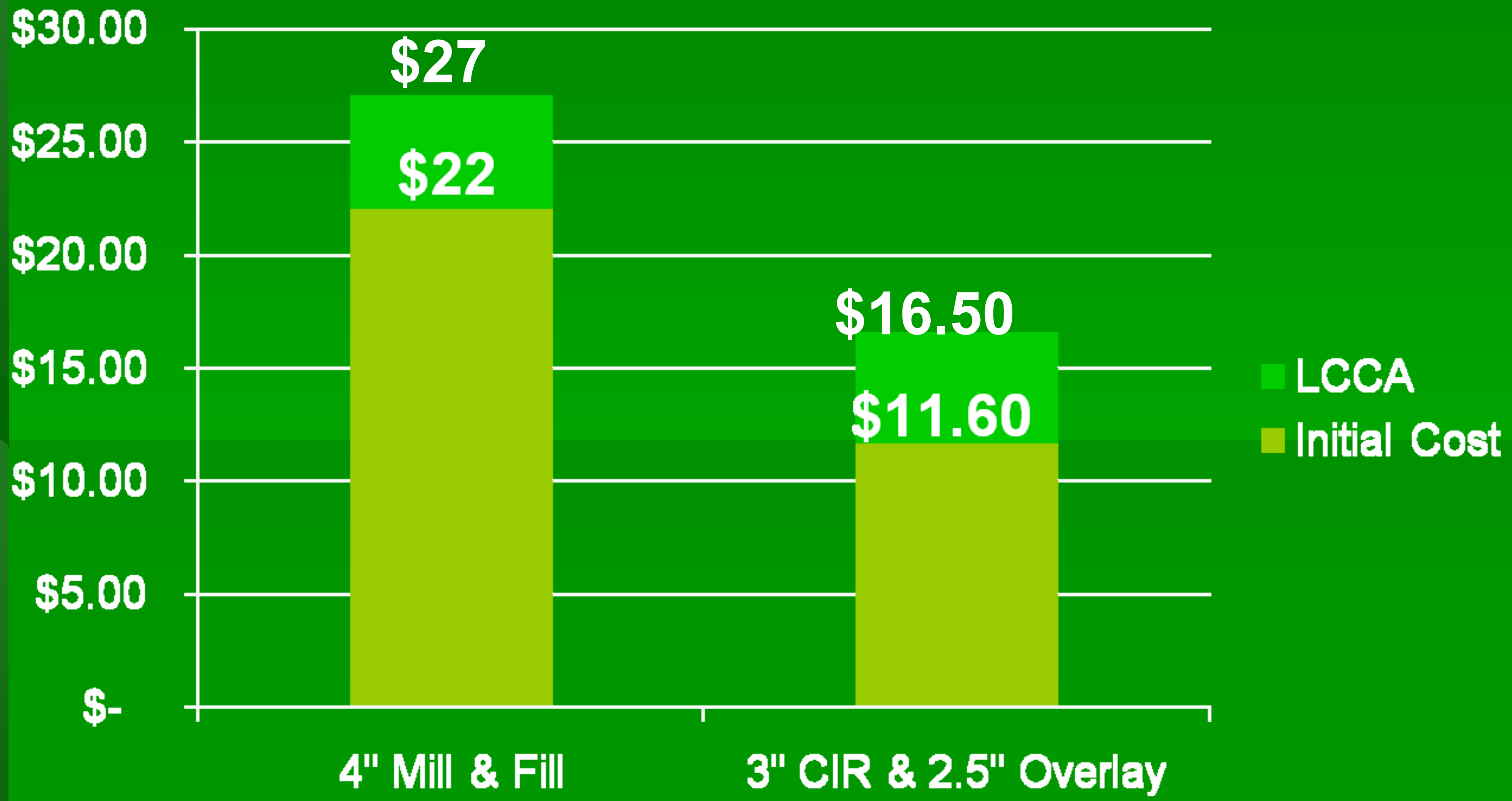
CIR Addresses All Types of Pavement Distress

Except Structural Deficiency

- Typical depth of CIR: 2” to 4”
- Reflective, wide transverse, longitudinal, block cracking

