Pavement Type Selection Not a Black or White Issue

Marvin Traylor

A Modern Life Cycle Cost Analysis

- Initial Costs
- Out Year Costs
- User Delay Costs

Score Card

	PCC	**HMA**
Initial Costs		
Out Year Costs		
User Delay Costs		

State	% of Pavements Constructed with Asphalt	State	% of Pavements Constructed with Asphalt
1. Alaska	100%	26. Tennessee	72%
2. Vermont	99%	27. Texas	67%
3. Maine	98%	28. Arkansas	64%
4. Montana	95%	29. South Carolina	63%
5. New Hampshire	94%	30. California	59%
6. New Mexico	93%	31. Oklahoma	55%
7. Arizona	93%	32. Kentucky	52%
8. Florida	92%	33. West Virginia	52%
9. Hawaii	92%	34. Mississippi	50%
10. Idaho	92%	35. South Dakota	49%
11. Nevada	91%	36. Nebraska	42%
12. Utah	91%	37. New Jersey	40%
13. Maryland	91%	38. Minnesota	37%
14. Alabama	90%	39. Connecticut	31%
15. Oregon	90%	40. Ohio	29%
16. Wyoming	89%	41. Wisconsin	28%
17. Massachusetts	88%	42. Louisiana	25%
18. Rhode Island	85%	43. New York	24%
19. Washington	85%	44. Pennsylvania	18%
20. Georgia	84%	45. Michigan	18%
21. Colorado	84%	46. Indiana	17%
22. North Carolina	81%	47. Missouri	12%
23. Kansas	79%	48. Iowa	9%
24. Virginia	78%	*49. Illinois* ****	*3%*
25. North Dakota	74%	50. Delaware	1%

Source: The Federal Highway Administration; Highway Statistics 1997; Table HM-31; Page V-18

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Source: The Federal Highway Administration; Highway Statistics 1997; Table HM-31; Page V-18

Illinois Asphalt Pavement Assn.
iapa

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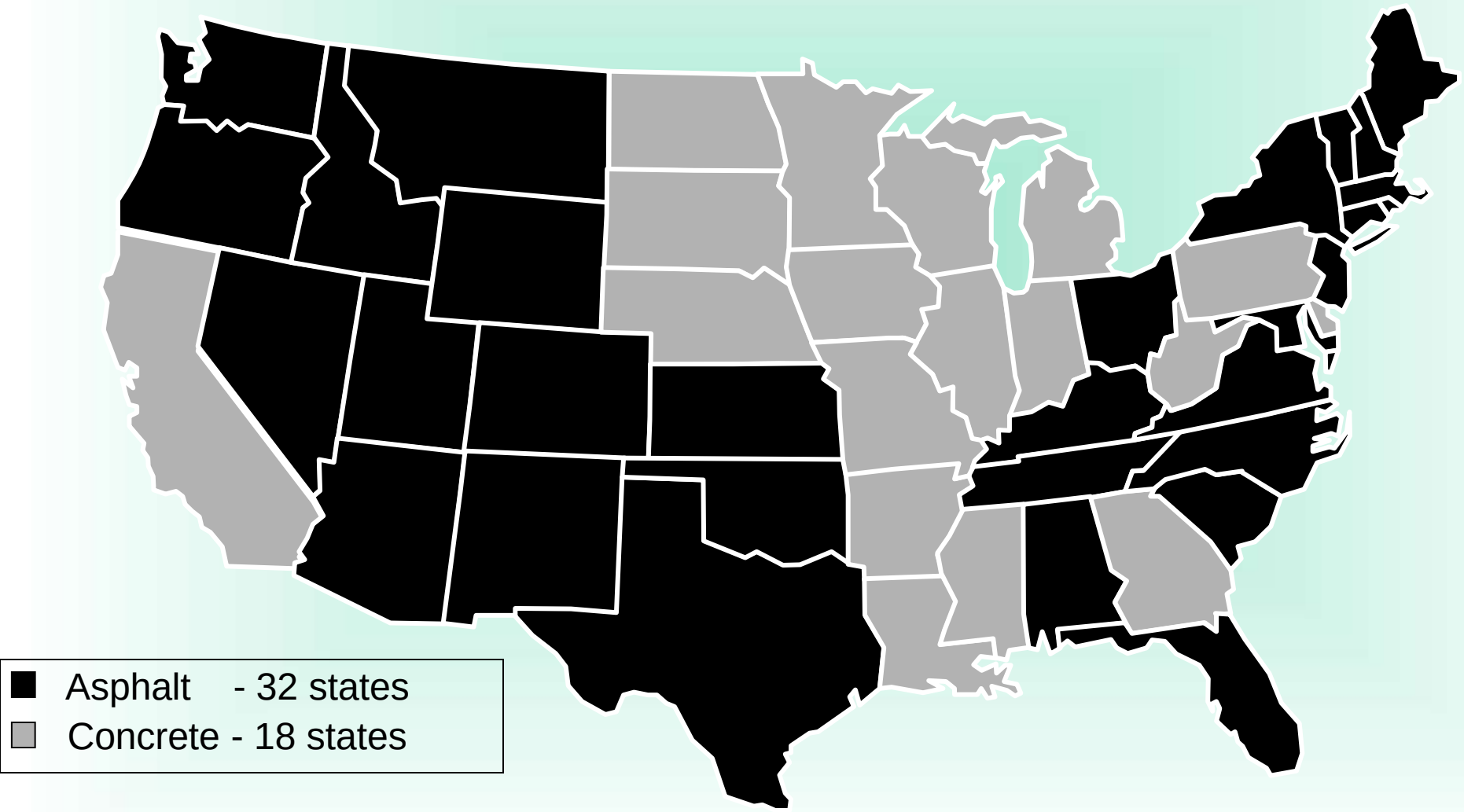
Source: The Federal Highway Administration; Highway Statistics 1997; Table HM-31; Page V-18

Breakout by Majority Pavement Type – Interstate System



Data source: US DOT, FHWA, Highway Statistics, Section V, Type of Surface, Interstate – Rural and Urban

Score Card

	PCC	**HMA**
Initial Costs		
Out Year Costs		
User Delay Costs		

	PCC	HMA
Initial Costs		
Out Year Costs		
User Delay Costs		

- Thickness
- X Sections
- Material Specifications
- Details

	PCC	HMA
Initial Costs		
Out Year Costs		
User Delay Costs		

- Time Horizon
- Distress Predictions
- Repair Strategies & Costs
- Reconstruction Considerations

	PCC	HMA
Initial Costs		
Out Year Costs		
User Delay Costs		

- Distress/Repair Predictions
- Traffic Modeling
- Unit Costs/Vehicle/Hour
- Not My Money!

