



9th International Conference on **MANAGING PAVEMENT ASSETS (ICMPA9)**

30 Years - 20 State DOTs Trends in Pavement Management observed through real world Implementation at the State DOT Level.

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Deighton Associates Limited



Agenda

- Acknowledgements
- Introduction
- Custom Systems and COTS Solutions
- Performance Indexes
- Deterioration Models and Transition Probability Matrices
- Project Sectioning
- Migration to Asset Management
- Enterprise Wide Solutions
- The Next 30 Years

Acknowledgements

- Co – Author

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- 21 State DOTs

Arkansas , Colorado, Connecticut, Indiana, Iowa, Louisiana, Maine, Massachusetts, Mississippi, New Hampshire, New Jersey, North Dakota, Ohio, Oklahoma, Pennsylvania, Puerto Rico, Rhode Island, South Dakota, Utah, Vermont, West Virginia

Introduction

- Toronto (1985)
- Toronto (1987)
- San Antonio (1994)
- Durban (1998)
- Seattle (2001)
- Brisbane (2004)
- Calgary (2008)
- Santiago (2012)



Custom Systems vs COTs Solutions

- Custom Systems
 - Mainframe based
 - Costly to Develop
 - “Reinventing the Wheel”
 - A solution for RIDOT could not easily be transferred to PennDOT
 - Data was not readily available to make true “data driven decisions”

Custom Systems vs COTS Solutions

- COTS Solutions
 - Solutions are configured for an agency – not specifically programed
 - Solutions can mature overtime through configuration
 - Solutions share the same basic principles but are flexible
 - Costs are generally more affordable
 - Data is now generally available to make true data driven decisions
 - Analysis and Optimization technologies have greatly increased

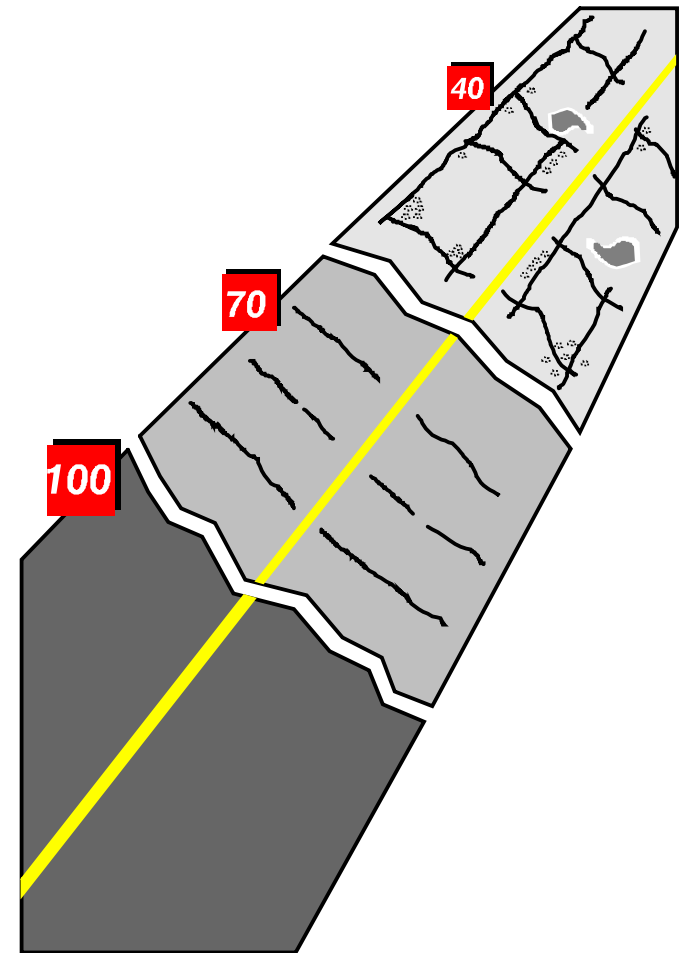
Custom Systems vs COTS Solutions

- COTS Solutions
 - Truly flexible COTS solutions can be expanded to include multiple assets
 - CDOT includes:
 - Bridges (major structures)
 - Culverts (minor structures)
 - Buildings
 - Fleet Equipment
 - Geo Hazards
 - ITS Devices
 - Pavements
 - Traffic Signals
 - Walls
 - Tunnels

