

Integrating Preservation into Pavement Management System Decision Making and Analysis

An Implementation Case Study for
New Mexico Department of Transportation



Presented by:
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NMDOT PMS Configuration Team

- Gathered Committee of Experts from Around the Agency
 - Materials
 - Engineering
 - Maintenance
 - IT
- Brought KEI On Board to Steer Process and Provide Expert Knowledge of Pavements and Software Configuration

NMDOT PMS Configuration Tasks

- Defining Management Sections (LRS)
- Attribute and Condition Data
- Distress and Index Definitions
- Treatments and Repair Strategies
- Decision Trees and Processes
- Performance Modeling
- Optimization Analysis Criteria

NMDOT PMS Incorporating Preservation

- Committee Made it Clear that Pavement Preservation was Top Priority for Agency
- Important that PMS Incorporates Treatment Selections with Proper Timing for Preservation
- Preservation, Preventive, and Maintenance Treatments needed to Add Life to Pavements in Configuration
- Fog Seals, Patching, and Crack Sealing Had to be Included in Analysis Treatment Selections

Pavement Distresses

Collecting Appropriate Condition
Data to Trigger Pavement Repairs

Distresses Collected by Pavement Type

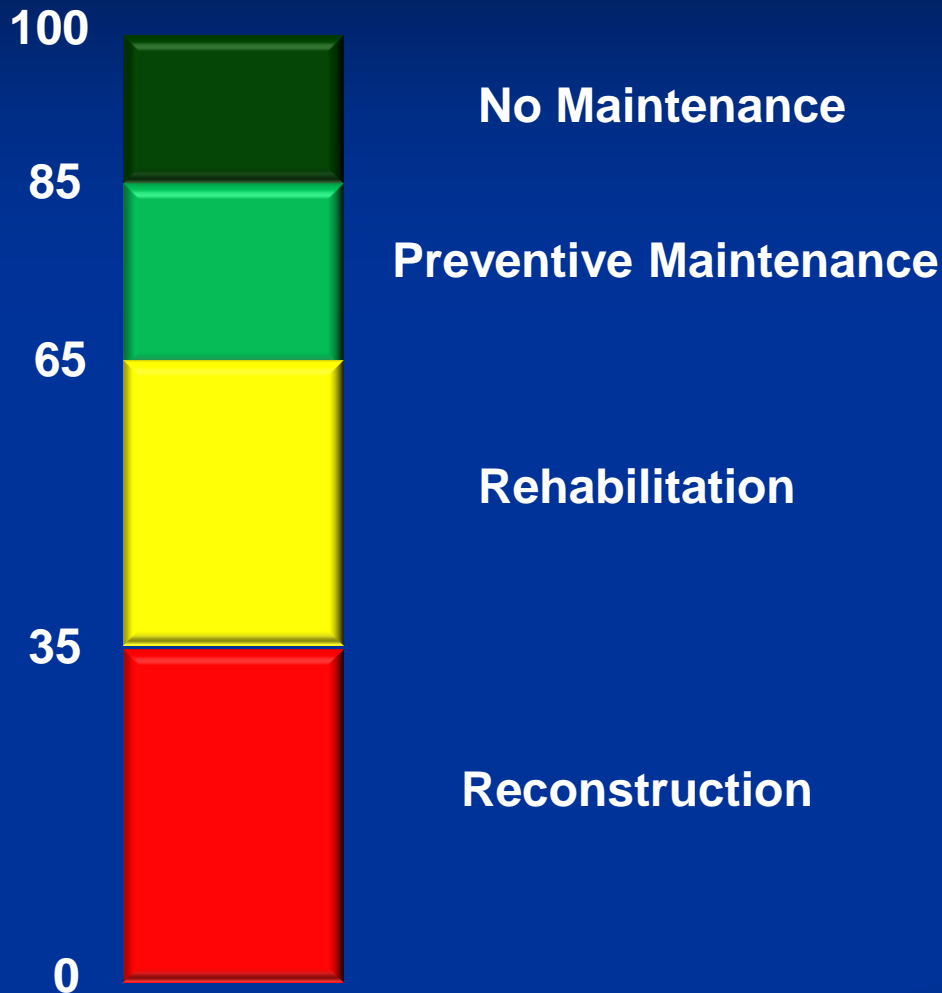
Flexible Pavements*	Rigid Pavements
Alligator Cracking	Corner Breaks
Transverse Cracking	Faulting
Edge Cracking	Joint Seal Damage
Longitudinal Cracking	Lane/Shoulder Drop-off
Block Cracking	Longitudinal Cracks
Patching	Patch Deterioration
Bleeding	Spalling of Joints & Cracks
Weathering & Raveling	Transverse & Diagonal Cracks

- *Reviewing Flexible setup due to time constraints

Condition Indexes

Converting Condition Data into Decision Variables for Triggering Treatments

Overall Condition Index



Problem:

- Single Index Only Provides a General Indicator of Overall Health

Questions:

- What Distresses are Present?
 - Severities and Extents?
- What Repair(s) Is Required?
- Reasonable Cost of Repair?