Illinois Selection History

Illinois Selection History

1918 – 1963

Illinois Selection History

1918 – 1963

- No Equivalents, No LCCA → All White

Illinois Selection History

1918 – 1963

- No Equivalents, No LCCA → All White

1963 - 1988

Illinois Selection History

1918 – 1963

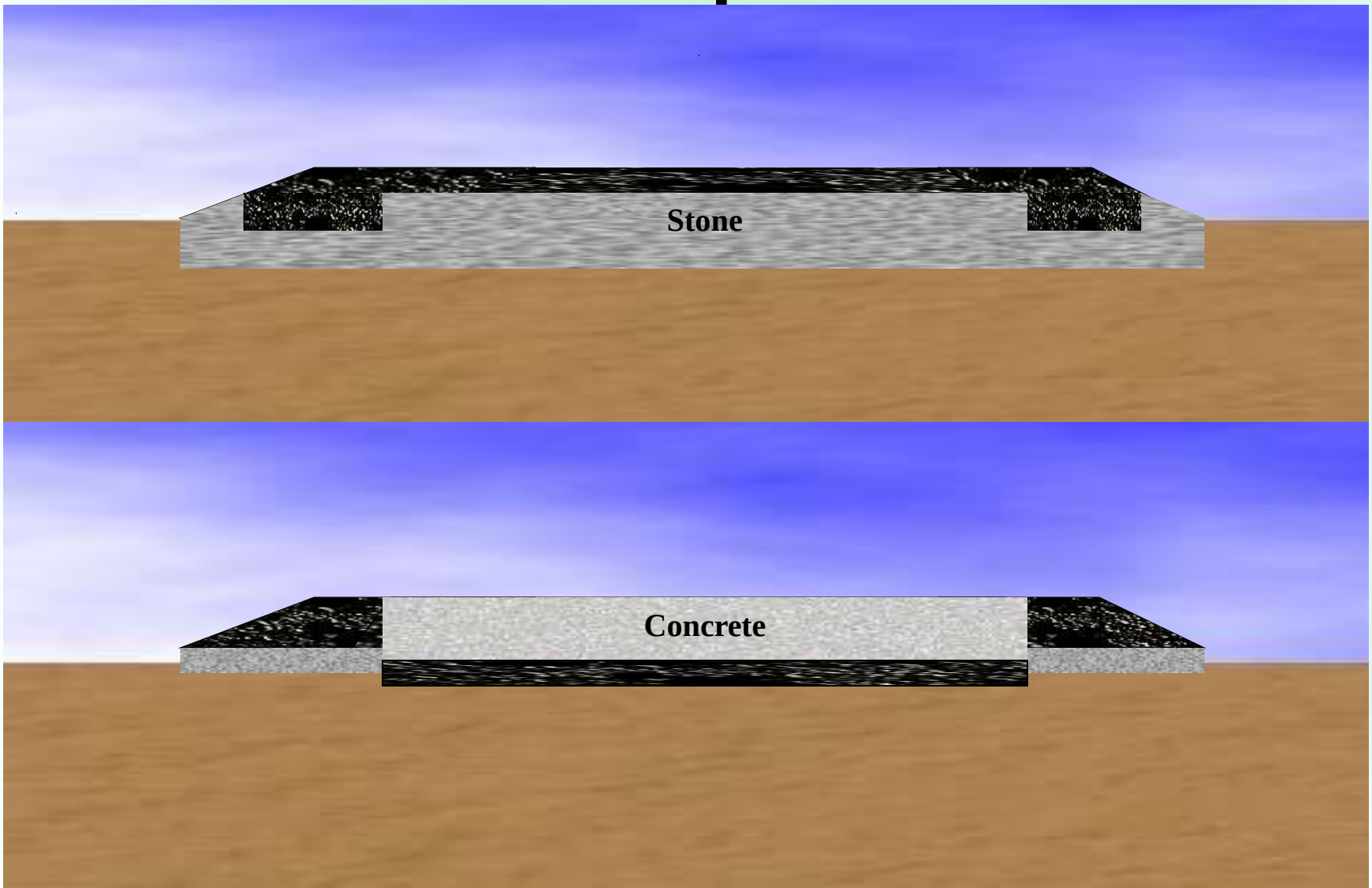
- No Equivalents, No LCCA → All White

1963 - 1988

- AASHO Equivalents

1963

AASHO Equivalents



Illinois Selection History

1918 – 1963

- No Equivalents, No LCCA → All White

1963 - 1988

- AASHO Equivalents, LCCA → Still All White

Illinois Selection History

1918 – 1963

- No Equivalents, No LCCA → All White

1963 - 1988

- AASHO Equivalents, LCCA → Still All White

1988 - Present

Illinois Selection History

1918 – 1963

- No Equivalents, No LCCA → All White

1963 - 1988

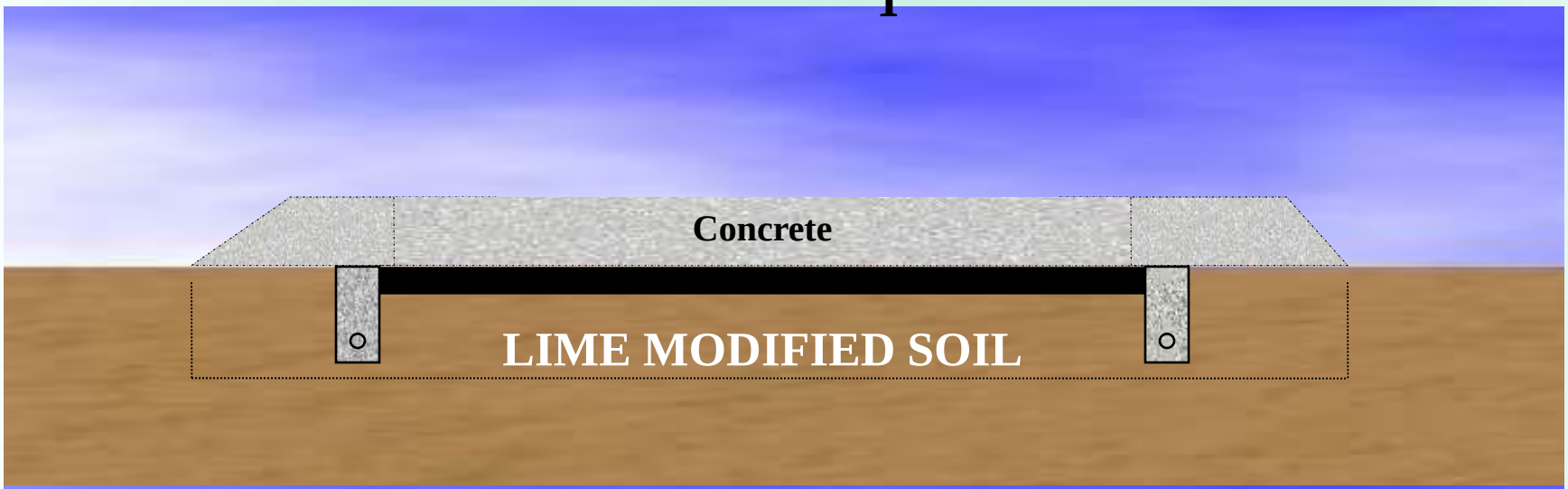
- AASHO Equivalents, LCCA → Still All White

1988 - Present

- Mechanistic Equivalents

1988

Mechanistic Equivalents



Illinois Selection History

1918 – 1963

- No Equivalents, No LCCA → All White

1963 - 1988

- AASHO Equivalents, LCCA → Still All White

1988 - Present

- Mechanistic Equivalents, New LCCA → 50% White

State System Design & Environment Manual Chapter 54

Score Card

	PCC	HMA
Initial Costs		
Out Year Costs		
User Delay Costs		

IDOT Equivalents
20 Year Thickness Designs

Trucks/Day	HMA	PCC
500	12.0	8.0