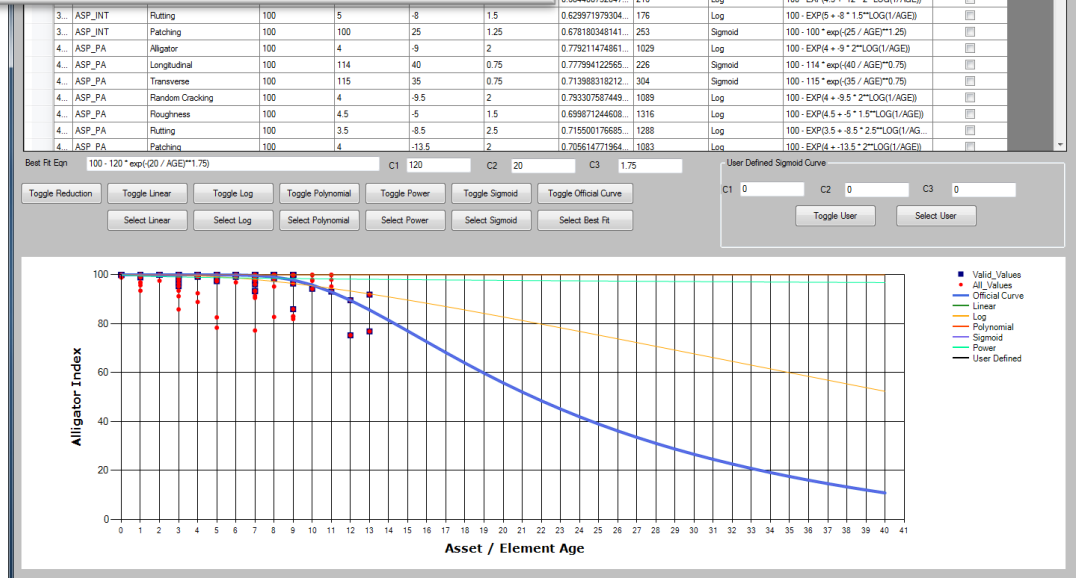
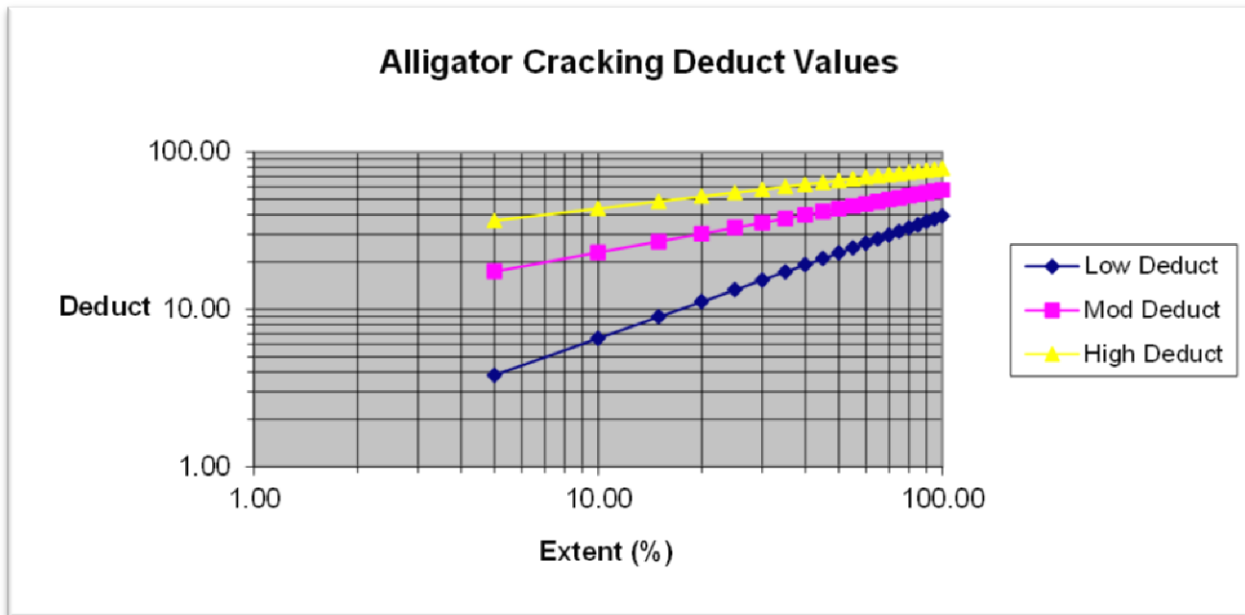


