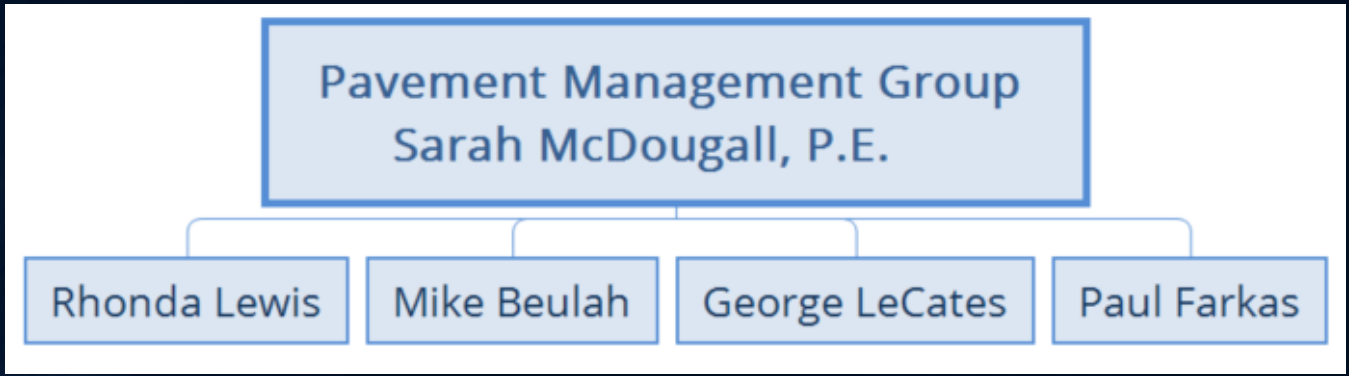
CURRENT PAVEMENT MANAGEMENT INITIATIVES OF DELAWARE DOT

February 14, 2018

Aaron D. Gerber, P.E.

DelDOT



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Background

- 1999: DelDOT begins implementing Pavement Management System (PMS)
- 2001: DelDOT goes live with PMS
- 1990-2007: Data Collection using Visual Survey
- 2007-2014: Data Collection using Semi-Automated
- 2014-Present: Data Collection using Fully-Automated
- 2014-Present: PMS Upgrades and Improvements

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List of Recent Initiatives

- Automated Data Collection
- Distress Index Calculation Improvements
- Management and Data Collection Sectioning config
- Suburban Streets Management
- Pavement Preservation Support
- Treatment Development
- Performance Models
- Decision Trees

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List of Recent Initiatives

- Data Governance
- Optimization Analysis Configuration
- Performance Measurements (Statewide and FHWA)
- Data Quality Management Plan
- Standard Operating Procedure (SOP) Development
- Executive Management

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Anatomy of DelDOT's Pavement Management System