1000	13.5	9.0
2000	15.0	10.0
4000	16.5	11.0
8000	18.0	12.0

Score Card

	PCC	HMA
Initial Costs		
Out Year Costs		
User Delay Costs		

PCC

Year		Cost	
0		$	1.00
5		$	.86
10	Patch & Seal	$	.74
15		$	.64
20	**Slabjack & Diamond Grind**	$	.55
25		$	.48
30	Patch & Seal	$	.41
35		$	.35
40		$	.31
	TOTAL	$	

HMA
Light Traffic

Year		Cost	
0		$	1.00
5		$	.86
10	Patch & Seal	$	.74
15		$	.64
20	**Mill & Overlay**	$	.55
25		$	.48
30	Patch & Seal	$	.41
35		$	.35
40		$	.31
	TOTAL	$	

HMA
Heavy Traffic

Year		Cost	
0		$	1.00
	Patch & Seal		
5	**Mill & Overlay**	$	.86
10	Patch & Seal	$	.74
	Mill & Overlay	$	
15		$	.64
	Patch & Seal		
20	**Mill & Overlay**	$	.55
25	Patch & Seal	$	.48
	Mill & Overlay	$	
30		$	.41
35	Patch & Seal	$	.35
40		$	.31
		———	
	TOTAL	$	

Score Card

	PCC	**HMA**
Initial Costs		
Out Year Costs		
User Delay Costs		

Net Result

Truck Traffic		**Winner**
Light	⇨	HMA
Medium (1,500)	⇨	10% Committee
Heavy	⇨	PCC

IDOT's Selection Process Now Under Review

- Thickness Design
- Distress & Repair Strategies
- Rutting Penalty
- Reconstruction Costs
- Rubblization/PCC Overlay
- User Delays

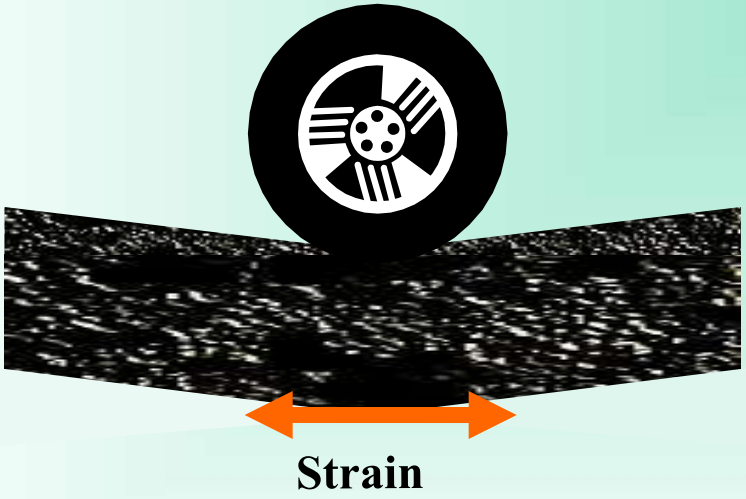
IDOT's Selection Process Now Under Review

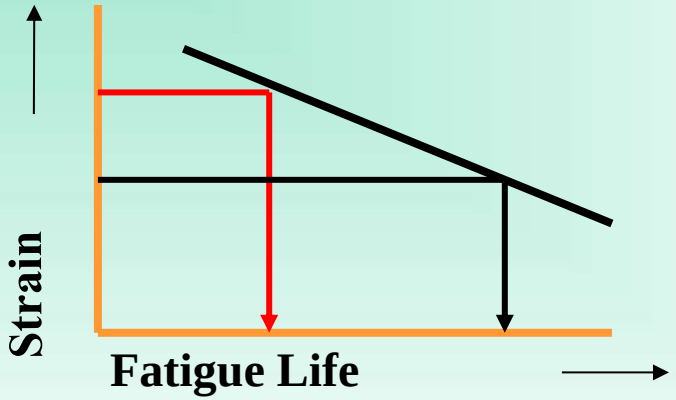
- **Thickness Design**
- Distress & Repair Strategies
- Rutting Penalty
- Reconstruction Costs
- Rubblization/PCC Overlay
- User Delays

