Developing a "Mix of Fixes" Strategy to Improve Highway Conditions

Illinois Bituminous Paving Conference

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ASCE news

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The newspaper for members of the American Society of Civil Engineers

ASCE's Infrastructure Report Card Gives Nation a D, Estimates Cost at $2.2 Trillion

that conferred four years ago, the projected | the report card components of our 2009 | The Society's 1998 infrastructure

Roads	D-	Americans spend 4.2 billion hours a year stuck in traffic at a cost to the economy of $78.2 billion, or $710 per motorist. Poor conditions cost motorists $67 billion a year in repairs and operating costs. One-third of America's major roads are in poor or mediocre condition and 45 percent of major urban highways are congested. Current spending of $70.3 billion per year for highway capital improvements is well below the estimated $186 billion needed annually to substantially improve conditions.

ary 28, approximately two months ahead of schedule. Although the overall grade given by the "report card"—a D—is the same as

the importance of informing and contributing to this discussion in a timely manner, we made an unprecedented decision to release

ASCE Offers Suggestions For Economic Stimulus Plan

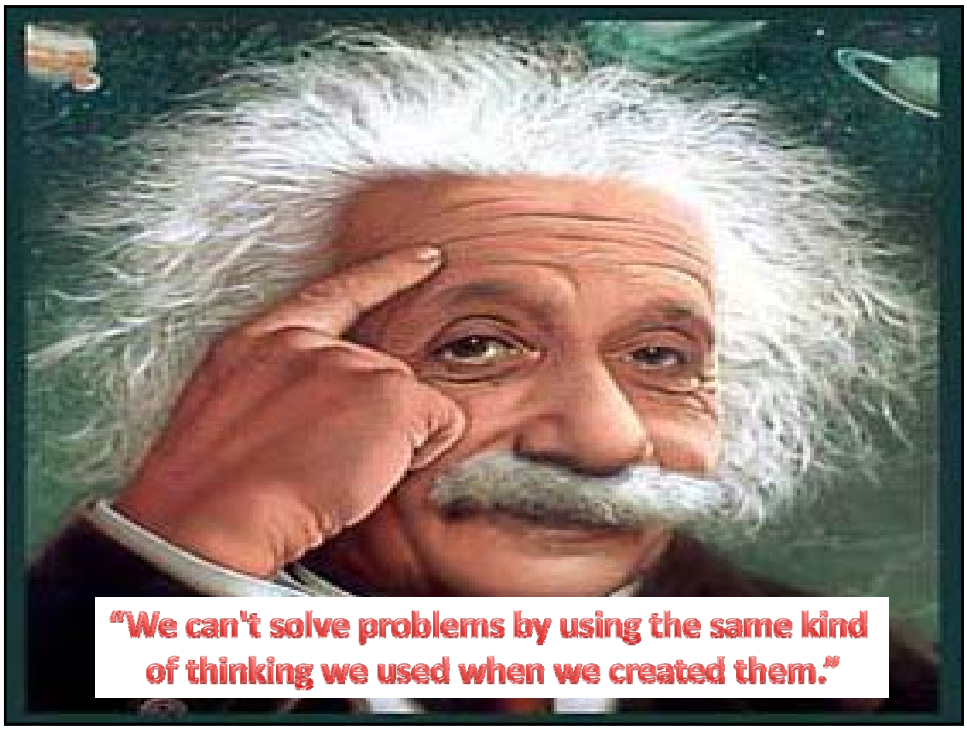
NATIONAL news

commerce and bind us together." As a strong supporter of the president's plan, the Society has prepared a document entitled "Principles for Infrastructure Stimulus Investment" and presented it to Obama's transition team as well as to congressional leaders.