Condition and Performance

- Condition and Performance Measures
 - One Overall Composite Index
 - Several Composite Indexes
 - Individual Indexes
 - Level of Service Measures

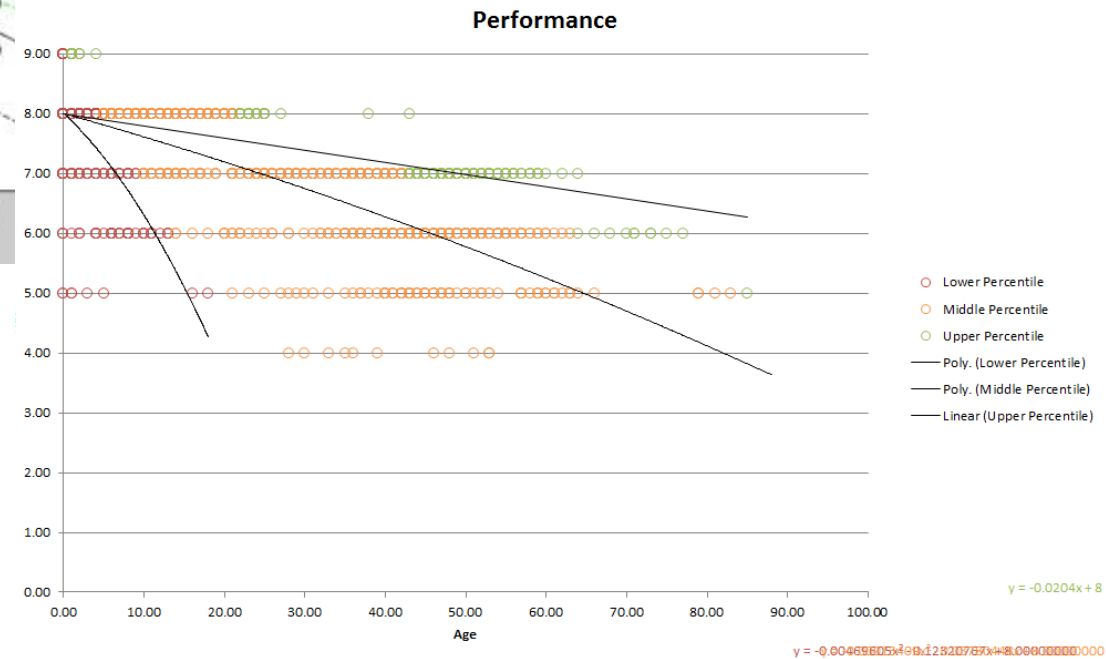
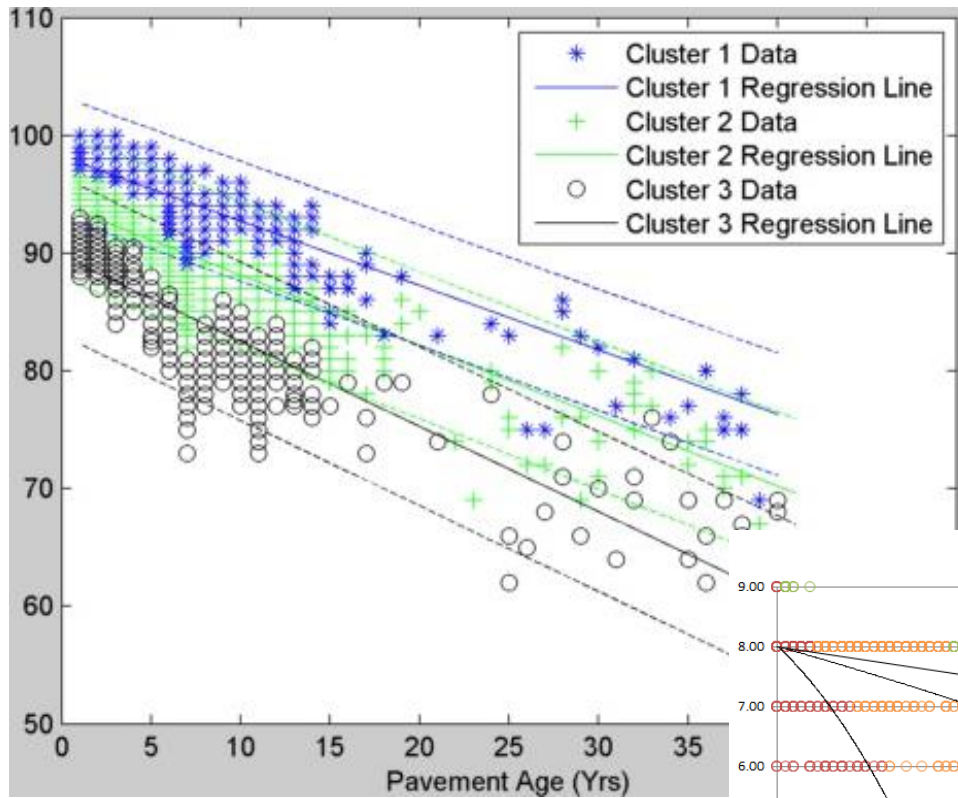