Fatigue Theory

High Strain = Short Life

Low Strain = Long Life





Fatigue-Based Thickness

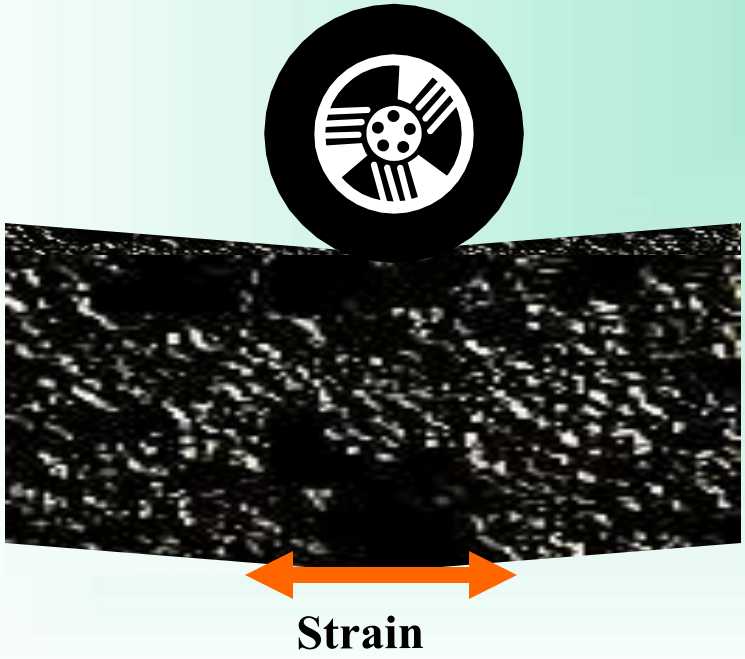
TF	Microstrain	Thickness
1	100	10.5
2	80	12.5
3	70	13.5
5	60	15.0
10	50	16.5
15	45	18.0
20	40	19.0
30	35	22.0

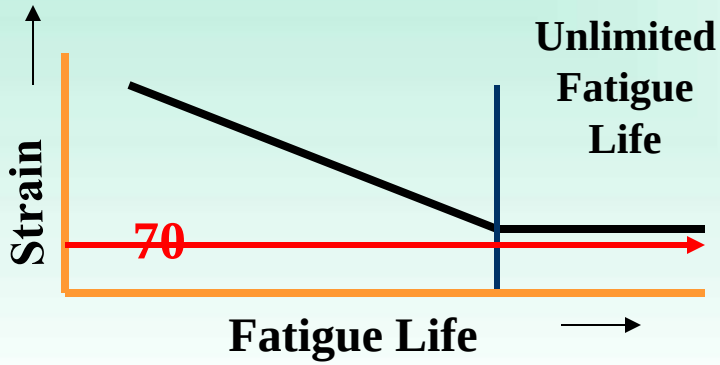
TF1 = 200 Trucks/Day

Fatigue Theory for Thick Pavements

High Strain = Short Life

Low Strain = Unlimited Life





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3	70	13.5
5	60	15.0
10	50	16.5
15	45	18.0
20	40	19.0
30	35	22.0

TF1 = 200 Trucks/Day

IDOT's Selection Process Now Under Review

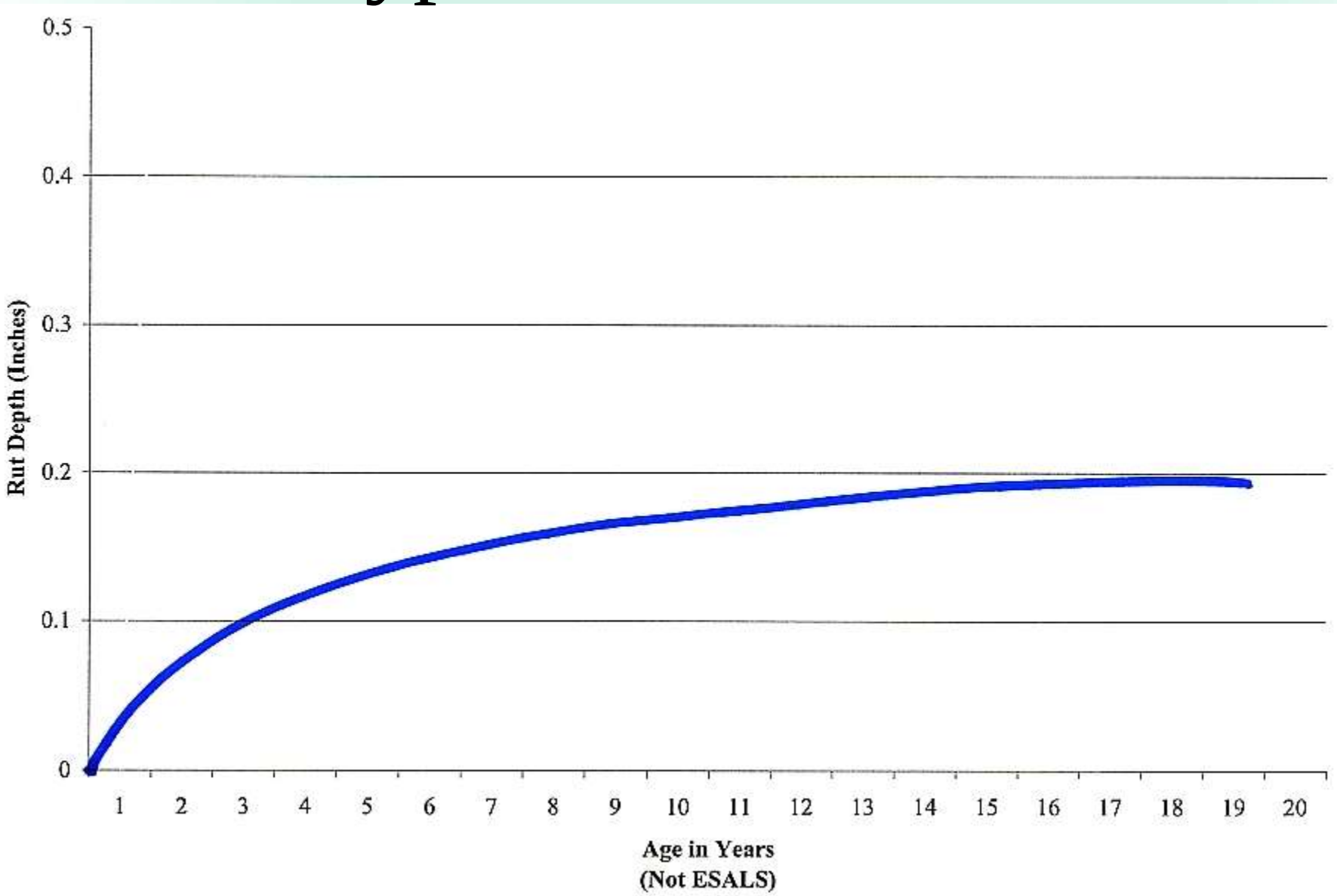
- Thickness Design
- **Distress & Repair Strategies**
- Rutting Penalty
- Reconstruction Costs
- Rubblization/PCC Overlay
- User Delays