The principles were developed by ASCE

The Society released its *2009 Report Card for America's Infrastructure* at the National Press Club, in

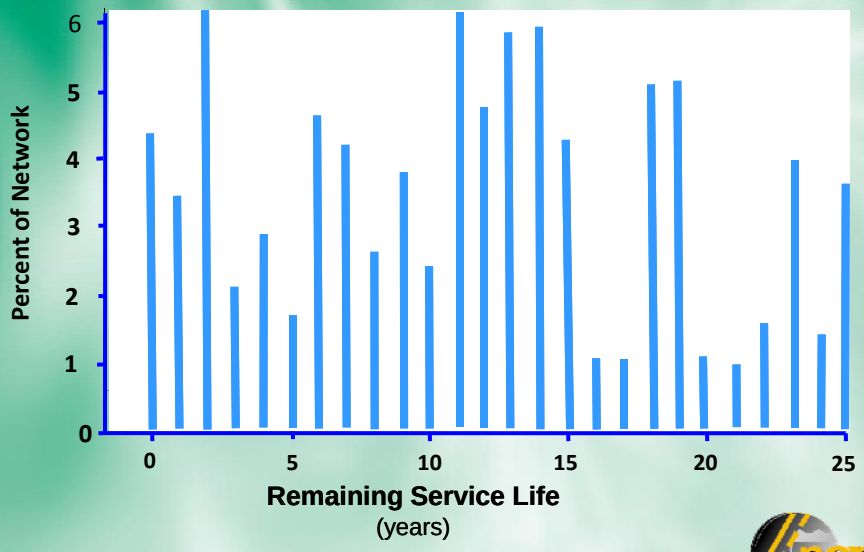
ncpp

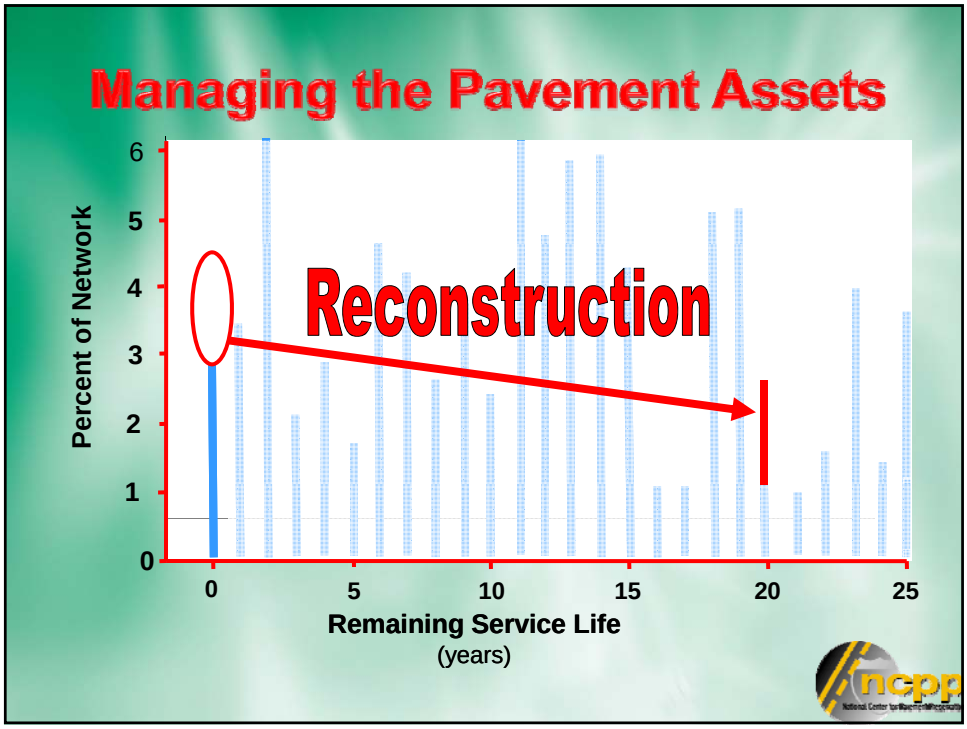


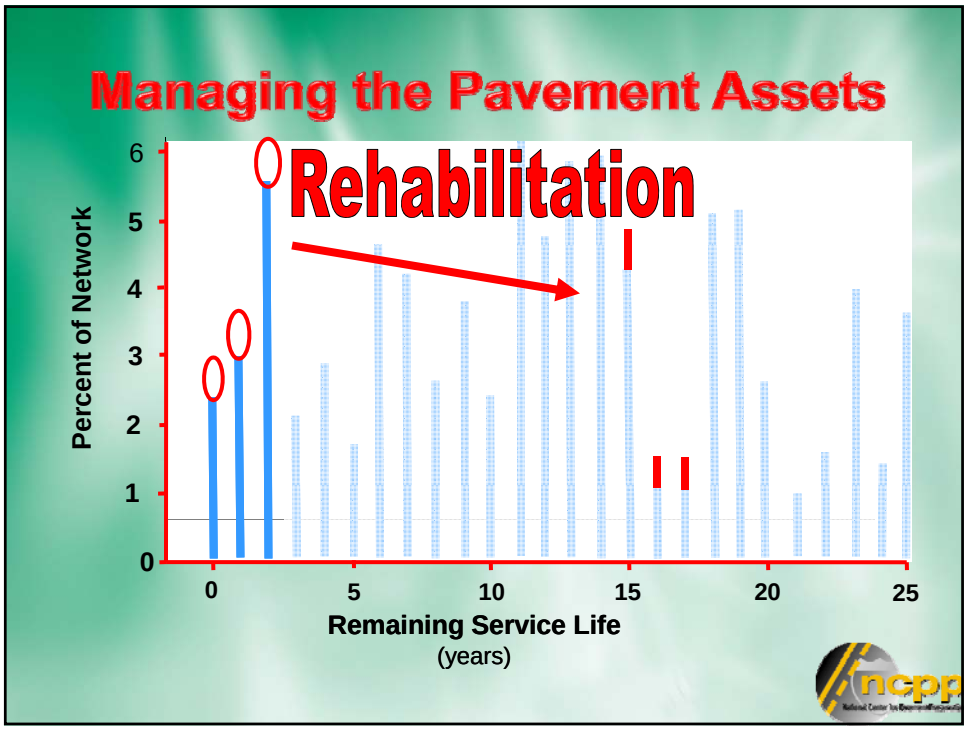
Must Focus on Long-Term Goals