Calculating Indexes from Low, Moderate, High Severity Extents



Regression of Indexes into deterministic performance Models by family.

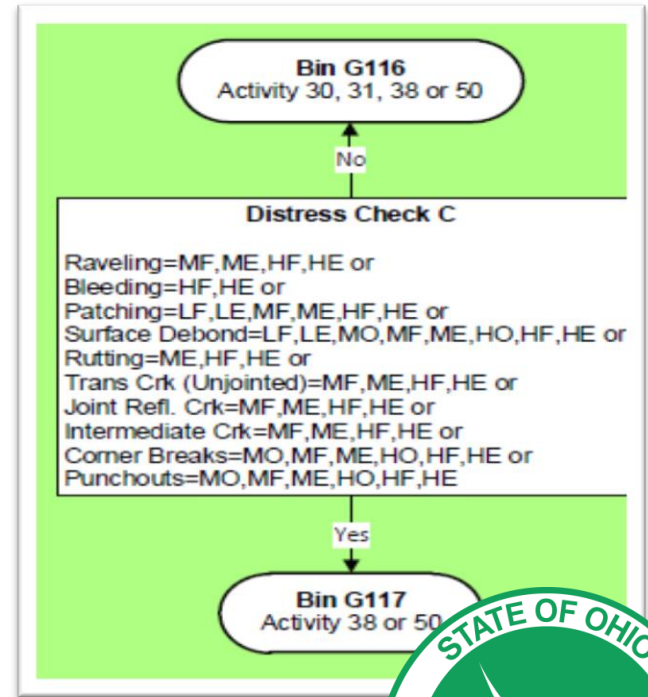
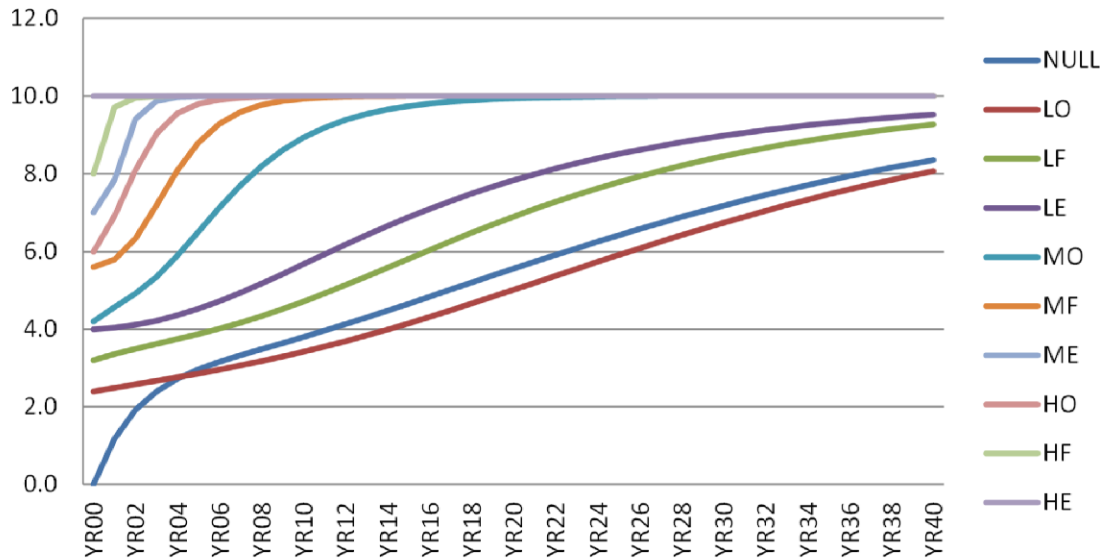
Curve Clustering - Resulting in Multiple Curves for Each Family