Eventual Distress

IDOT's Selection Process Now Under Review

- Thickness Design
- Distress & Repair Strategies
- **Rutting Penalty**
- Reconstruction Costs
- Rubblization/PCC Overlay
- User Delays

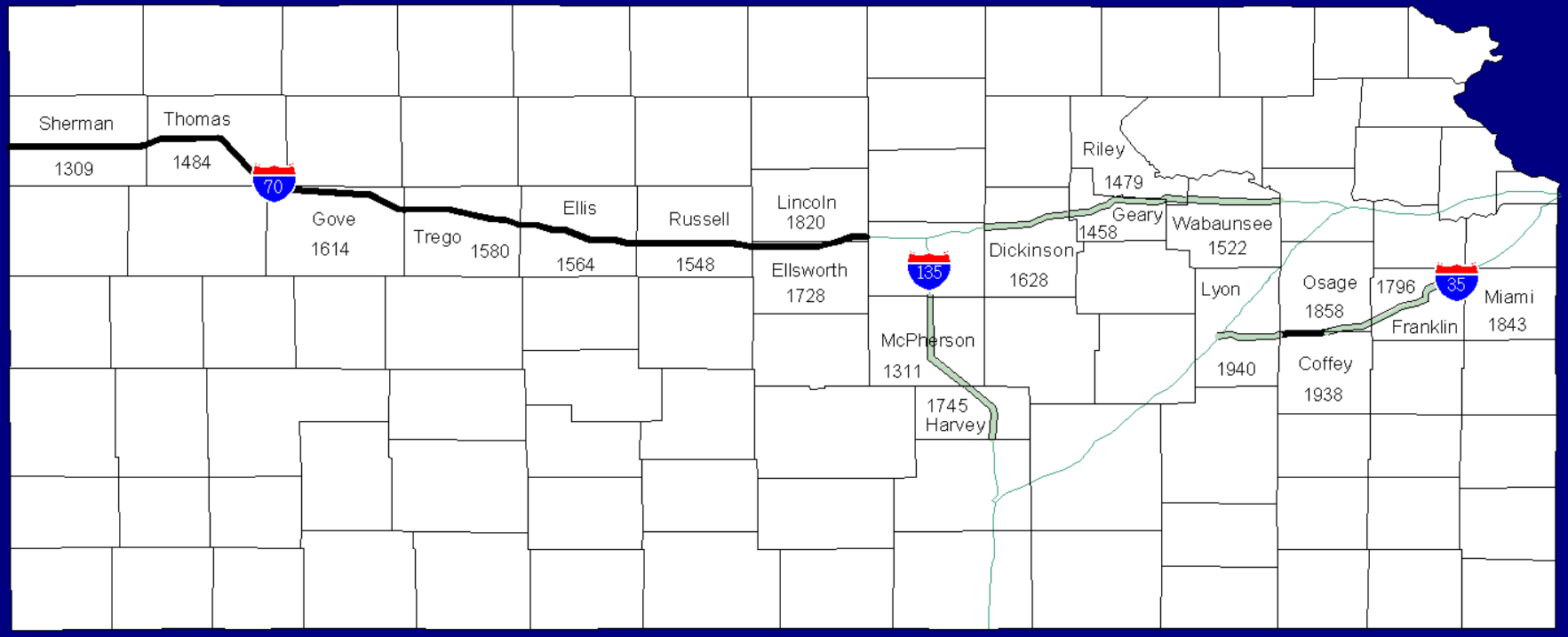
Typical Rut Curve



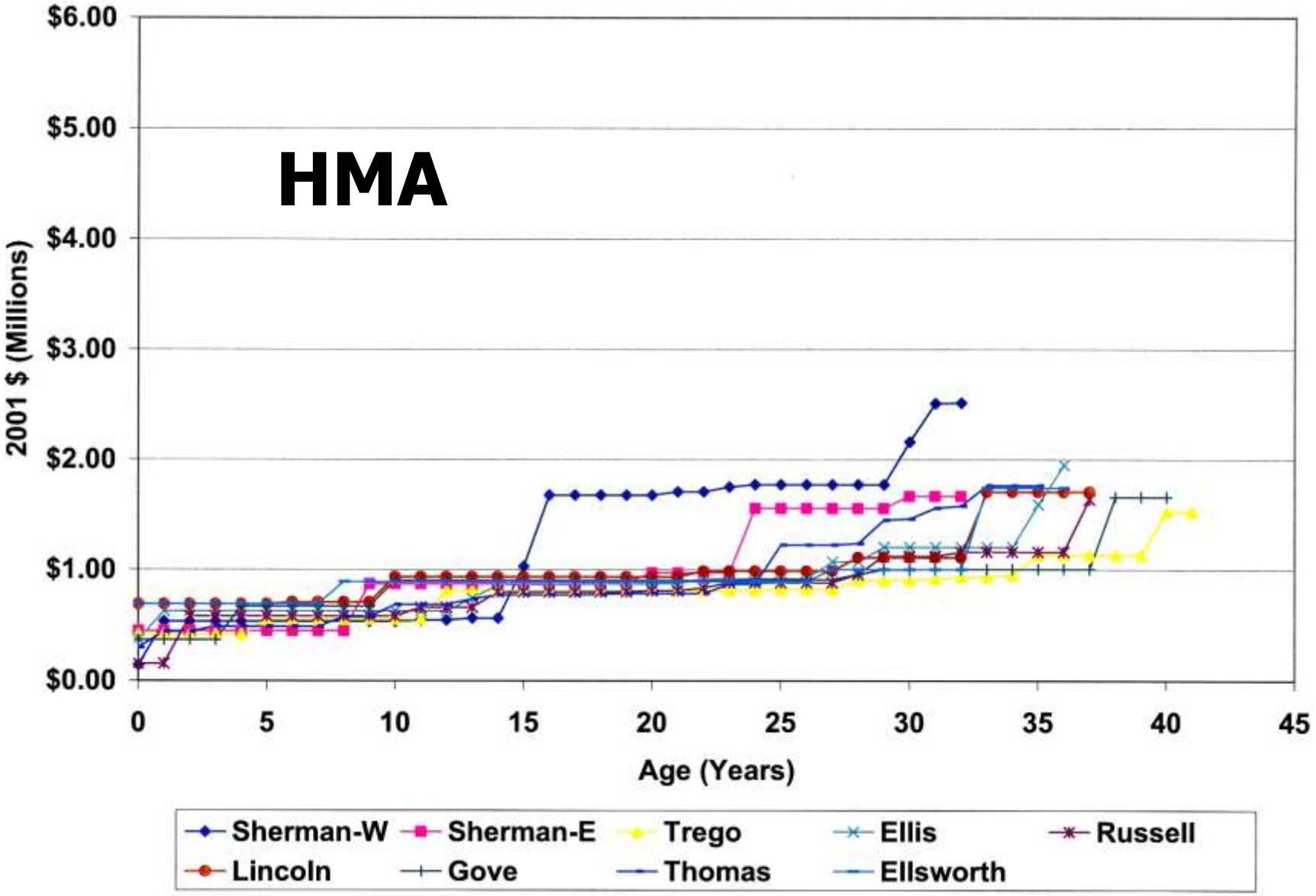
IDOT's Selection Process Now Under Review

- Thickness Design
- Distress & Repair Strategies
- Rutting Penalty
- **Reconstruction Costs**