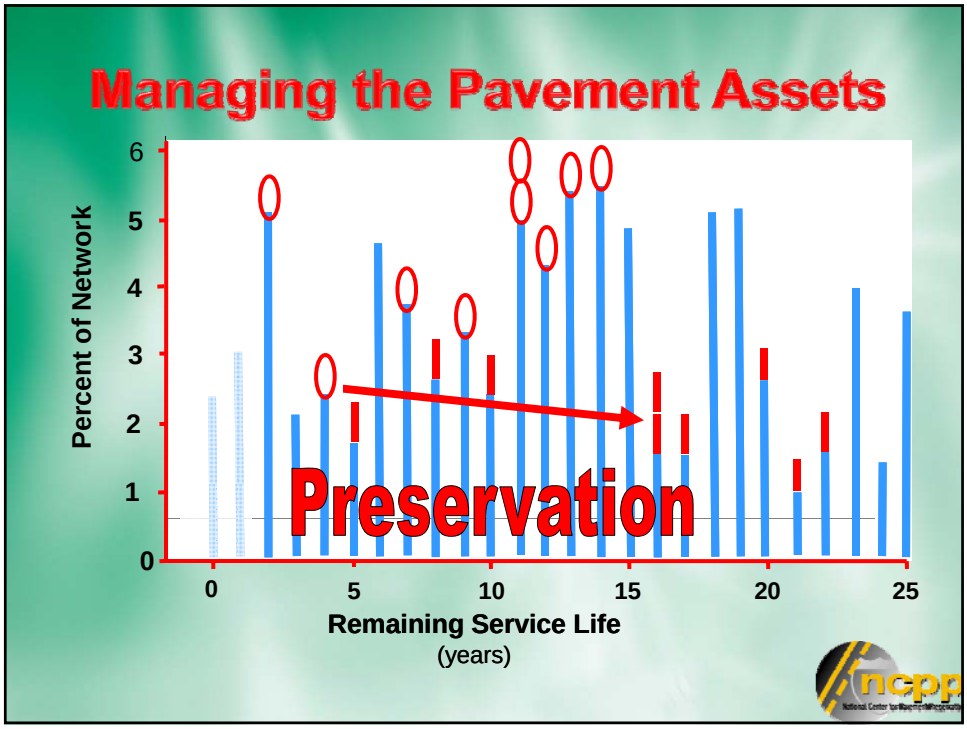
- Manage for the whole-life of the pavement
- Use performance measures to guide investment decisions
- Adopt a 'preservation first' strategy for investment priorities
- Move away from a "worst first" investment strategy, and instead adopt investment principles based on life cycle costing