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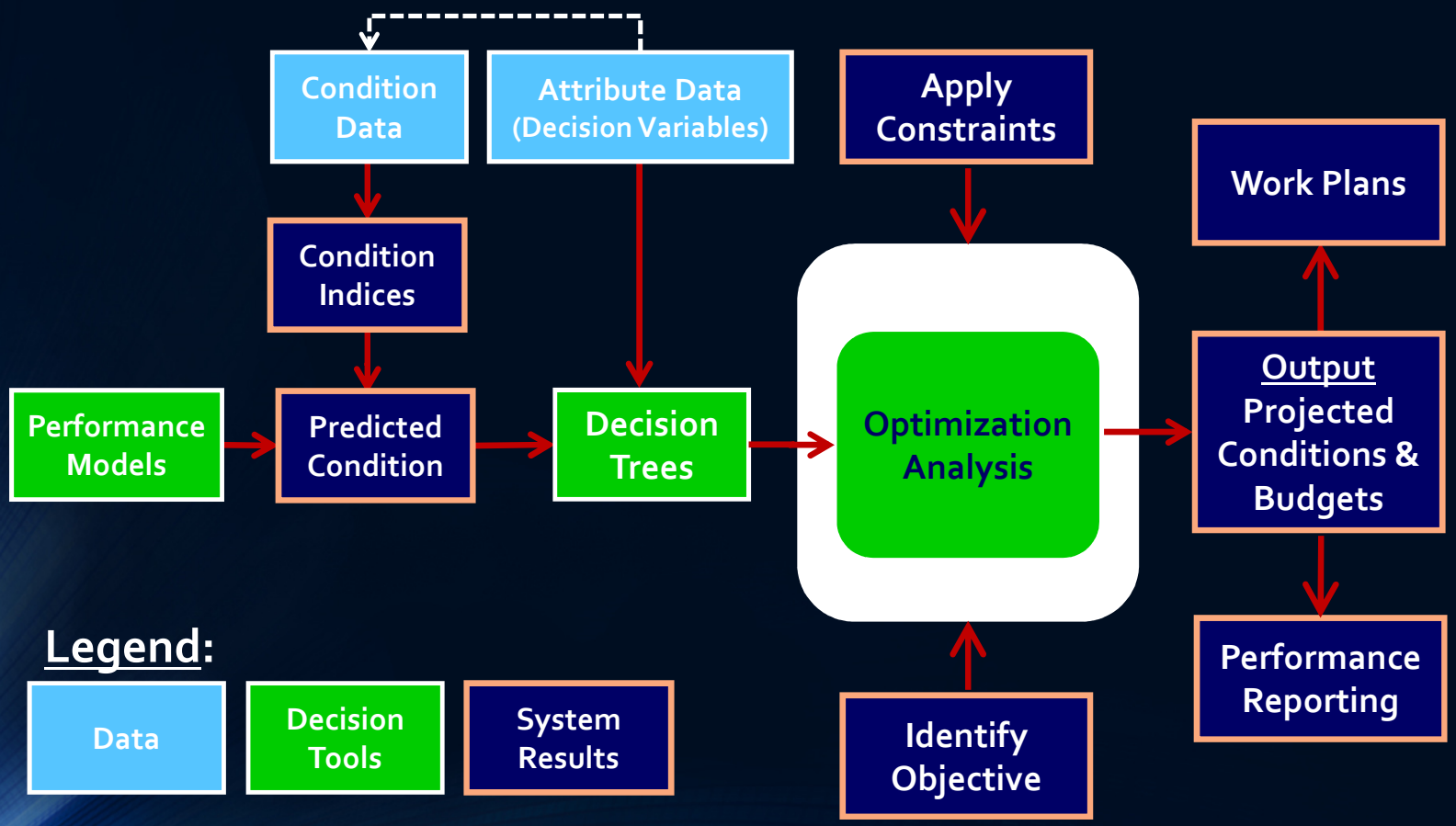
DelDOT PMS Diagram



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Data Collection Change: Visual Survey to Automated Detection

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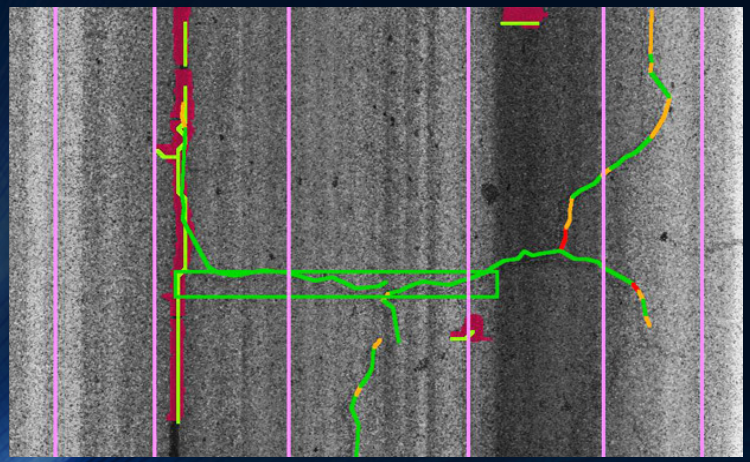
Automated Pavement Condition Data Collection