Treatment Selection Indexes

Individual Index

Alligator Cracking

Edge Cracking

Potholes/Patching

Transverse Cracking

Block Cracking

Oxidation/Raveling

Skid

Rutting

Ride Quality

Combined Index

Structural Index

Environmental Index

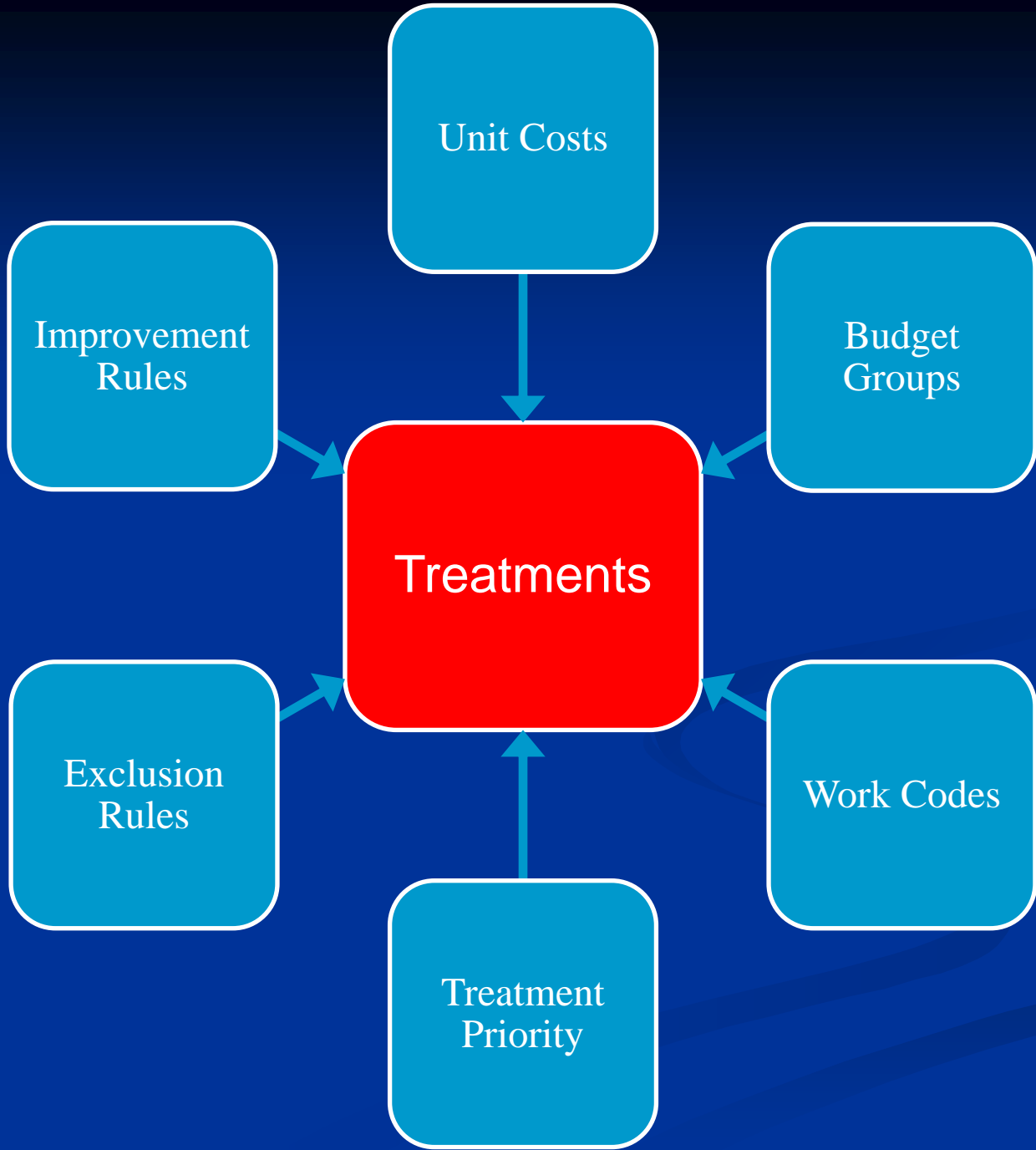
Functional Index

Preservation Targeting

Condition

Treatment

Treatments and Repair Strategies



Treatments & Repair Categories

Flexible Repair Category	Treatment
0 - Monitor	0 - Monitor
F1 - Preventative	F1A - Crack Seal F1B - Fog Seal
F2 - Patch	F2 - Patch
F3 - Preservation (Minor)	F3A - Scrub Seal F3B - Chip Seal F3C - Slurry Seal F3D - Cape Seal F3E - OGFC F3F - Micro Surfacing F3G - Plant Mix Wearing Course overlay – Nova Chip
F4 - Preservation (Major)	F4A - Pavement Resurfacing and Curb line milling Cutler (1.5" to 2.5") F4B - Hot In-Place Recycling (Remixing) (1.5" to 2.5") F4C - Hot In-Place Recycling (Heater Scarification) (1.5" to 2.5") F4D - Cold Mill Asphalt Recycling (Warm or Cold) F4E - HMA/WMA Mill and Inlay (1.5" to 2.5") F4F - SMA Mill and Inlay (1.5" to 2.5")
F5 - Rehabilitation (Minor)	F5A - HMA/WMA Mill and Inlay 2.5" to 4" F5B - Hot In-Place Recycling (Remixing) (2.5" to 4") F5C - Hot In-Place Recycling (Heater Scarification) (2.5" to 4") F5D - Pavement Resurfacing and Curb line milling Cutler (2.5" to 4") F5E - HMA/WMA Overlay 2.5" to 4" F5F - SMA Mill and Inlay (2.5" to 4.0")
F6 - Rehabilitation (Major)	F6A - HMA/WMA Mill and Inlay greater than 4" F6B - Hot In-Place Recycling (Remixing) greater than 4" F6C - Hot In-Place Recycling (Heater Scarification) greater than 4" F6D - Pavement Resurfacing and Curb line milling Cutler greater than 4" F6E - HMA Overlay greater than 4" F6F - Process Place and Compact W/Overlay F6G - Full Depth Reclamation (FDR)
F7 - Reconstruction	F7 - Reconstruction

Preservation Treatments

Flexible Repair Category	Treatment
F1 - Preventative	F1A - Crack Seal F1B - Fog Seal
F2 - Patch	F2 - Patch
F3 - Preservation (Minor)	F3A - Scrub Seal F3B - Chip Seal F3C - Slurry Seal F3D - Cape Seal F3E - OGFC F3F - Micro Surfacing F3G - Plant Mix Wearing Course overlay – Nova Chip
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Condition Index Improvements by Repair Category

Indexes	Prevent.	Patch	Pres. (Minor)	Pres. (Major)	Rehab. (Minor)	Rehab. (Major)	Recon.
Structural	Add 0	Add 10	Add 5	Add 15	Add 40	Add 60	Reset to 100
Environmental	Add 10	Add 0	Add 10	Add 30	Add 50	Reset to 100	Reset to 100
Safety	Add 0	Add 0	Reset to 100	Reset to 100	Reset to 100	Reset to 100	Reset to 100
Roughness	Add 0	Add 0	Add 5	Reset to 100	Reset to 100	Reset to 100	Reset to 100

Treatment Timing is Everything

There is a most Beneficial and Cost-effective Treatment for every Pavement Condition