- Rubblization/PCC Overlay
- User Delays

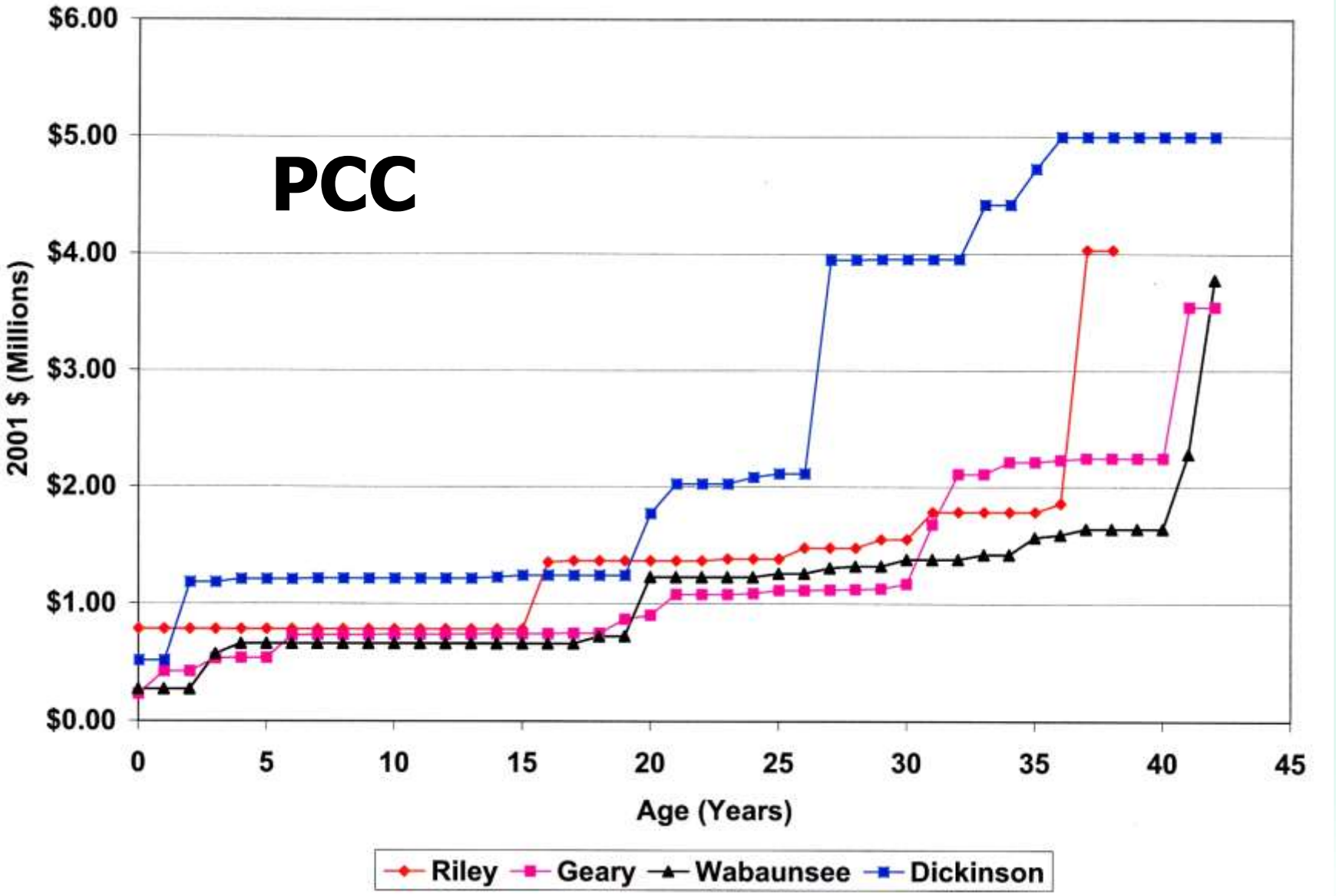
Kansas Interstate Study


Sherman
1309
Thomas
1484
70
Gove
1614
Trego
1580
Ellis
1564
Russell
1548
Lincoln
1820
Ellsworth
1728
135
McPherson
1311
1745
Harvey
Riley
1479
Geary
1458
Dickinson
1628
Wabaunsee
1522
Lyon
1940
Osage
1858
Coffey
1938
1796
35
Franklin
Miami
1843
70
Interstate/Kansas Turnpike
PCC Pavement (184 miles)
HMA Pavement (244 miles)