Courtesy: Mandli Communications

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Distress Index Calculations: Converting Raw Measurements to Decision Making Scores

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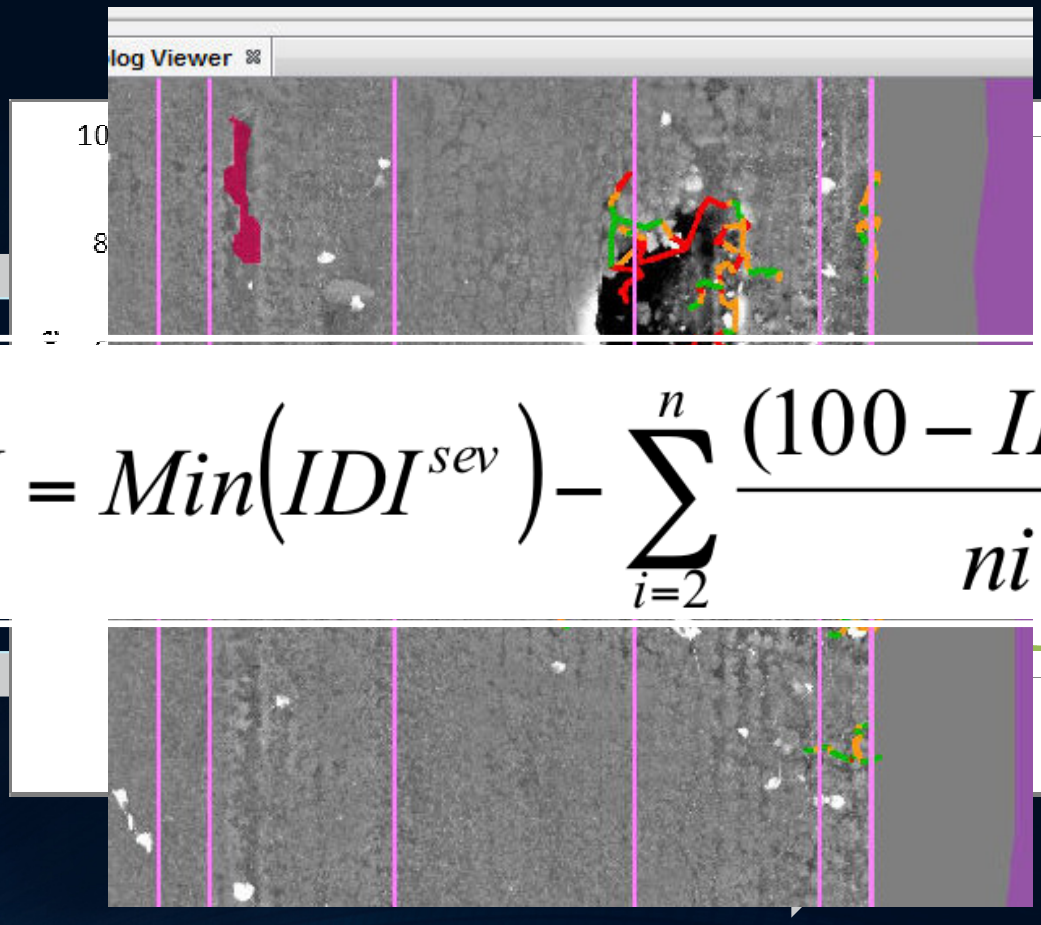
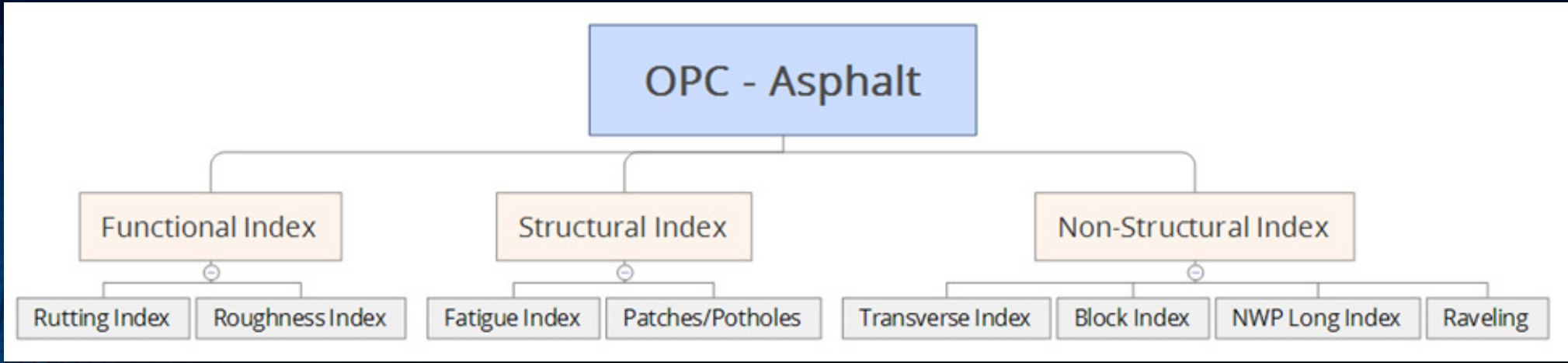
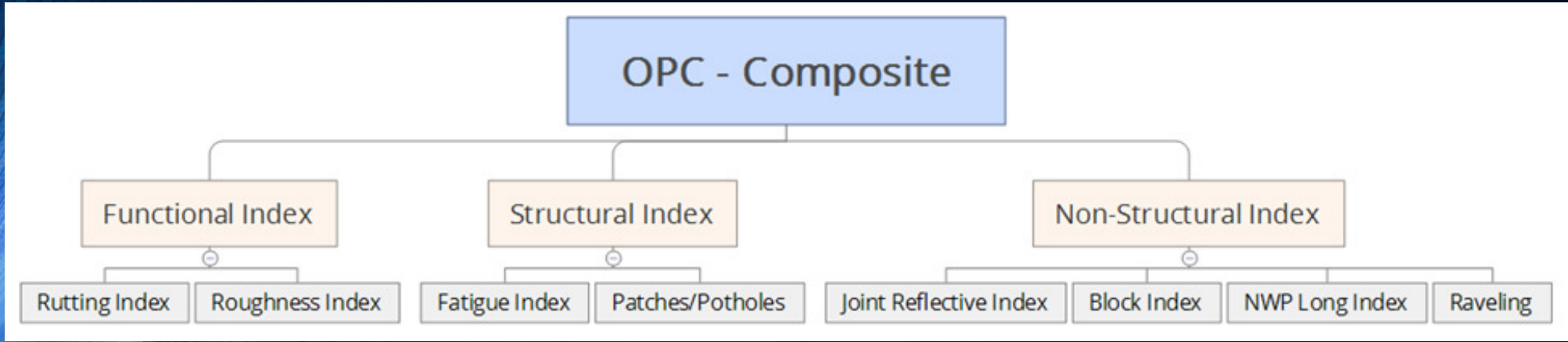
Data Conversion Process