LCCA for Conventional vs. CIR Strategy

≈ 40% Less Cost with CIR



In-Place Recycling

The Right Strategy

- Hot In-Place (HIR)
- Cold In-Place (CIR)
- Full-Depth Reclamation (FDR)

Pavement Candidates

for FDR
Structural Failure

FDR Using Emulsion

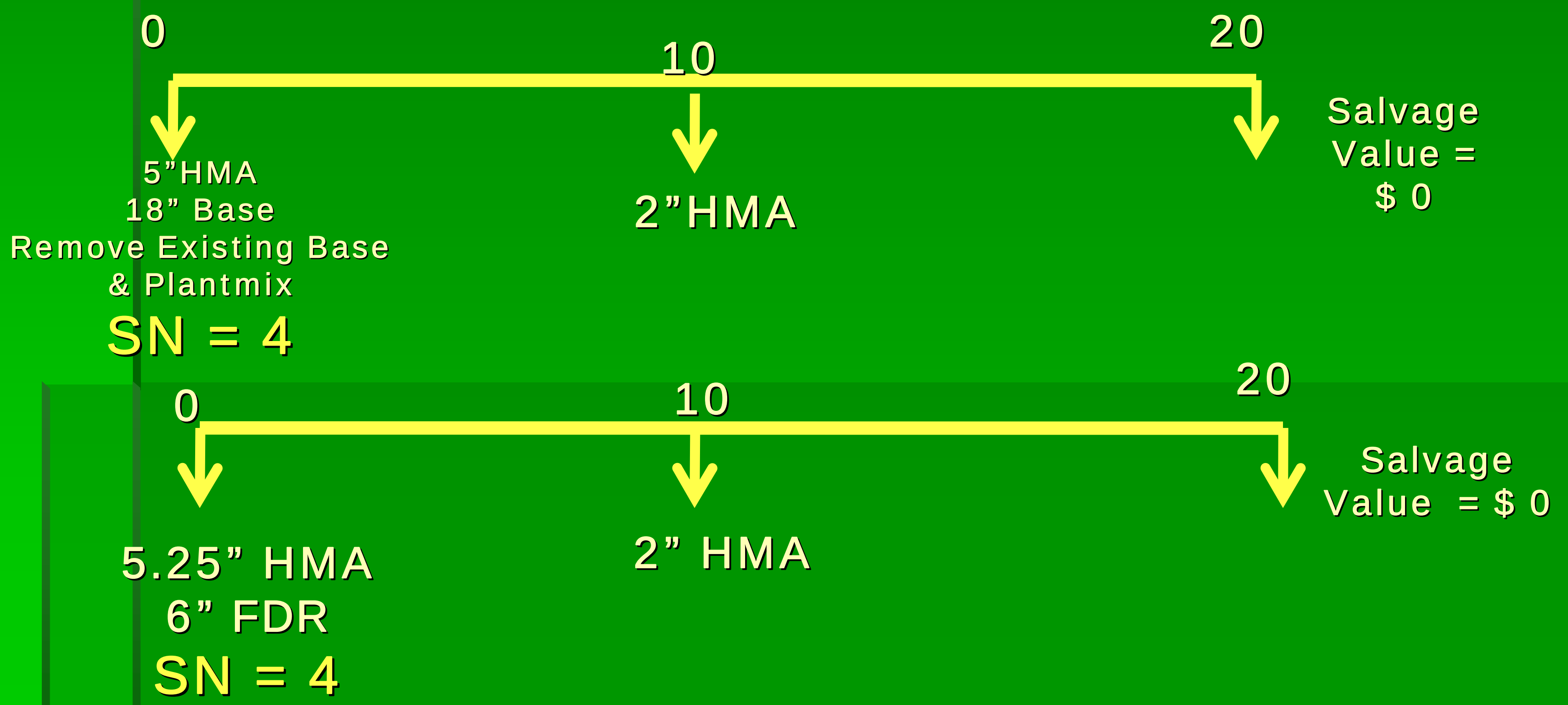
Snow Canyon Parkway
just off Bluff Street in St. George, Utah