Total Expenditures Per 4-Lane Mile Per Year, HMA Pavements, I-70



Total Expenditures Per 4-Lane Mile Per Year, PCC Pavements, I-70



Average Life Cycle Cost

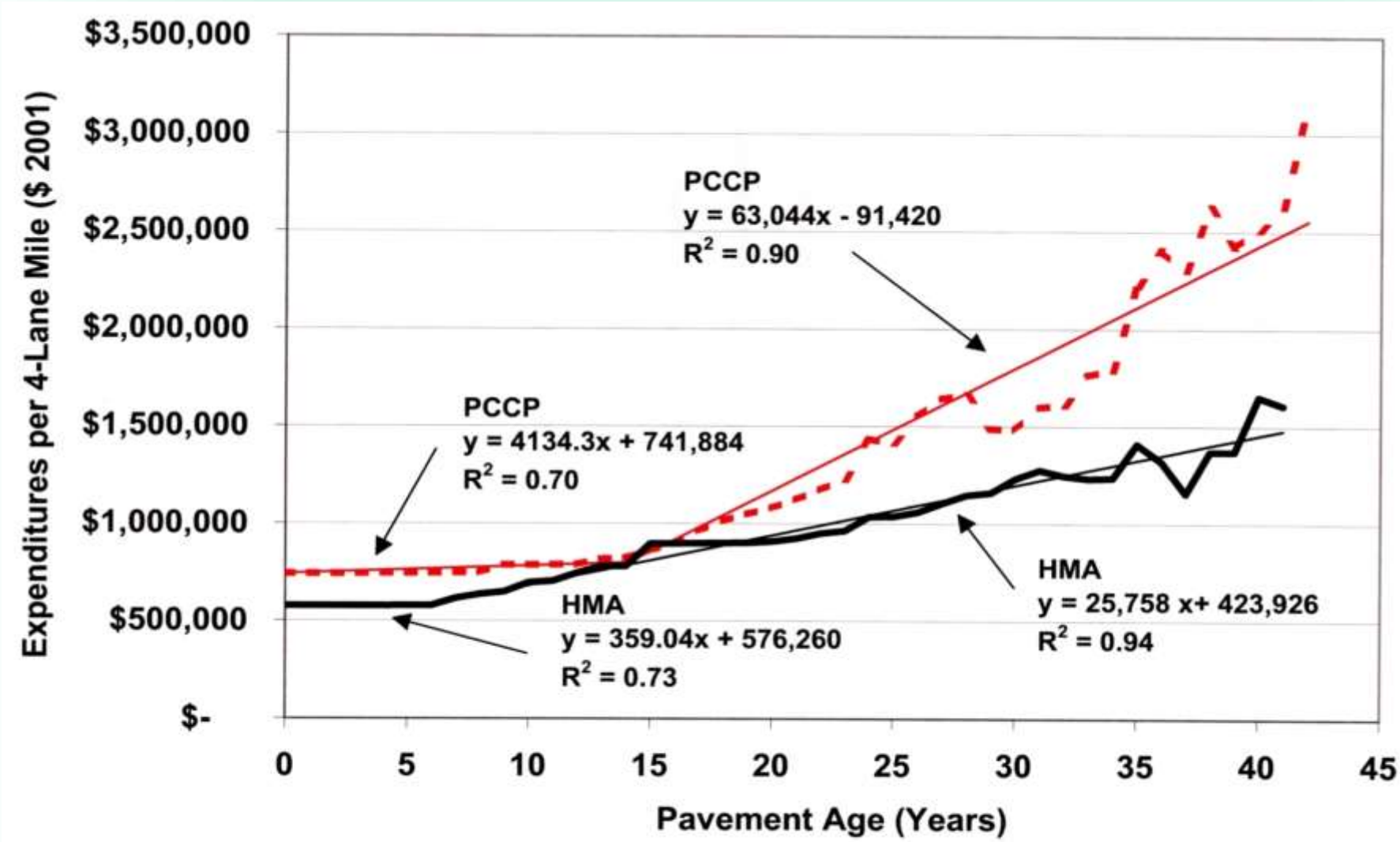


Figure 12. Regression Curves for Average Life-Cycle Cost

IDOT's Selection Process Now Under Review

- Thickness Design
- Distress & Repair Strategies
- Rutting Penalty
- Reconstruction Costs
- **Rubblization/PCC Overlay**
- User Delays


ANTIGO
LANE

IDOT's Selection Process Now Under Review

- Thickness Design
- Distress & Repair Strategies
- Rutting Penalty
- Reconstruction Costs
- Rubblization/PCC Overlay
- **User Delays**

Dollars & Days

30 Year Concrete

Year	Activity	$ (millions)	Days
0	New Construction	4.0	60
10			
20			
30	Patch/Overlay	0.4	60
40	Patch/Overlay	0.4	60
50	Reconstruction	4.0	60
60			
70			
80	Patch/Overlay	0.4	60
90	Patch/Overlay	0.4	60
100	Reconstruction	4.0	60
	TOTAL	$13.6	420

Perpetual Pavement

Year	Activity	$ (millions)	Days
0	New Construction	3.0	30
10			
20	Mill/Overlay	0.3	15
30			
40	Mill/Overlay	0.3	15
50			
60	Mill/Overlay	0.3	15
70			
80	Mill/Overlay	0.3	15
90			
100	Mill/Overlay	0.3	15
	TOTAL	$4.8	105

Local System
Local Roads Manual
Chapter 37

IDOT's Mechanistic Design for Local Roads and Streets

- Rigid Jointed Pavement
- Conventional Flexible Pavement
- Full Depth Flexible Pavement