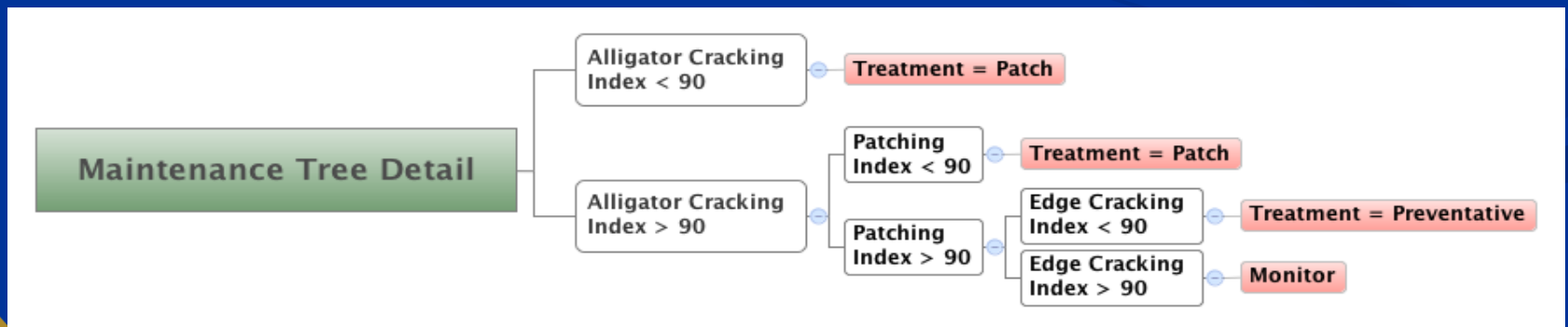
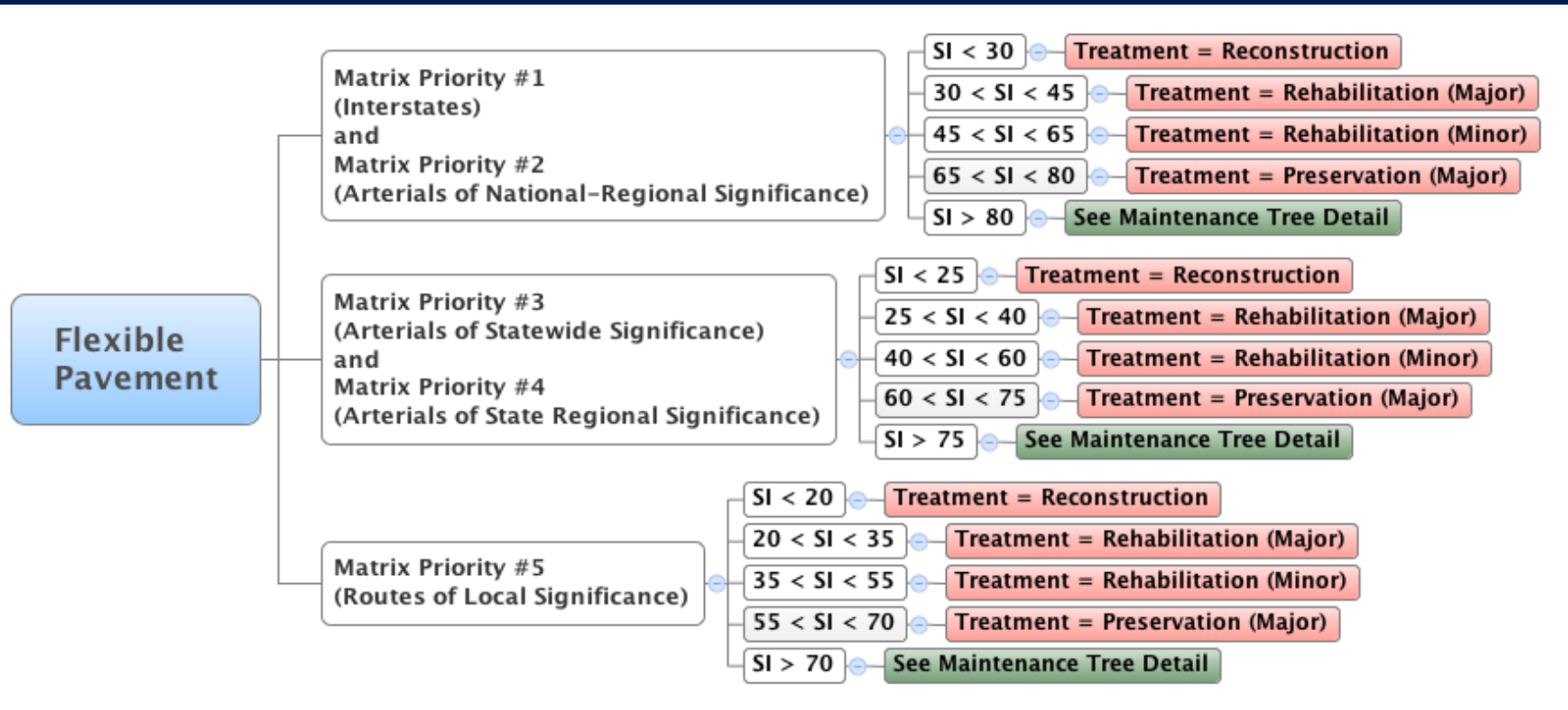


Decision Trees

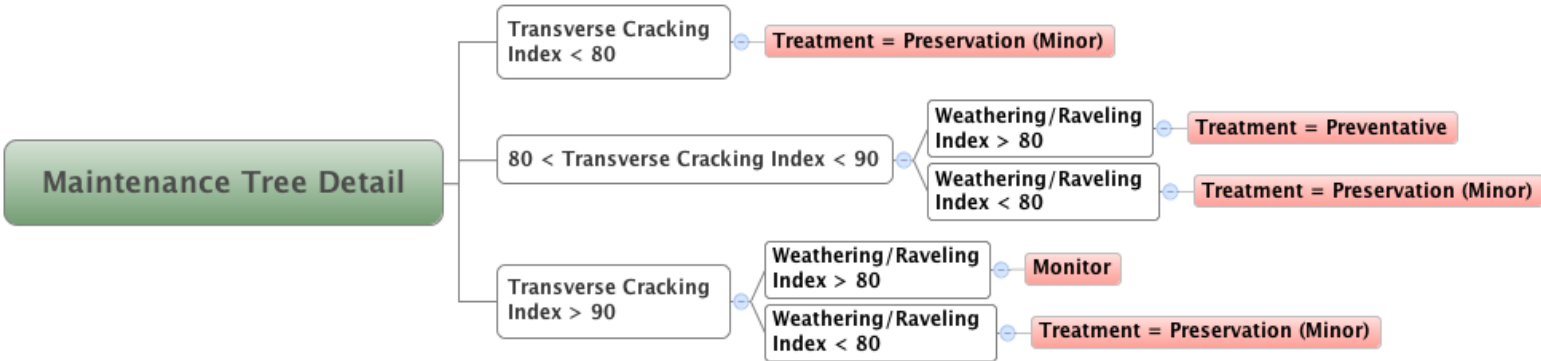
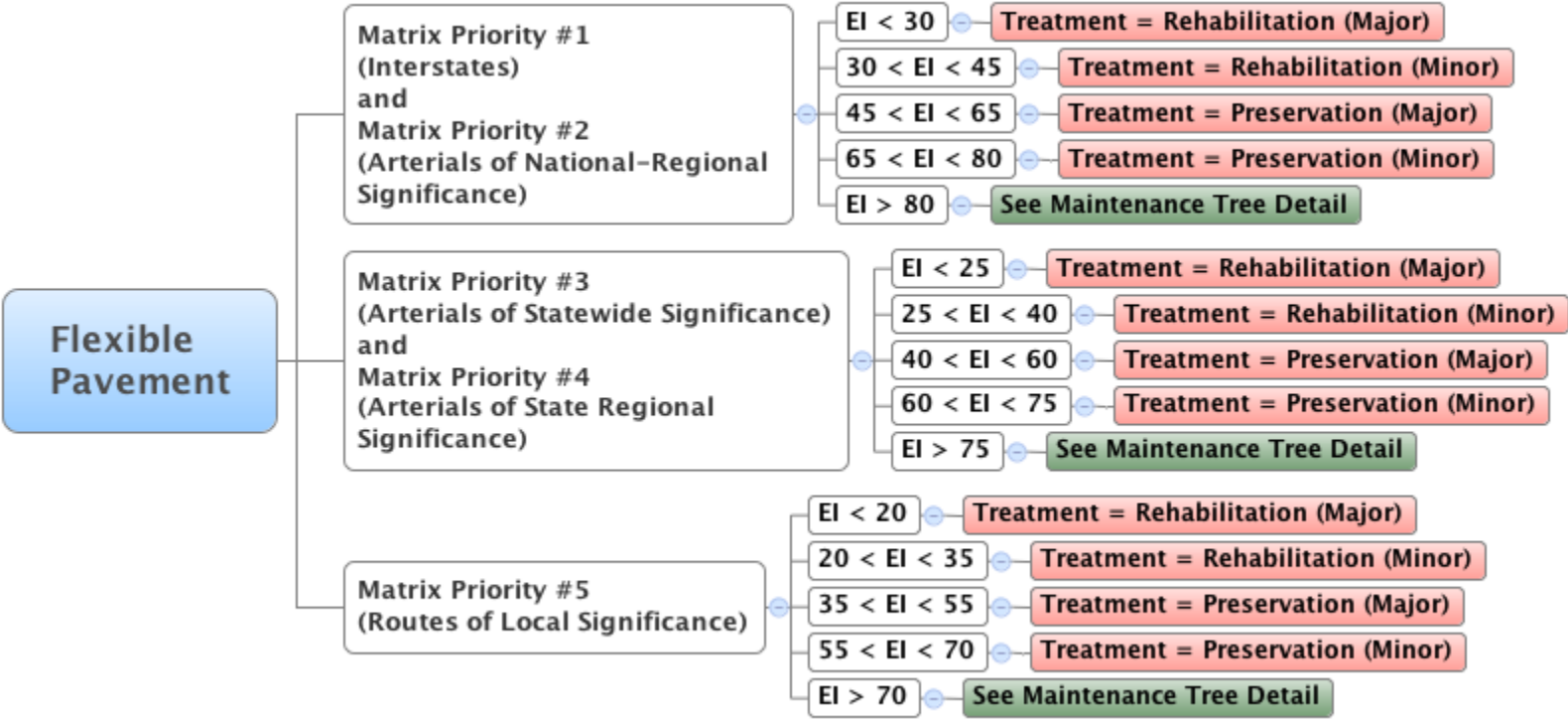
Purpose:

Right Treatment, Right Place, Right Time

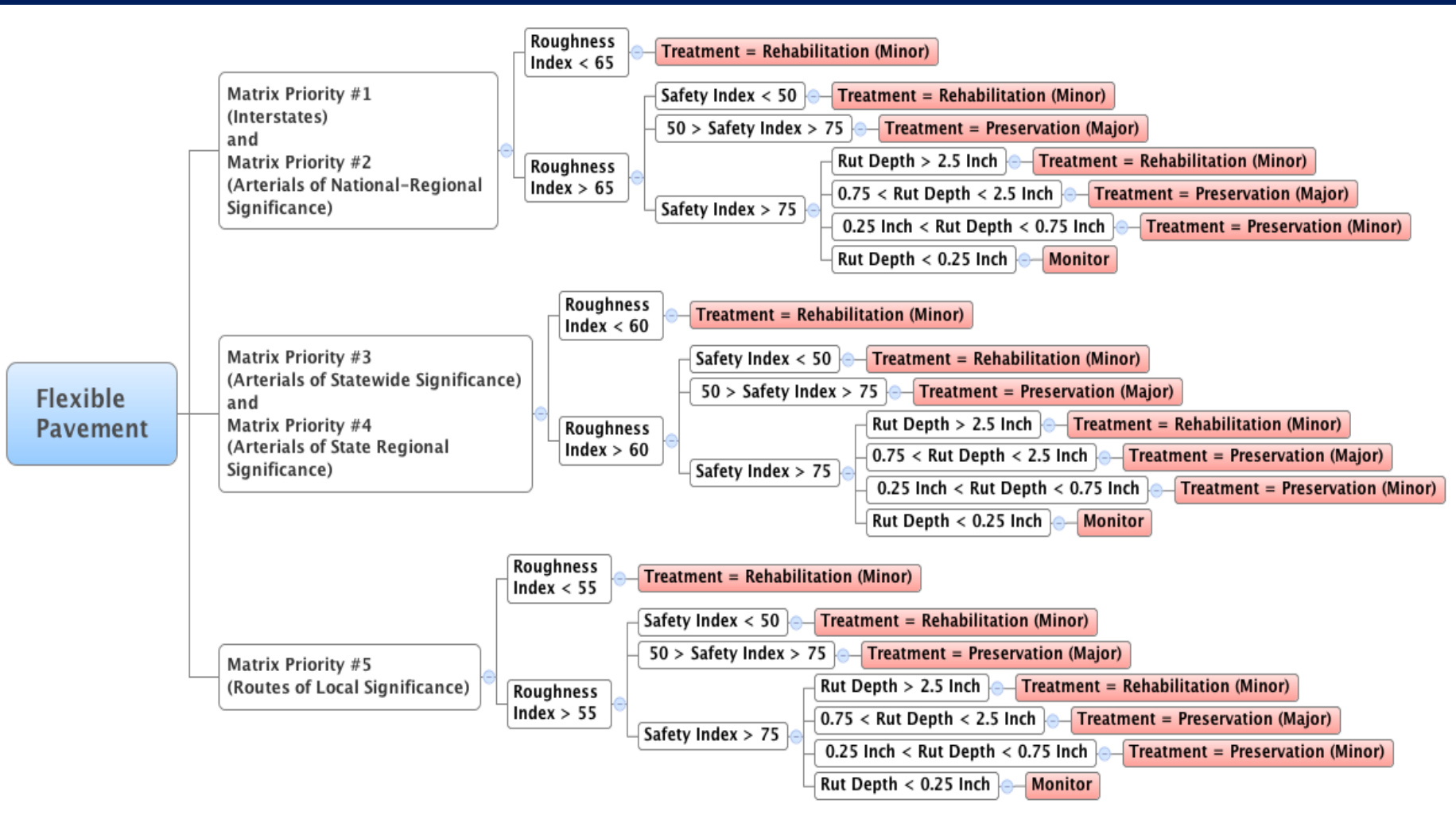
Structural Decision Tree



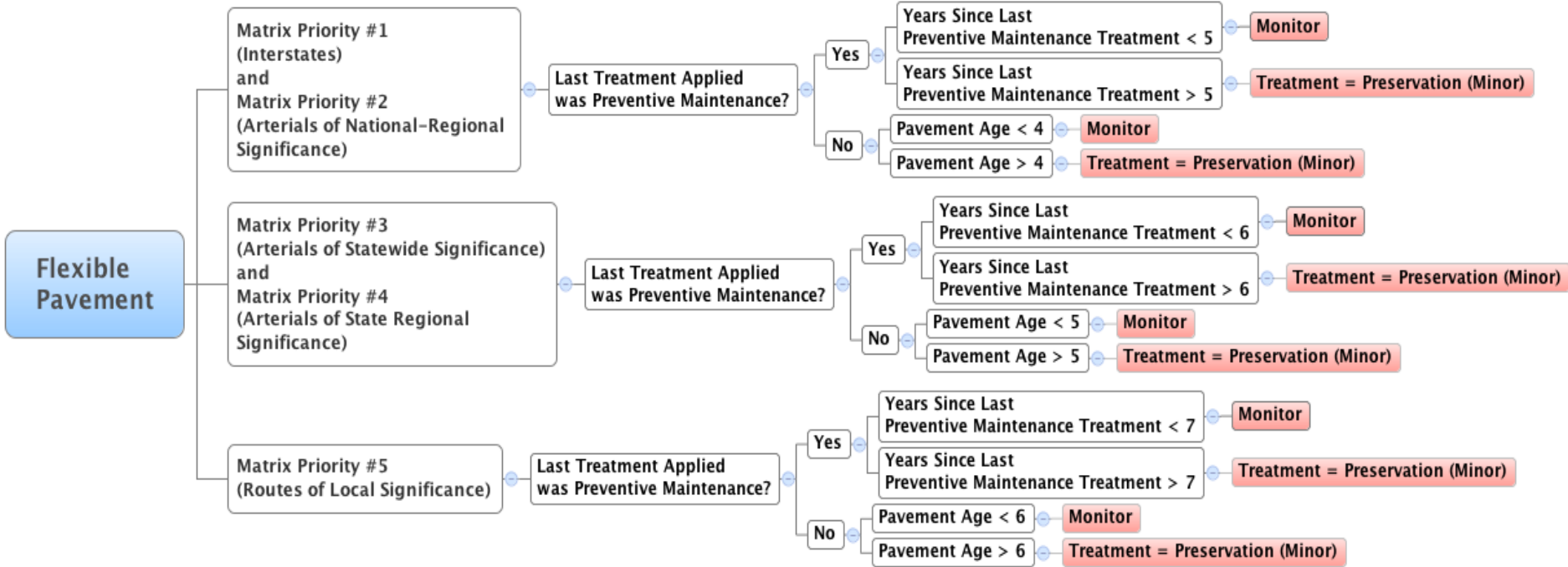
Environmental Decision Tree