Contractor: Western Rock
Sub-Contractor: Coughlin Construction
2008

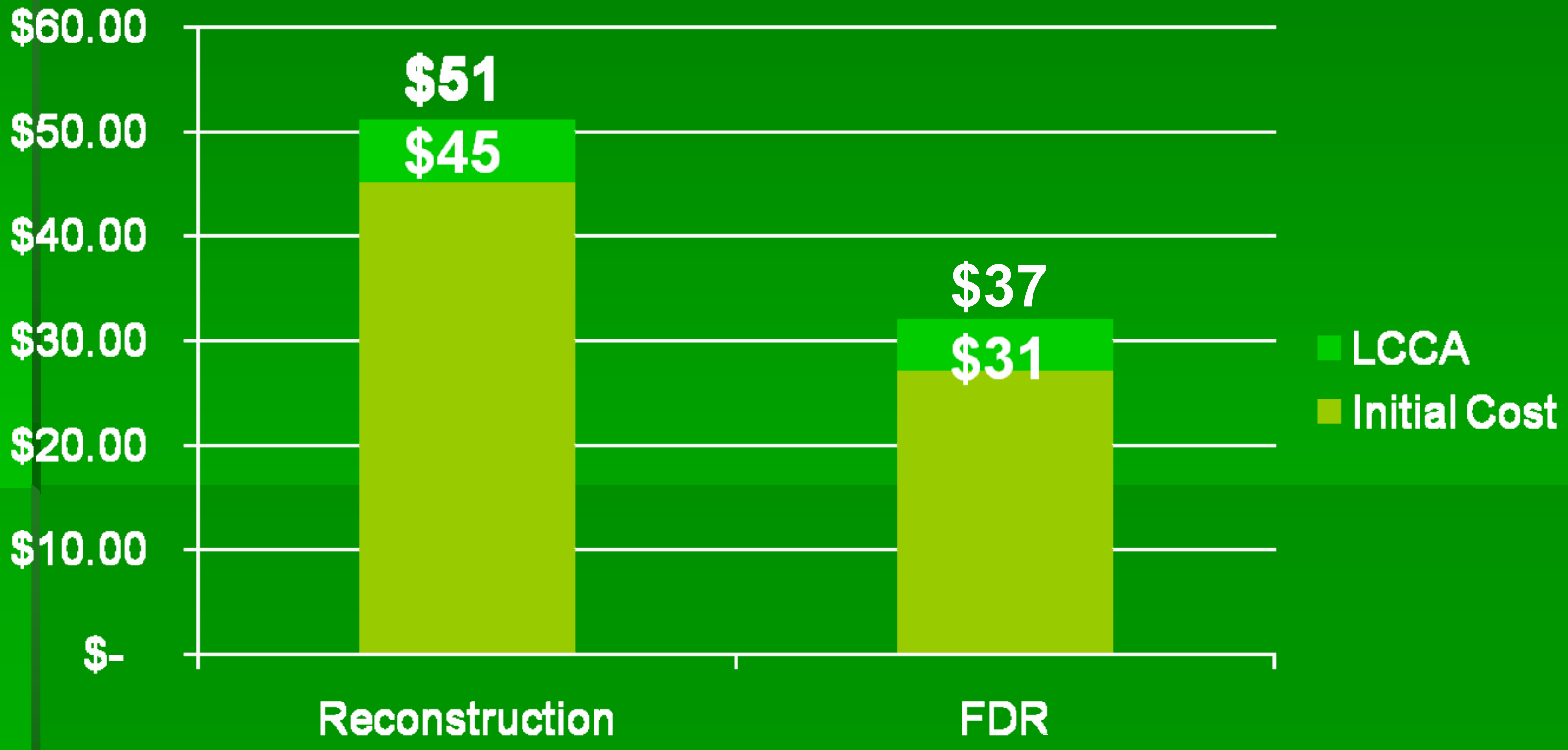
FDR Addresses Structural Deficiency

- Typical FDR depth: 6” to 12”
- Mix the asphalt pavement with base to provide uniform structural section
- Need to use the right additive
  - Cement
  - Emulsion
  - Lime & fly ash