Transition Probability Matrix											
Deduct Level	NULL	LO	LF	LE	MO	MF	ME	HO	HF	HE	Total Mileage
NULL	0.6002	0.2585	0.0030	0.1383	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	371.5
LO	0.0000	0.9177	0.0558	0.0265	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	434.55
LF	0.0000	0.0000	0.8026	0.1919	0.0055	0.0000	0.0000	0.0000	0.0000	0.0000	68.63
LE	0.0000	0.0000	0.0000	0.9267	0.0586	0.0001	0.0003	0.0143	0.0000	0.0000	287.57
MO	0.0000	0.0000	0.0000	0.0000	0.7467	0.2141	0.0000	0.0393	0.0000	0.0000	33.63
MF	0.0000	0.0000	0.0000	0.0000	0.0000	0.5144	0.0000	0.4856	0.0000	0.0000	13.88
ME	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1608	0.0000	0.8392	0.0000	2.86
HO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2095	0.4353	0.3552	0.0000	11.6
HF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1449	0.8551	7.11
HE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0

Ohio DOT uses a 9x9 Transition Probability Matrix to predict distress in 9 different combinations of Extent and Severity.

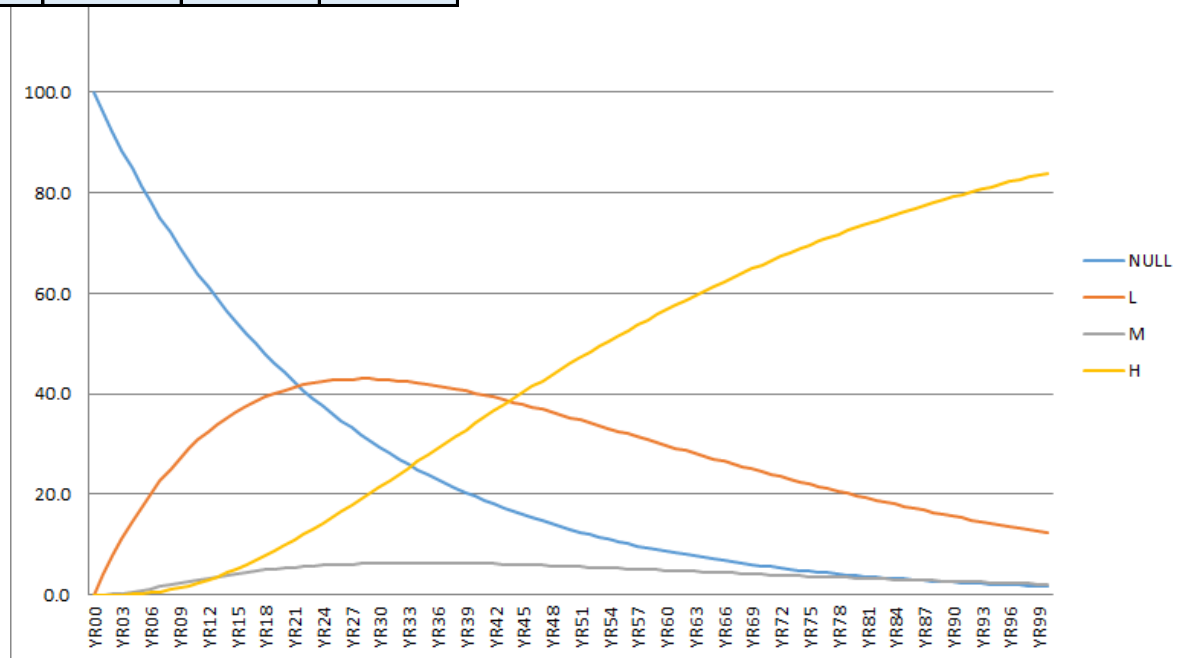
Example Deduct Progression



Transition Probability Matrix				
Severity	NULL	L	M	H
NULL	0.96	0.04	0.00	0.00
L	0.00	0.97	0.03	0.00
M	0.00	0.00	0.80	0.20
H	0.00	0.00	0.00	1.00