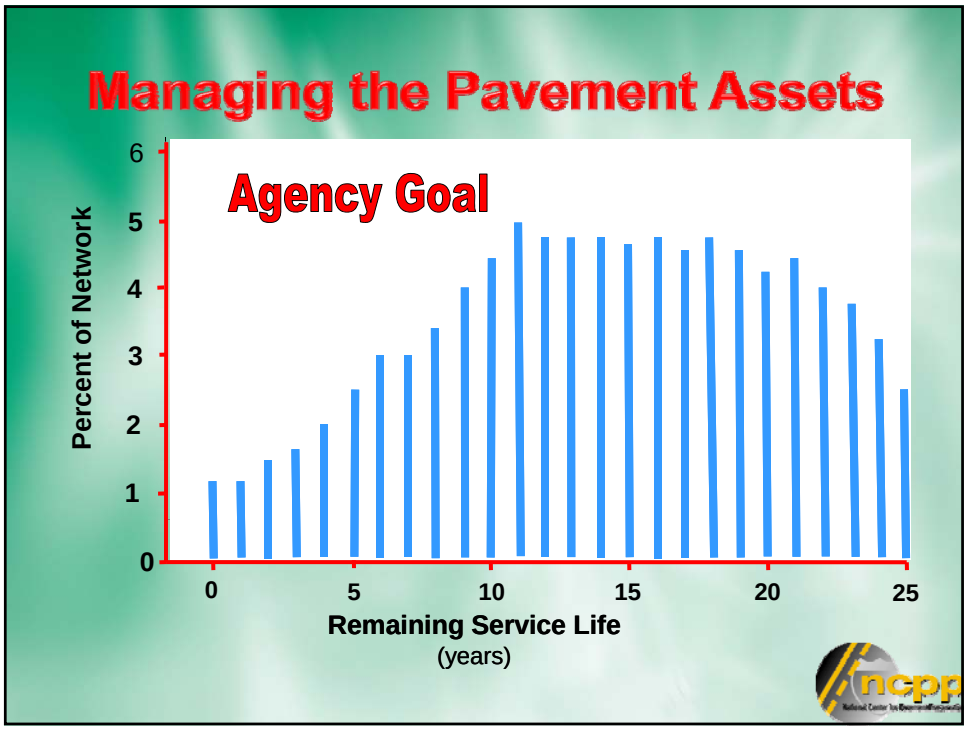
Pavement Assets



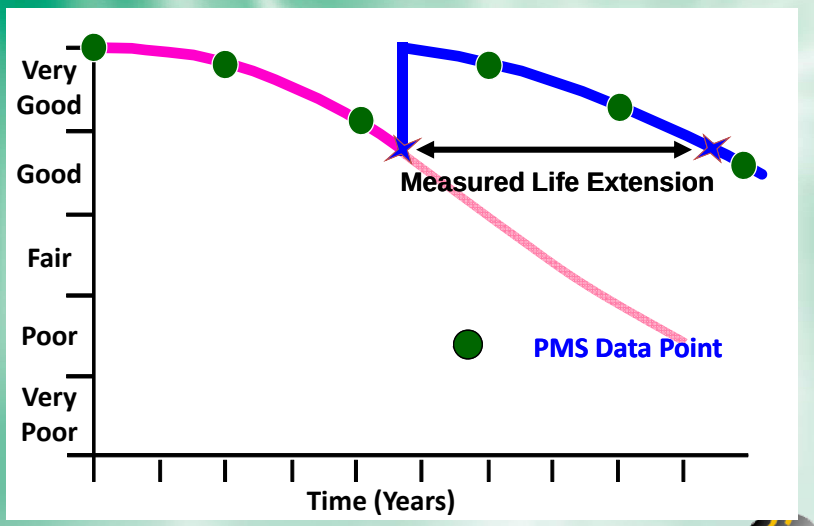

Managing the Pavement Assets
Reconstruction
Percent of Network
0
1
2
3
4
5
6
0
5
10
15
20
25
Remaining Service Life
(years)


Managing the Pavement Assets
Rehabilitation
Percent of Network
0
1
2
3
4
5
6
0
5
10
15
20
25
Remaining Service Life
(years)

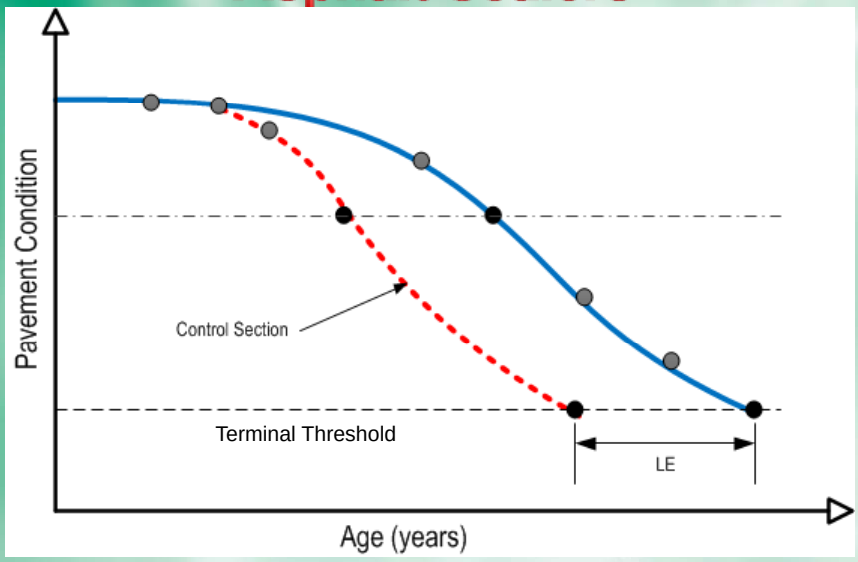

Managing the Pavement Assets
Percent of Network
0
1
2
3
4
5
6
Preservation
0
5
10
15
20
25
Remaining Service Life
(years)


Managing the Pavement Assets
Percent of Network
0
1
2
3
4
5
6
Agency Goal
0
5
10
15
20
25
Remaining Service Life
(years)

Life Extension



Life Extension of Rejuvenators & Asphalt Sealers



Typical Life Extensions
(Years)

Treatment	Good Condition (PCI=80)	Fair Condition (PCI=60)	Poor Condition (PCI=40)
Crack Fill	1 - 3	0 - 2	0
Crack Seal	1 - 5	0 - 3	0
Fog Seal	1 - 3	0 - 1	0
Chip Seal	4 - 10	3 - 5	0 - 3
Micro-Surfacing	4 – 8	3 - 5	1 - 4
Thin HMA	4 - 10	3 - 7	2 - 4