Functional Decision Tree



Pavement Age Decision Tree

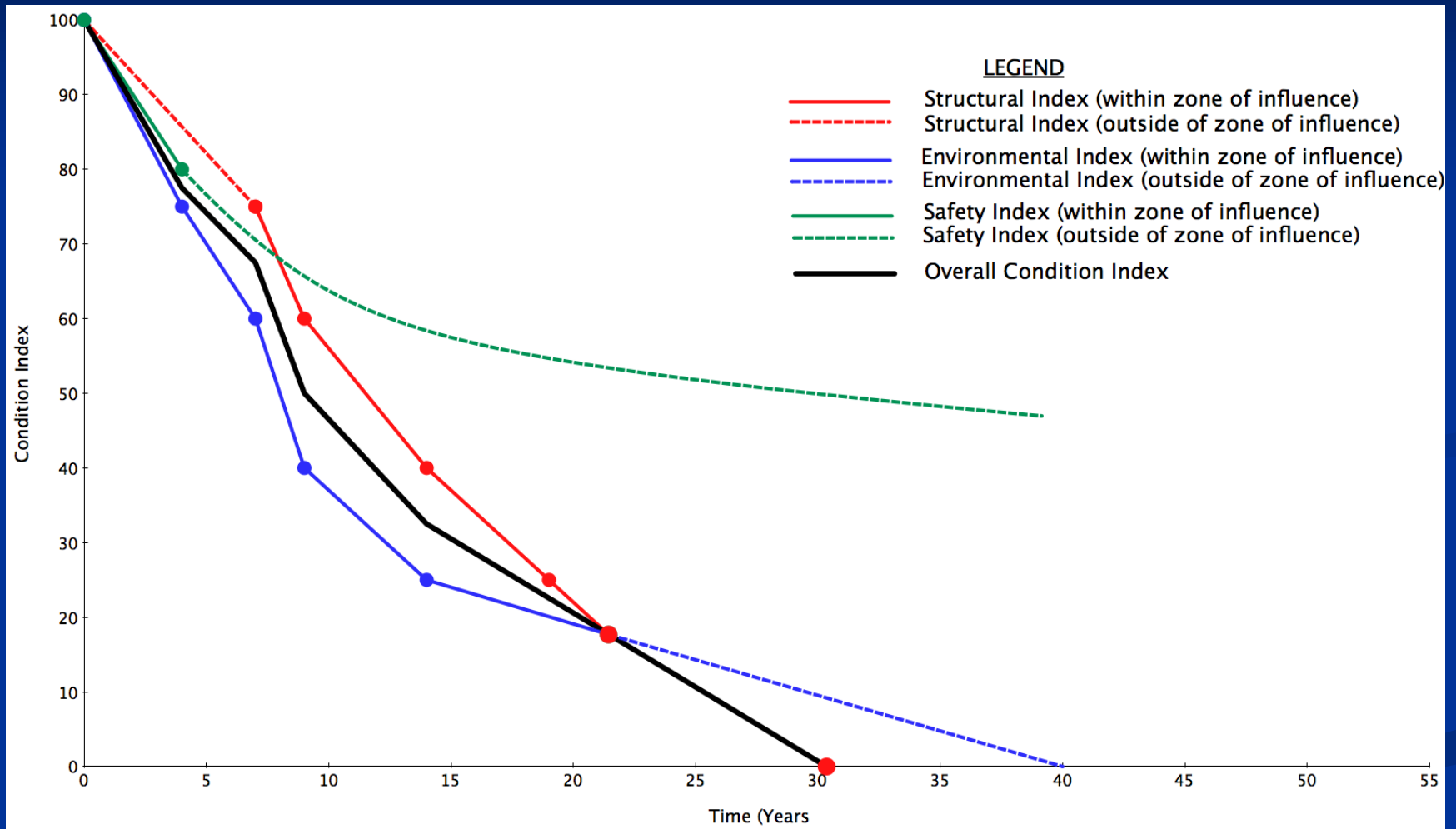


Performance Models

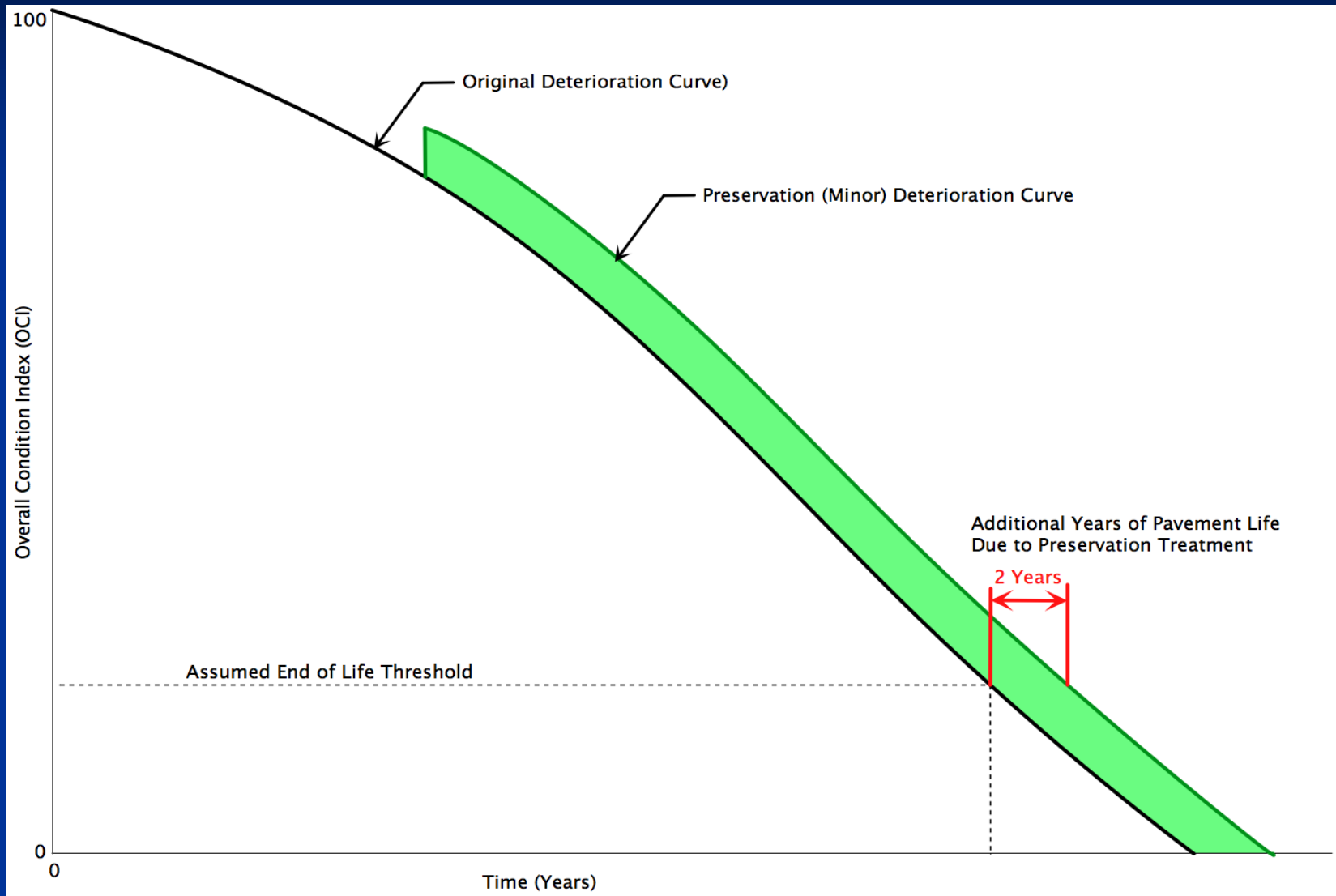
Purpose:

**Define Treatment Life and Benefit
(Reviewing Preservation Only)**

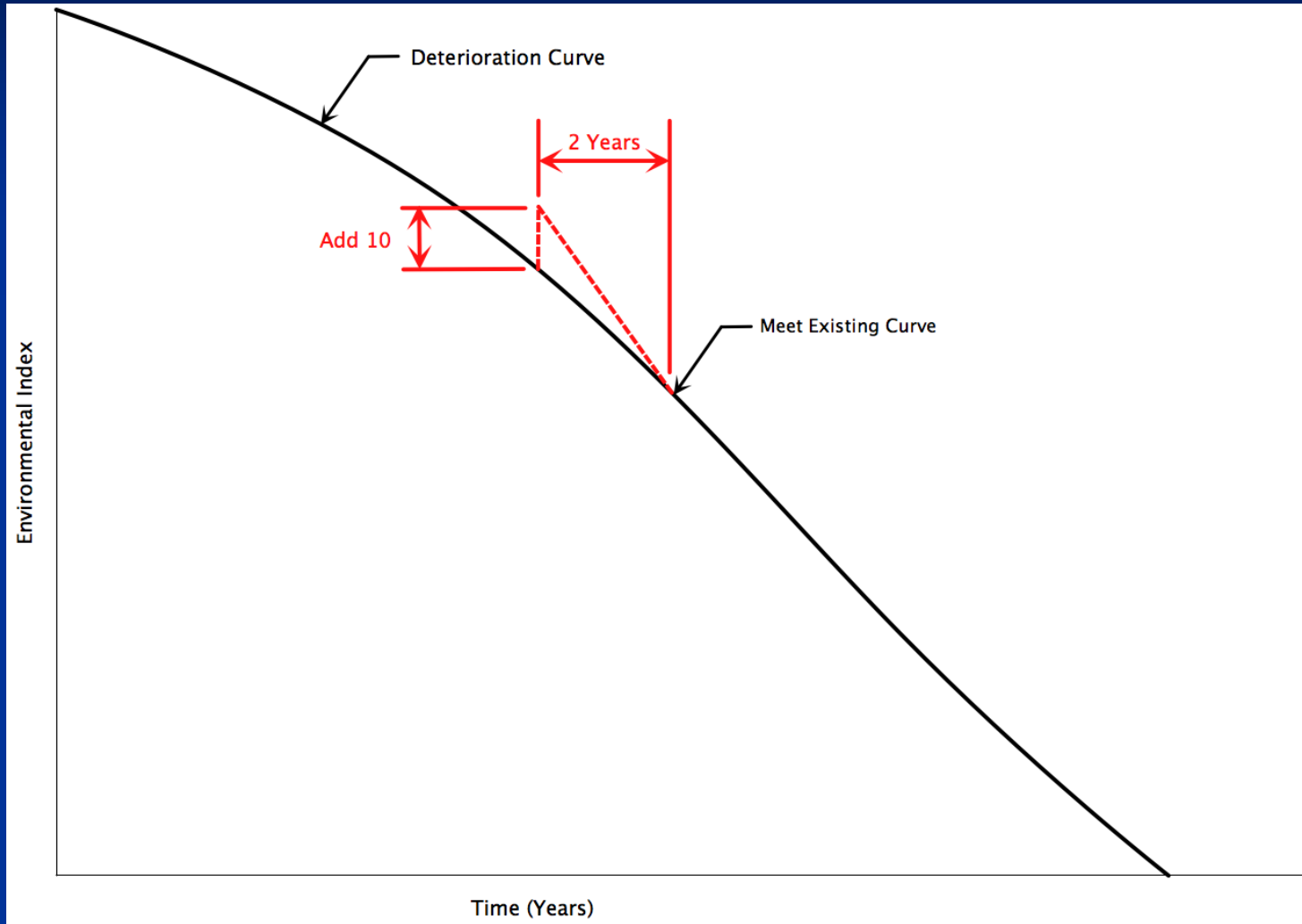
Preservation (Major) Models



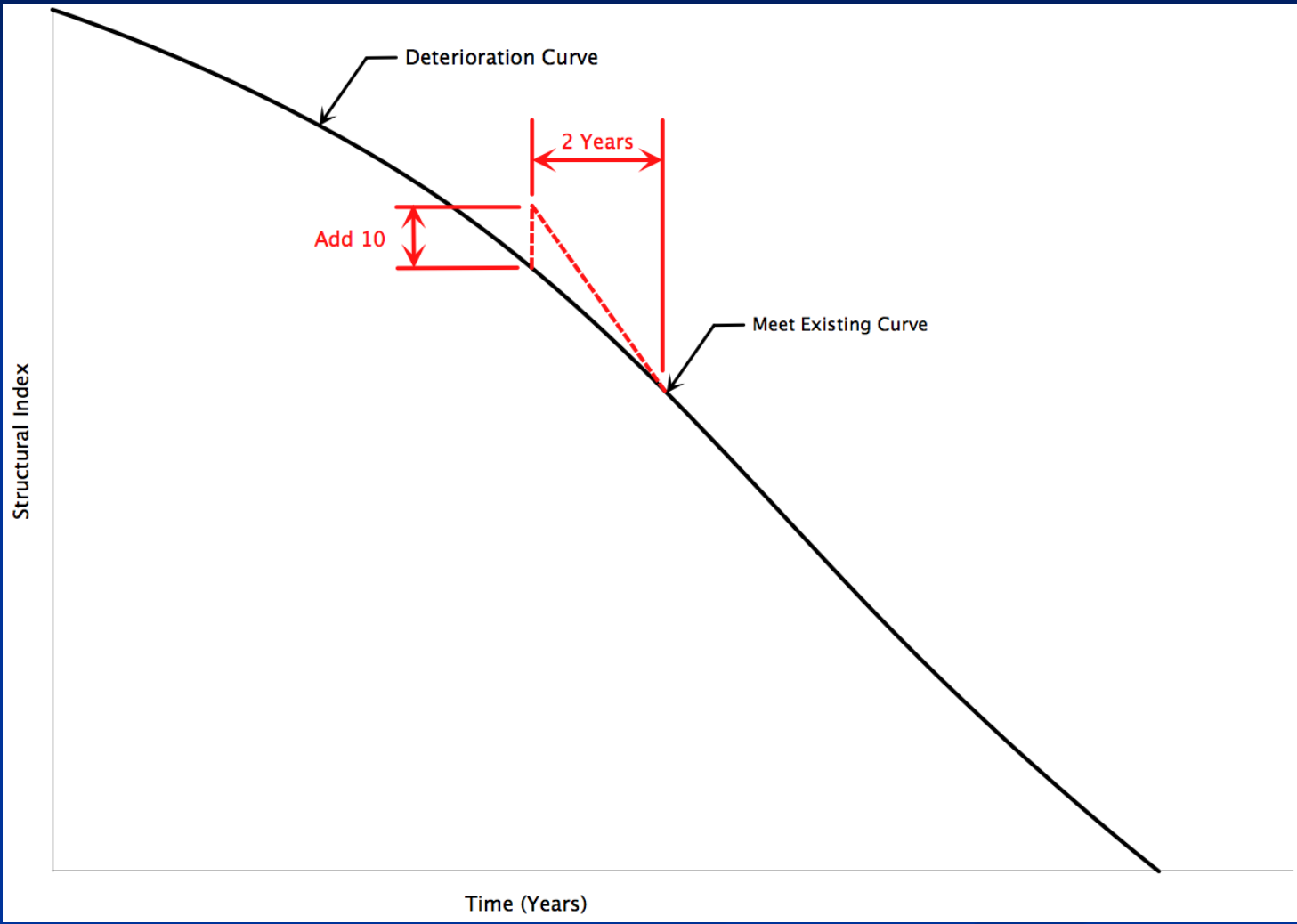
Preservation (Minor) Model



Crack Seal Model

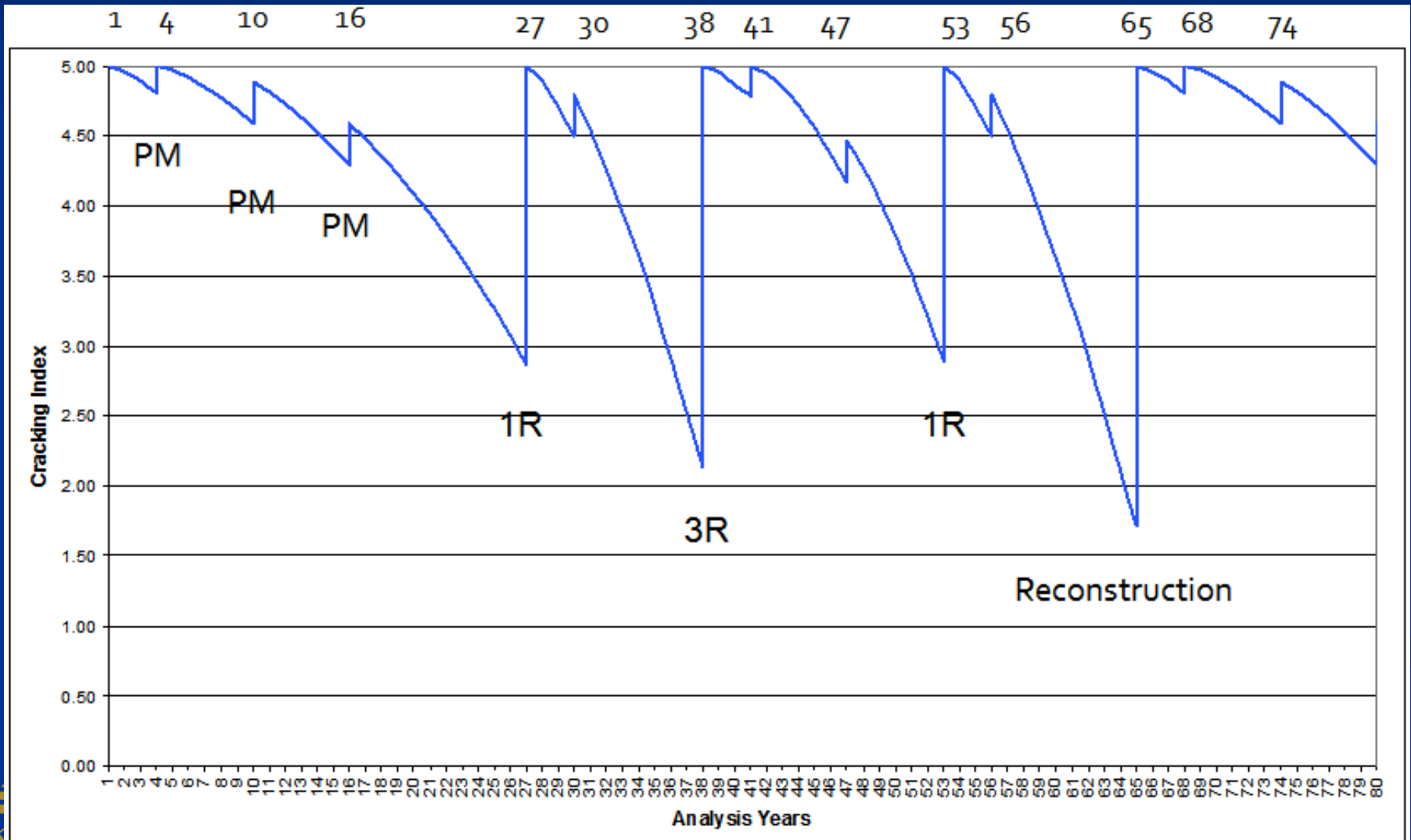


Patching Model



Life Cycle Treatment Rules

If Funded when Conditions Reach Threshold Values

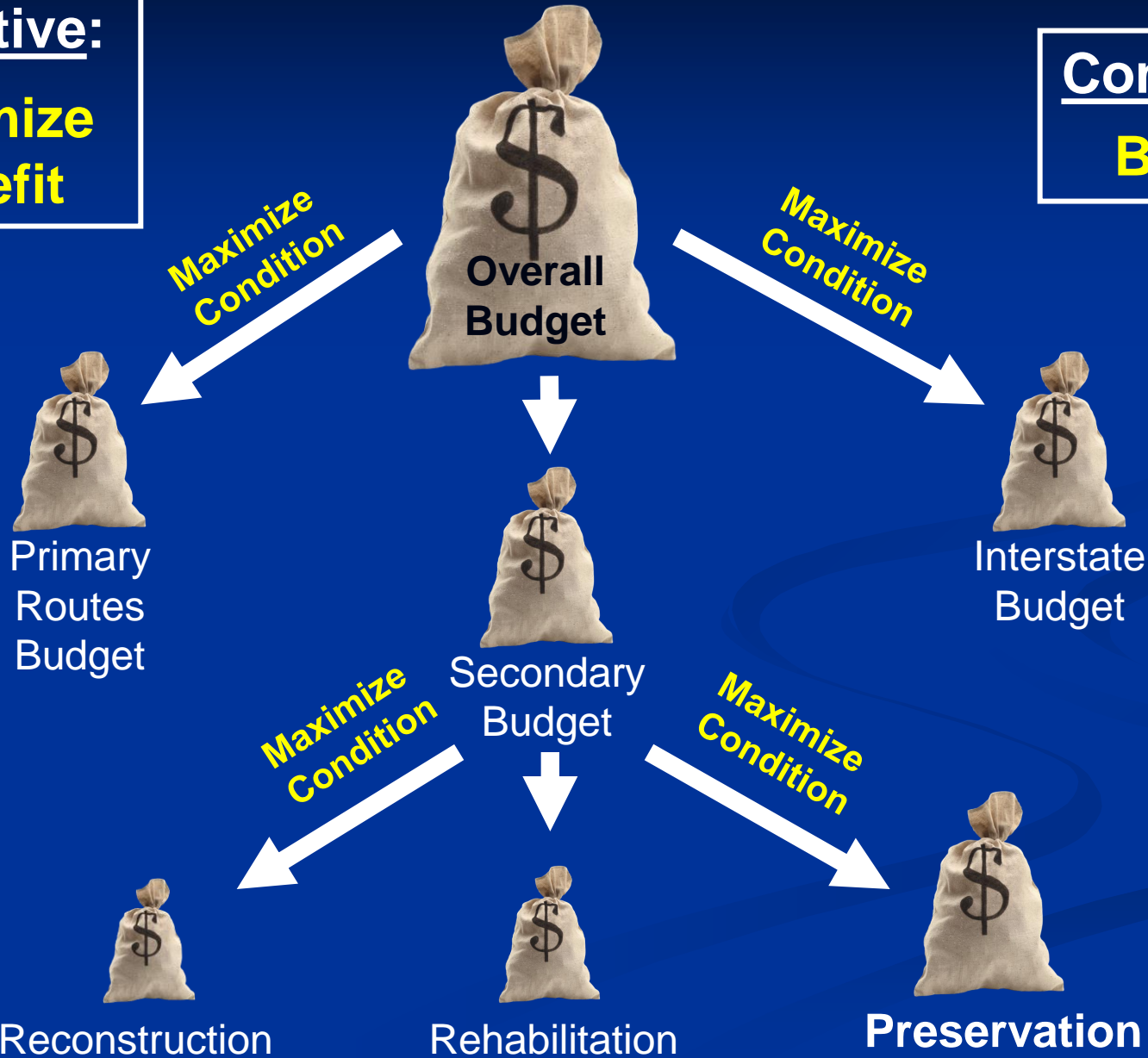


Multi-Constraint Optimization Analysis

Multi-Constraint Optimization Analysis

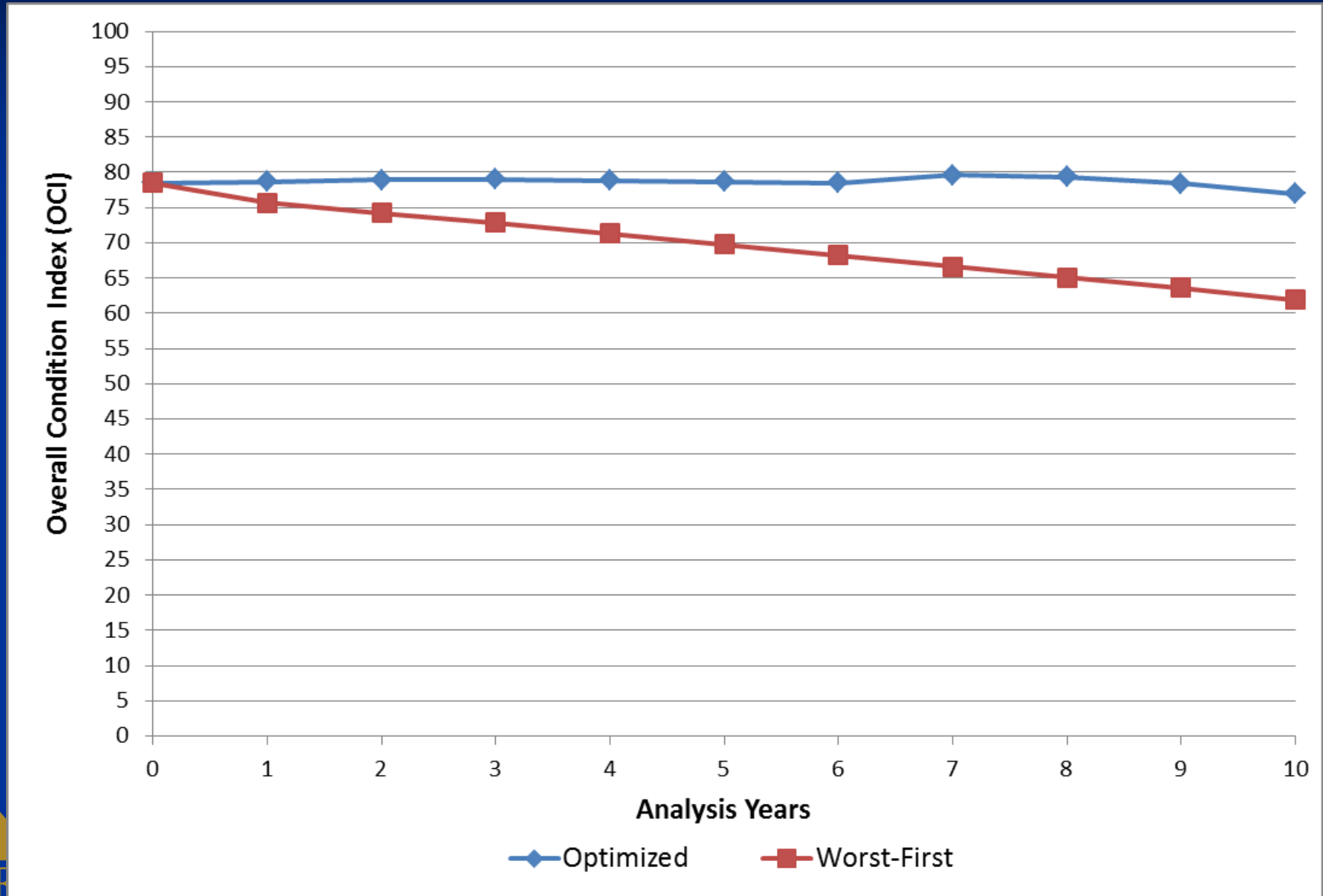
Objective:
**Maximize
Benefit**

Constraint:
Budget



Optimized vs. Worst-First Analysis

Why Choosing Preservation is Critical



Thoughts on Software Calibration

- Reconstruction and Major Rehabilitation Treatments are Easy
 - Typically Indexes Reset to 100
 - Thickness of Treatments removes most if not all Distresses
 - Agency has Good Historical Data available to Support Performance Predictions
- Preservation Treatments are more Complex
 - Indexes Increase but may not Reset to Perfect
 - Typically, performance of the Treatment is dependent on the previous Treatment
 - Performance is Absolutely Dependent on Existing Condition

NMDOT Moving Forward

- Transitioning from Manual Distress Surveys to Automated Surveys
- Linking Historical Construction Records with Pavement Performance
- Also Linking Pavement Design with Pavement Performance with MEPDG Dashboard
- More Analysis Testing to Ensure Configuration is Finely Tuned to Agency Expectations

Questions????

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