PennDOT uses a 4x4 matrix to predict extents of Null, Low, Moderate and High Severity distress

19_Rut Depth



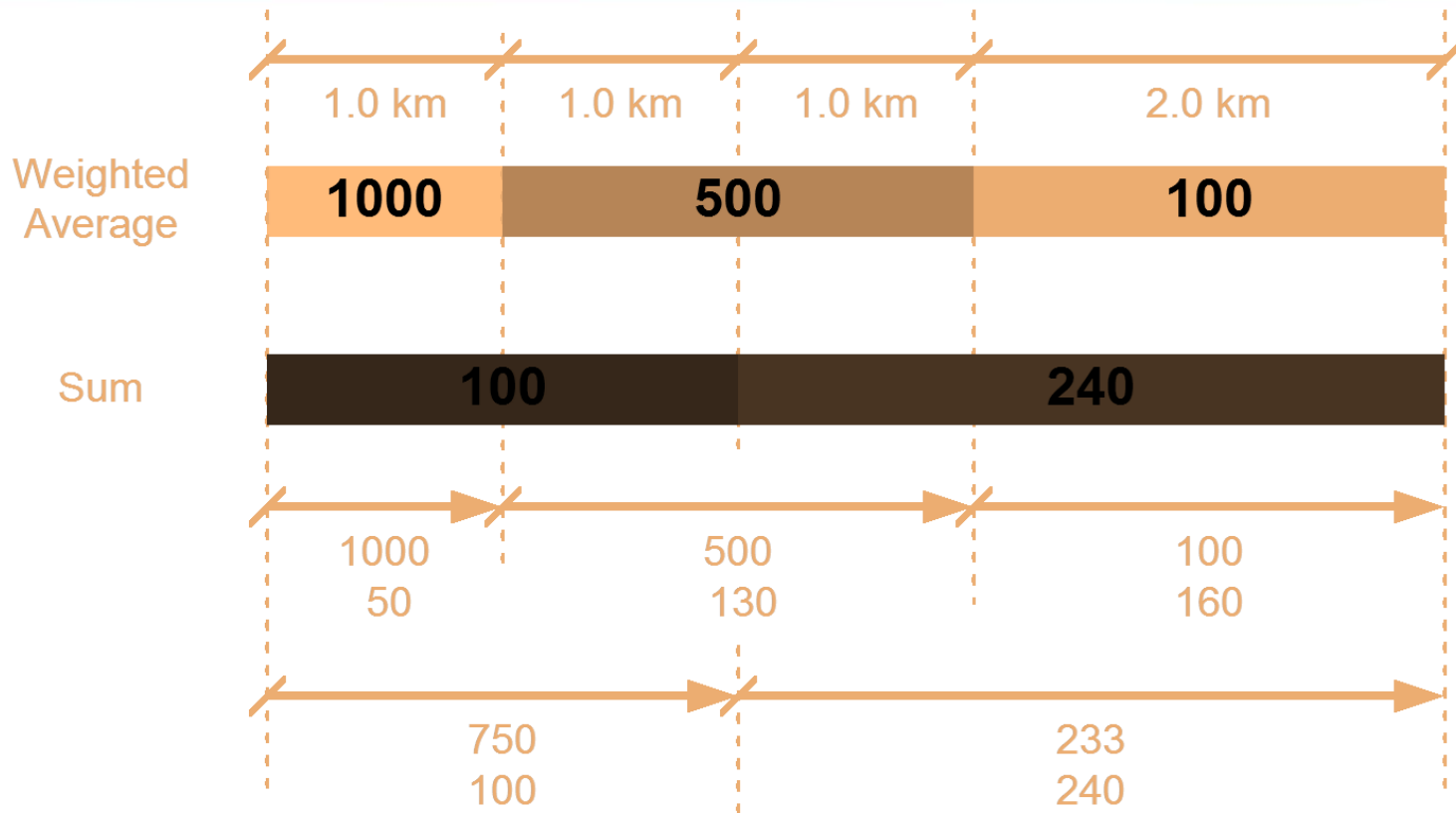
PMS FOR STRATEGIC ANALYSIS AND TACTICAL PROGRAM DEVELOPMENT

- PMS role has expanded
 - Strategic Analysis
 - Funding Needs
 - District / Regional Allocation
 - Level of Service Analysis
 - Performance Goals and Targets
 - Tactical Analysis
 - Program Development
 - Pavement Preservation
 - Long Term Analysis