LCCA for Conventional vs. FDR Strategy



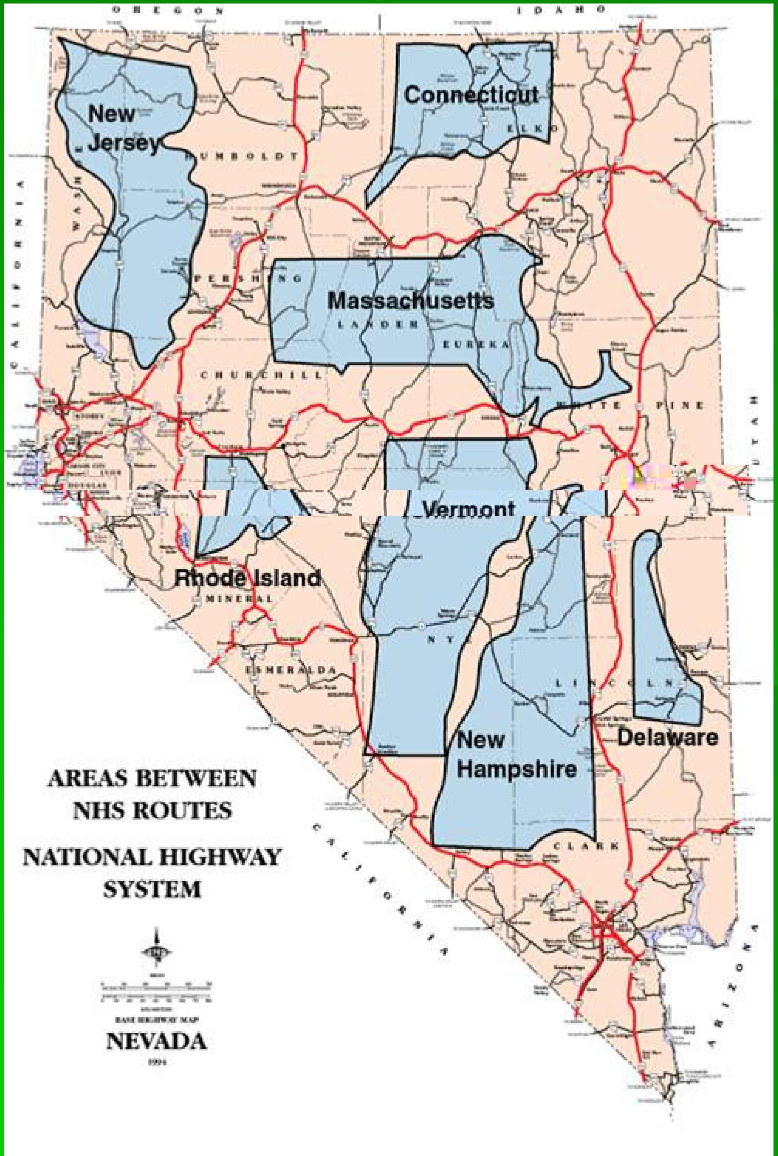
≈ 17% Less Cost with FDR



Case Study

How Nevada used a sustainable approach to reduce $600M in project cost and significantly improve its pavement condition

NDOT Facts



- Maintains 5,300 centerline miles
- Fastest growing state
- 7th largest state
- Highest % of NHS roads in smooth category (FHWA website)
- Maintained same funding for pavement preservation from 1992-2005, while price of hotmix asphalt increased 400%

Caution: Smooth Roads Ahead!