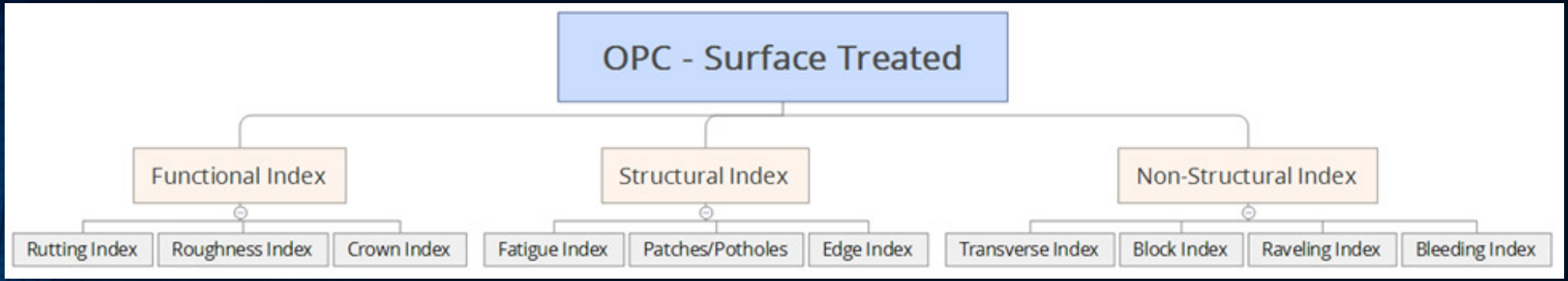
$$IDI = Min\left(IDI^{sev}\right) - \sum_{i=2}^{n} \frac{\left(100 - IDI_i^{sev}\right)}{ni}$$