FIXED PROJECT LENGTH SEGMENTS

vs.

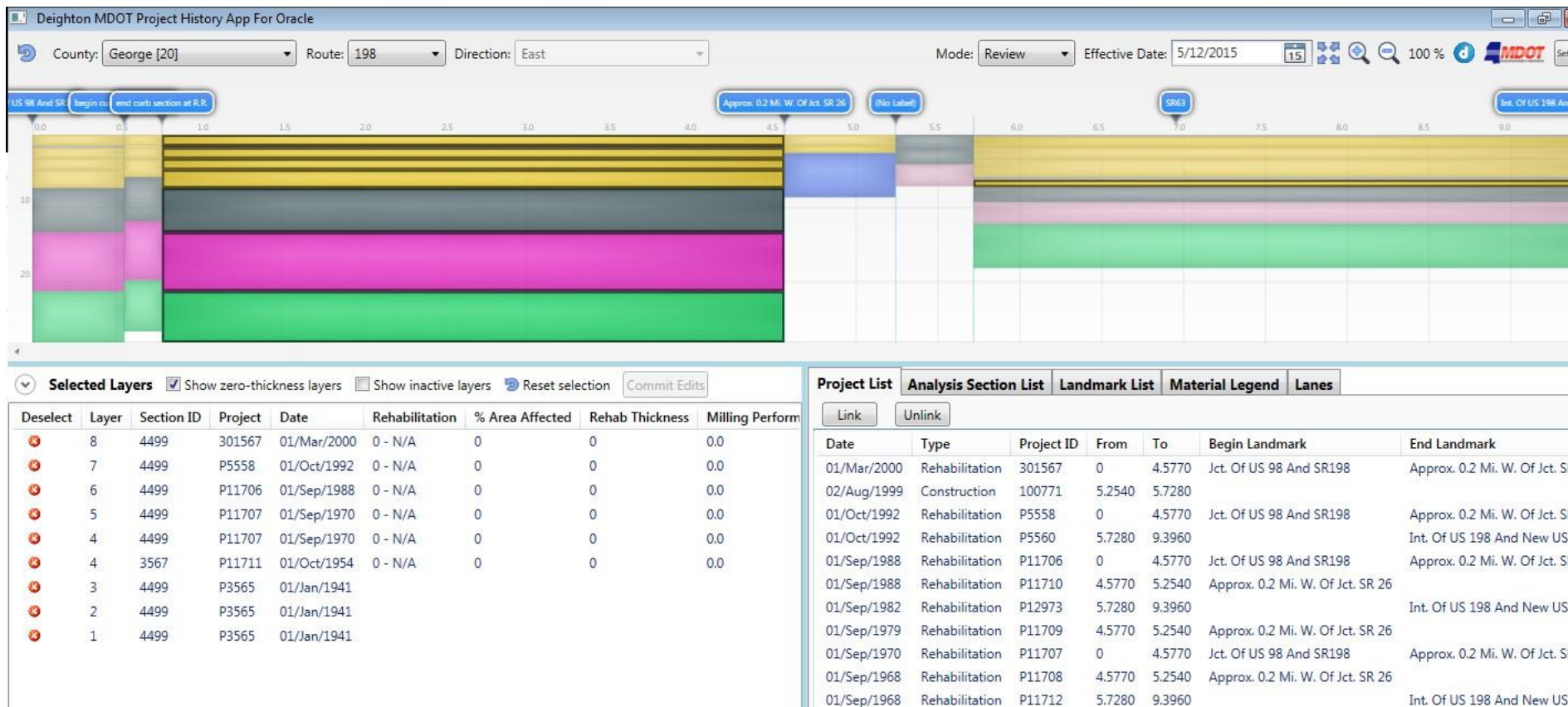
VARIABLE LENGTH SEGMENTS



FIXED PROJECT LENGTH SEGMENTS

VS.