Local Road Equivalents

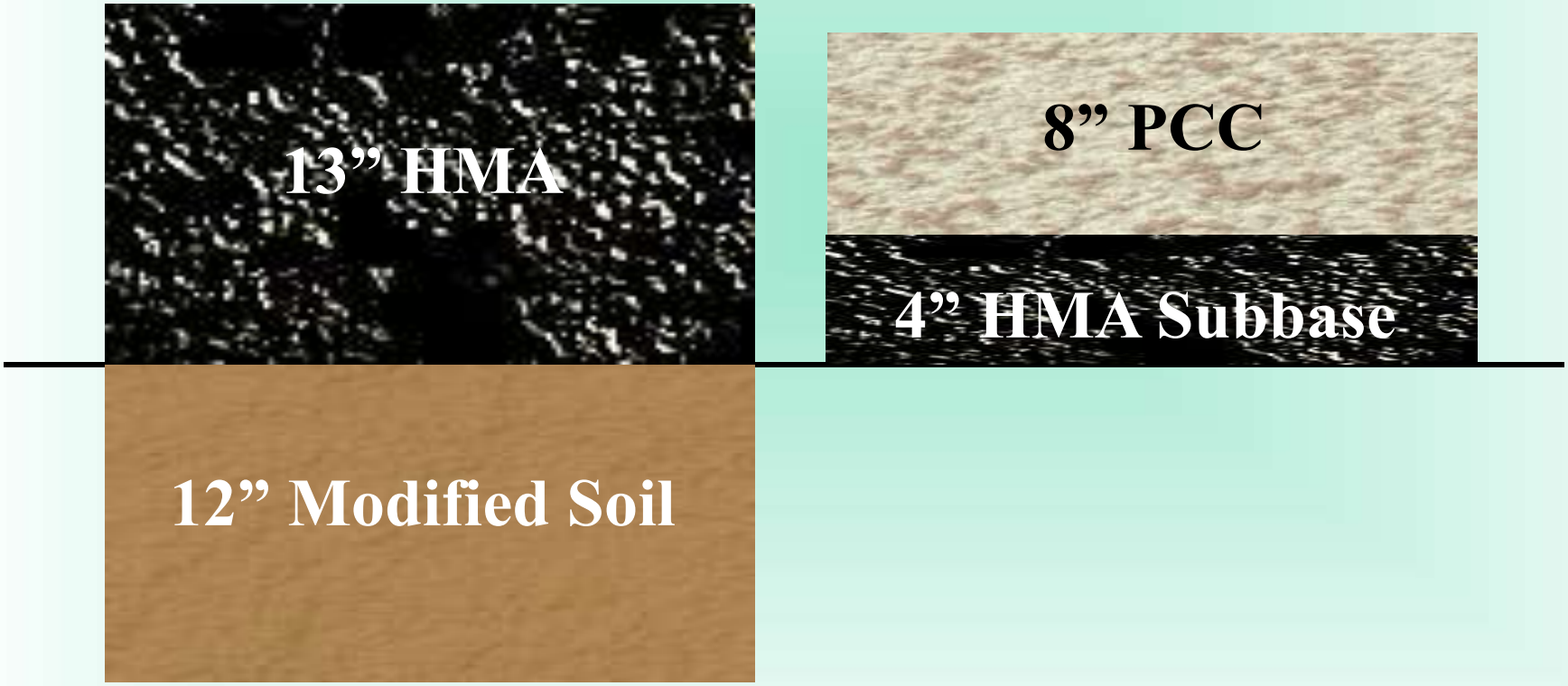
Trucks/Day	HMA	PCC
50	6.00	6.50
100	7.00	6.75
200	8.00	7.00
400	10.75	7.25
800	12.25	7.75
1600	13.50	8.25

Local Preference for MFT Projects

- No LCCA Required
- Alternate Bids
- Type Bids

Stanford Avenue

Alternate Pavements



Engineer's Estimate
(Total Project)

WHITE	BLACK
$2,445,407	$2,331,134

5% Difference

Actual Bids (Total Project)

	WHITE	BLACK
FREESEN	$2,114,322	$1,599,532
FLATT		$1,599,992
SANKEY		$1,772,477
MERRILL		$1,779,209
CALHOUN	$2,343,458	

32% Difference

Nascar Tracks

Atlanta Motor Speedway
Autodromo Hermanos Rodriguez
Bristol Motor Speedway
California Speedway
Chicagoland Speedway
Darlington Raceway
Daytona International Speedway
Dover International Speedway
Gateway International Raceway
Homestead-Miami Speedway
Indianapolis Motor Speedway
Indianapolis Raceway Park
Infineon Raceway
Kansas Speedway
Kentucky Speedway
Las Vegas Motor Speedway
Lowe's Motor Speedway
Mansfield Motorsports Speedway
Martinsville Speedway
Memphis Motorsports Park
Michigan International Speedway
The Milwaukee Mile
Nashville Superspeedway
Nazareth Speedway
New Hampshire International Speedway
Phoenix International Raceway
Pikes Peak International Raceway
Pocono Raceway
Richmond International Raceway
Talladega Superspeedway
Texas Motor Speedway
Watkins Glen International

Nascar Tracks

Atlanta Motor Speedway
Autodromo Hermanos Rodriguez
Bristol Motor Speedway
California Speedway
Chicagoland Speedway
Darlington Raceway
Daytona International Speedway
Dover International Speedway
Gateway International Raceway
Homestead-Miami Speedway
Indianapolis Motor Speedway
Indianapolis Raceway Park
Infineon Raceway
Kansas Speedway
Kentucky Speedway
Las Vegas Motor Speedway
Lowe's Motor Speedway
Mansfield Motorsports Speedway
Martinsville Speedway
Memphis Motorsports Park
Michigan International Speedway
The Milwaukee Mile
Nashville Superspeedway
Nazareth Speedway
New Hampshire International Speedway
Phoenix International Raceway
Pikes Peak International Raceway
Pocono Raceway
Richmond International Raceway
Talladega Superspeedway
Texas Motor Speedway
Watkins Glen International

Illinois Asphalt Pavement Assn.

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