2005 IRI Data	Good < 95	Fair 95 to 170	Poor > 170
NHS	95%	5%	0%

*from FHWA HPMS website

Cold In-Place Recycling (CIR) in Nevada

- 15% of system (over 1000 centerline miles 97-2007)
- Will meet or exceed 20-yr design life with preventive maintenance
- 1.5” – 4” Hotmix asphalt placed over medium - high traffic areas
- Double chip seal placed for low volume roads < than 1000 ADT

CIR on Nevada Roads

Medium - High Volume	Low Volume
>1000 ADT or >1M ESAL	<1000 ADT & <1M ESAL
Lime slurry, and emulsion	Engineered emulsion
1.5" to 4" Hotmix overlay and friction course	No overlay
	Double chip seal

CIR on High Volume Roads

I-80 at Pequop Nevada

(2008 Roads & Bridges Magazine Award Recipient)

Cost: $33.7 Million

Project Length:
≈ 20 miles

Pavement Section:
3.5” CIR
4” Hotmix Overlay
¾ ” Friction-wearing surface

2007-2008

CIR on Low Volume Roads

SR – 892 Nevada

Cost: $2 Million

Project Length:
≈ 35 miles

Subcontractor: Valentine Surfacing, 2005

Pavement Section:
2" CIR
Double Chip Seal

Cores

SR-892
Well-Coated Material

2005

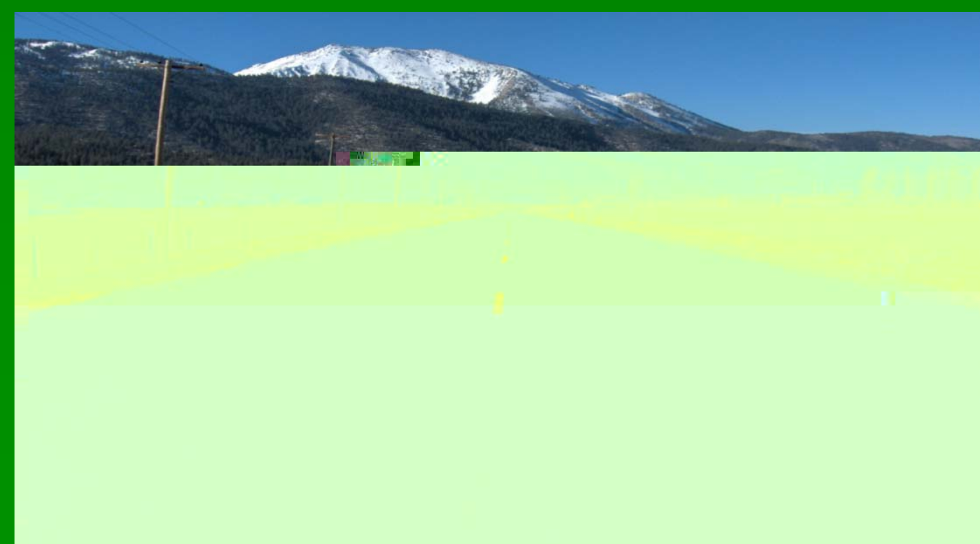
Cost-Effectiveness

Category	ADT & Loading	Strategy	Total Structural Numbers	Strategy Cost	Cost Reduction /mile	Increase in Structural Number
Low	<400 ADT <1M to 2M ESAL	2” mill & HMA	(2*0.42)-(2”*0.44/2) **= 0.4**	240K	**$134K**	**110%**
		3” CIR & double Chip seal	3*0.28 **=0.84**	106K	**56%**	
Medium	<400 ADT<5000 2M<ESAL<4M	3” Mill & 3” HMA	(3*0.42)-(3”*0.44/2) 0.6	350K	**$80K**	**180%**
		3” CIR & 2” HMA	(3”*0.28)+(0.42*2”) =**1.68**	270K	**23%**	
High	<5000 ADT<40,000 4M <ESAL<25M	3” Mill & 6” HMA	(6*0.42)-(3”*0.44/2) **=1.86**	650K	**$180K**	**50%**
		3” CIR & 4” HMA	(4”*0.42)+(3*0.28) **=2.52**	**470K**	**28%**	

CIR & FDR *Saved* NDOT over $600M

Based on 10-year Performance Data:

20-year Design Life is Expected



Long –Term Performance

Long-Term Performance

McCarran Blvd., Reno, NV
CIR Process and Asphalt Paving Operation

Agency: RTC Washoe County
Contractor: Granite Construction
Subcontractor: Arizona Pavement Profiling
2002