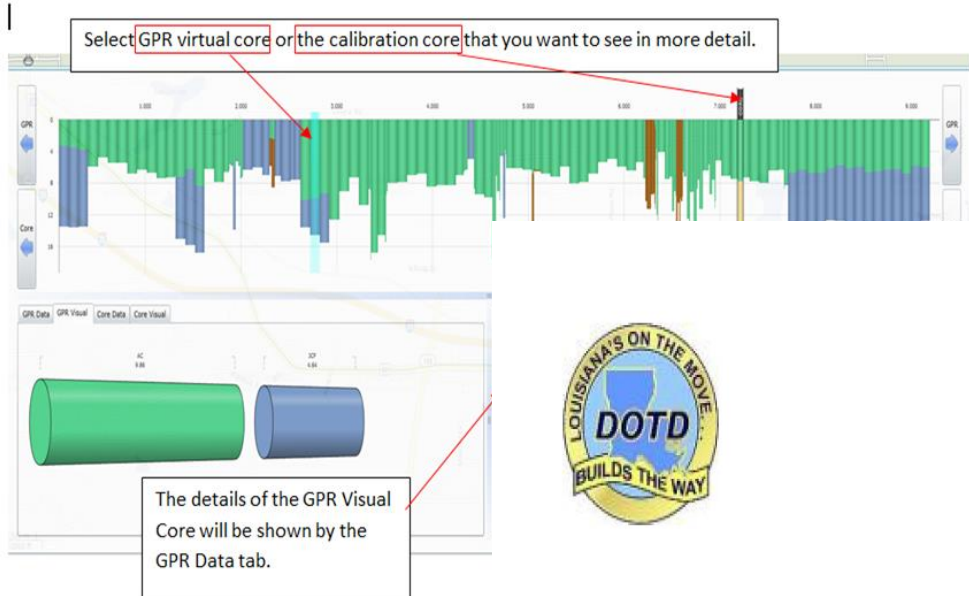
VARIABLE LENGTH SEGMENTS



FIXED PROJECT LENGTH SEGMENTS

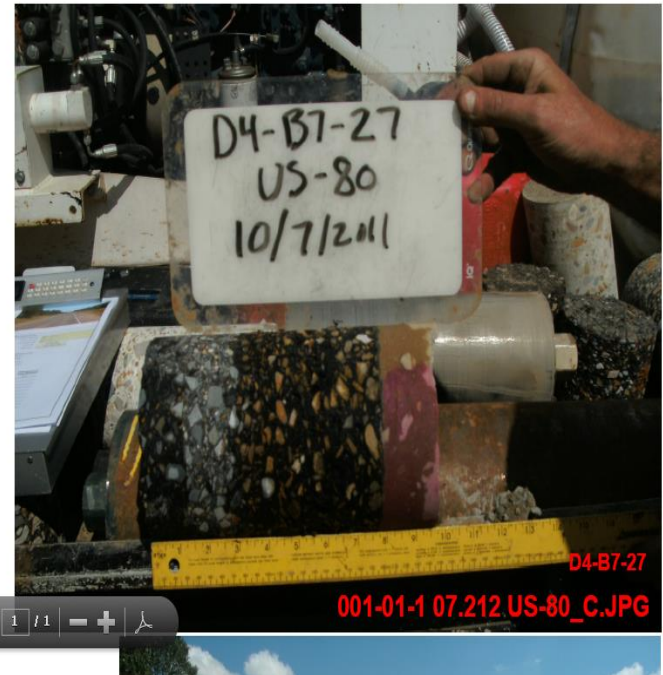
VS.

VARIABLE LENGTH SEGMENTS



Coring Log

Parish	Caddo	
Control Section	001-01	1 - Primary
Date Cored	10/7/2011	
Highway	US-80	
CSLM	7.212	
Nearest Town	Flournoy	
Lane Direction	East	



THE NEXT 30 YEARS

- 20th International Conference on Managing Pavement Assets in 2045
 - Web Based Enterprise Wide Solutions
 - Seamless data integration
 - Increased Performance Measures
 - New Performance Prediction Technologies
 - New Optimization Technologies