Developing a "Mix of Fixes" Strategy

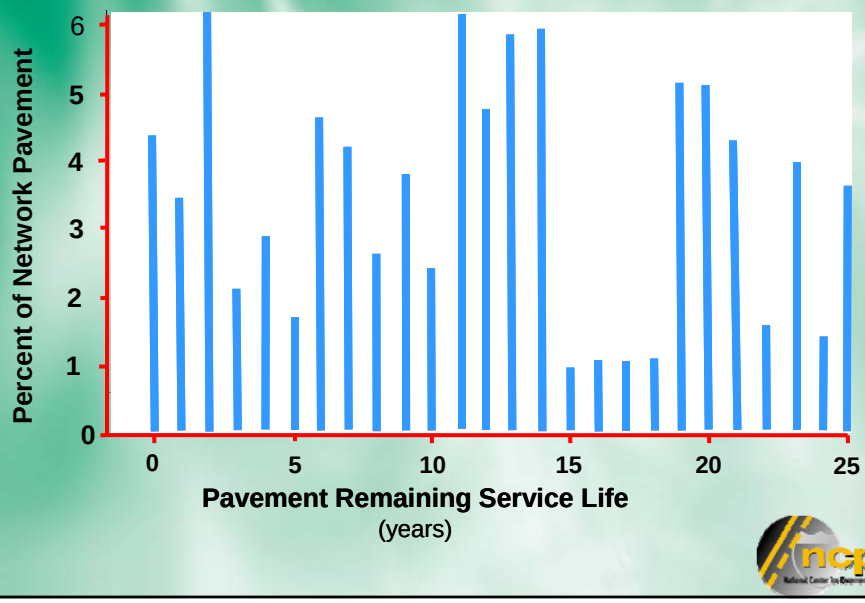
- Must know:
  - Available Budget
  - Lane Miles of Network
  - Unit Costs of Work Types
  - Design Life of Reconstruction & Rehabilitation Work Types
  - Life Extensions of Pavement Preservation Treatments

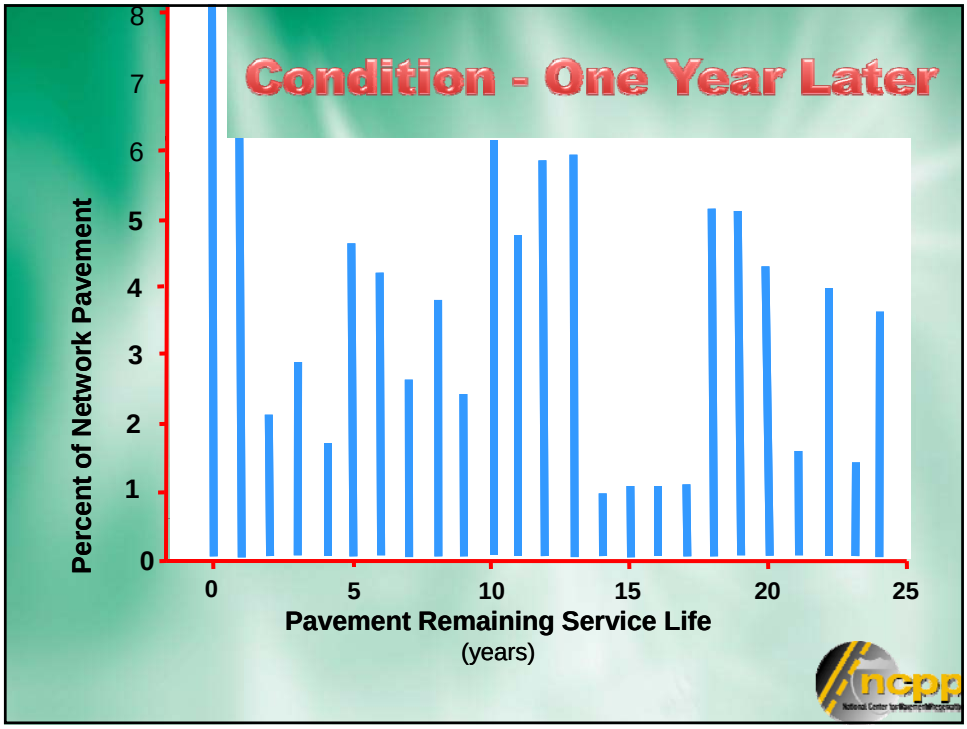
Example:

Agency Highway Network

Network Size = 4,356 lane miles

Current Condition





Agency Highway Network = 4,356 lane miles

Each year the network will lose

4,356 lane mile years

Reconstruction Evaluation

Project	Lane Miles	Design Life	Lane Mile Years	Lane Mile Costs	Total Cost
#1	22	25 yrs	550	$463,425	$10,195,350
#2	18	30 yrs	540	$556,110	$10,009,980
	Total	=	1,090		$20,205,330

Rehabilitation Evaluation

Project	Lane Miles	Design Life	Lane Mile Years	Lane Mile Costs	Total Cost
#3	22	18 yrs	396	$263,268	$5,791,896
#4	28	15 yrs	420	$219,390	$6,142,920
#5	32	12 yrs	384	$115,848	$3,707,136
	Total	=	1,200		$15,641,952

Pavement Preservation Evaluation

Project	Lane Miles	Life Ext.	Lane Mile Years	Lane Mile Costs	Total Cost
#101	12	2 yrs	24	$2,562	$30,744
#102	22	3 yrs	66	$7,743	$170,346
#103	26	5 yrs	130	$13,980	$363,480
#104	16	7 yrs	112	$29,750	$476,000
#105	8	10 yrs	80	$54,410	$435,280
Total		=	412		$1,475,850

Network Trend

Required: 4,356 lane mile years

Programmed Activity		Lane Mile Years	Total Cost
Reconstruction *(40 lane miles)*	$$$$	1,090	$20,205,330
Rehabilitation *(82 lane miles)*	$$$	1,200	$15,641,952
Pavement Preservation *(84 lane miles)*	$	412	$1,475,850
Total	=	2,702	$37,323,132

Network Needs Summary

Network Size *(needs)*	4,356 *(lane mile years)*
Programmed Activity	2,702 *(lane mile years)*
Deficit =	1,654 *(lane mile years)*

Steps to Address Minimal

Required: 4,356 lane mile years

Programmed Activity	Lane Mile Years
Reconstruction *(31 lan* *(40 lane*	*820* ~~1,090~~
Rehabilita *es)* *es)*	*1,125* ~~1,200~~
Paven reservation *(84 lane miles)*	412
Total =	*2,357* ~~2,702~~

Savings = $ 6.1 M

Program Modification

Savings = $ 6,101,940 Needs = 1,999 LMY

Preservation Treatment	Life Ext	Lane Miles	Lane Mile Years	Total Cost
Concrete Reseal	4 yrs	31	124	$979,600
Thin HMA Overlay	10 yrs	16	160	$870,560
Micro-surfacing	7 yrs	44	308	$1,309,000
Chip Seal	5 yrs	79	395	$1,104,420
Crack Seal	2 yrs	506	1,012	$1,296,372
			1,999	$5,559,952

Revised Network

Required: 4,356 lane mile years

Programmed Activity	Lane Mile Years
Reconstruction (31 lane miles)	820
Rehabilitation (77 lane miles)	1,125
Pavement Preservation (2,083 lane miles)	2,411
Total =	4,356

Net Savings = $ 541,988

Defining Sustainability

Sustainability means meeting present needs without compromising the ability of future generations to meet their needs.

The Eco-efficiency Analysis

Energy Use and GHG Emissions Basics

- **Energy Use Components**
  - Raw Materials- obtain, transport, processing
  - Mixing/Heating/Production
  - Jobsite Transport
  - Jobsite Installation

Pavement Reuse
Hot In-place Recycling

Pavement Reuse
Cold In-place Recycling

Energy Reduction
Warm Mix Asphalt

Energy Reduction
Chip Seals

Energy Reduction
Micro-surfacing

Preservation Process Designs

Treatment	Quantities	Life Ext.
Hot Mix AC	1½ inch	5-10 yr
HIR	1½ inch	5-10 yr
Chip Seal	.44 gal - 38 lb/ yd^2	3-6 yr
Type II Slurry	16 lb/ yd^2	3-5 yr
Crack Seal	1 lin ft/ yd^2	1-3 yr
Crack Fill	2 lin ft/ yd^2	1-2 yr
Fog Seal	0.10 gal/ yd^2	1 yr