6-Year Performance
McCarran Blvd. Reno

Reconstructed Section

April 2008

CIR and 2” Overlay Section

In-place Recycling Provides a Sustainable Solution

Time, Oct. 1, 2007

Newsweek, April 16, 2007

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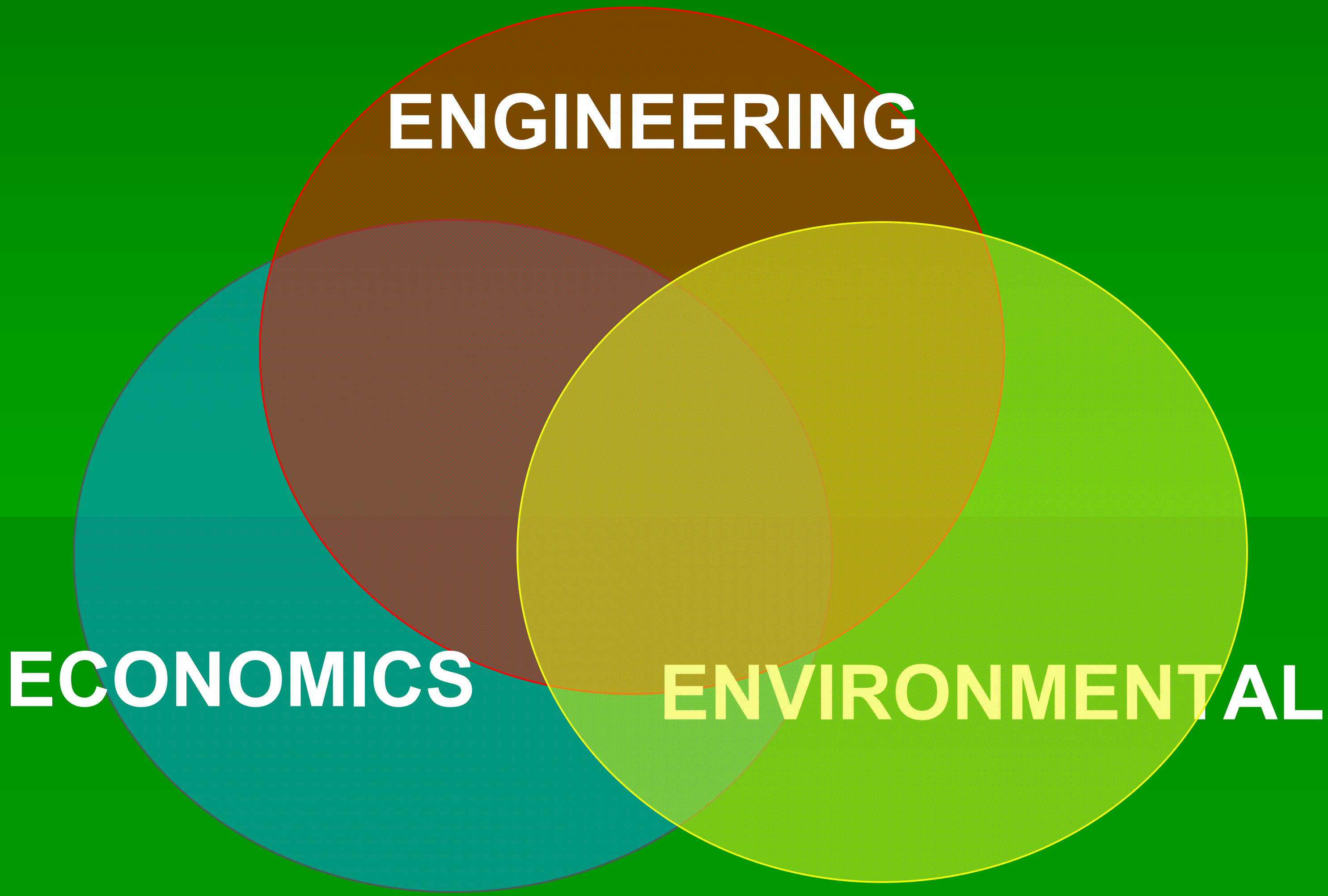

Thank You!

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