Annualized Energy and GHG

Process	BTU/ yd^2/ yr	lb CO_2/ yd^2/ yr
Hot Mix (1½")	4,660 – 9,320	0.9 - 1.8
HIR (1½")	3,870 – 7,740	0.7 - 1.4
Chip Seal	1,170 – 2,340	.15 - .30
Slurry Seal	968 – 1,935	.10 - .20
Crack Seal	290 - 870	.05 - .14
Crack Fill	930 – 1,860	.13 - .25
Fog Seal	500	.07

The Status of Pavement Preservation Today

Pavement Preservation 1999 Implementation Survey

41 State Agencies Reporting

Treatment	Percent	Treatment	Percent
Cape Seals	4.9%	Mill & HMA Overlay	82.9%
Chip Seals	80.5%	NovaChip®	22.8%
Cold In-Place Recycling	51.2%	Profile Milling	61.0%
Crack Filling	73.2%	Rejuvenators	NA
Fog Seals	29.3%	Sand Seals	NA
Hot In-Place Recycling	34.1%	Scrub Seals	17.0%
HMA Overlays (≤1½")	90.2%	Slurry Seals	34.1%
Micro-Surfacing	68.3%	Ultra-Thin HMA Overlay	34.1%

2005-2010 Technical Appraisal

What treatments are currently used in the agency's preservation "toolbox"?:

* Agencies may choose more than one

Based on 41 State DOTs

* 'Not Applicable' means these agencies do not use any pavement preservation treatments

Treatment	Percent	Treatment	Percent	Treatment	Percent
Not Applicable	0%	HMA Inlays	4.9%	Scrub Seals	7.3%
Armor Coats	7.3%	HMA Overlays	97.6%	Slab Replacement	19.5%
Cape Seals	12.2%	HMA Patching	14.6%	Slurry Seals	41.5%
Chip Seals (Inc. Pass Oil)	85.4%	Joint Sealing	65.9%	Spall Repair / PCC Patching	39%
Concrete Pavement Restoration (CPR)	7.3%	Micro-surfacing	75.6%	Surface CIR Recycling	24.4%
Crack Filling	78%	Mill and HMA Overlay	65.9%	Surface HIR Recycling	41.5%
Crack Sealing	73.2%	NovaChip ®	61%	Surface Patching	7.3%
Cross Stitching	12.2%	Open Graded Friction Course	12.2%	Thin HMA Overlay	51.2%
Diamond Grinding	63.4%	Partial Depth Repair	48.8%	Ultrathin HMA Overlay	7.3%
Dowel Bar Retrofits	46.3%	Profile Milling	7.3%	Ultrathin Whitetopping	9.8%
Flush Seals (Inc. Pass Oil)	4.9%	Rejuvinators	14.6%	Under-Drain / Drain Cleanout	7.3%
Fog Seals (Inc. Pass Oil)	31.7%	Sand Seals	7.3%	Under-sealing	22%
Full Depth Repair	56.1%				

Change in State DOTs Use of Pavement Preservation Treatments

41 State Agencies Reporting

Treatment	Percent	Treatment	Percent
Cape Seals	+7.3%	Mill & HMA Overlay	-17.1%
Chip Seals	+4.9%	NovaChip®	+38.2%
Cold In-Place Recycling	-26.8%	Profile Milling	-53.7%
Crack Filling	+4.9%	Rejuvenators	+14.6%
Fog Seals	+2.4%	Sand Seals	+7.3%
Hot In-Place Recycling	+7.3%	Scrub Seals	-9.7%
HMA Overlays (≤1½")	+7.3%	Slurry Seals	+7.3%
Micro-Surfacing	+7.3%	Ultra-Thin HMA Overlay	-26.8%

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