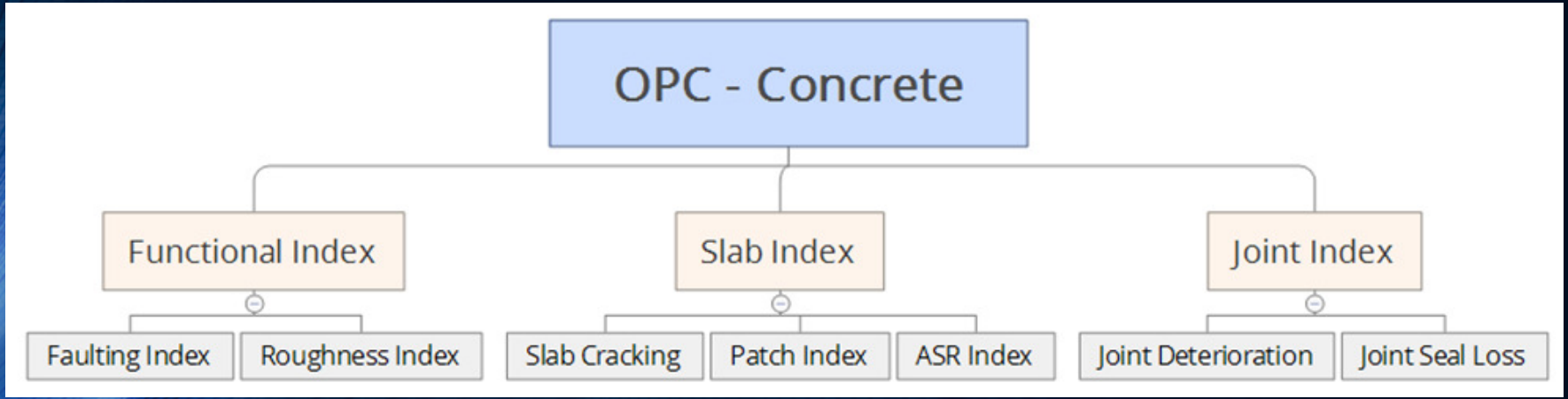
OPC Distress Index Structure





OPC Distress Index Structure





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Management and Data Collection Sectioning

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Management Sectioning

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Suburban Streets Management

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Suburban Streets Management

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Pavement Preservation Support

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Pavement Preservation Support

Crack Sealing

Patching

Microsurfacing

Scrub Seal

Cold In-Place Recycling

Full-Depth Reclamation

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Chip Seal Program

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Microsurfacing

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Rejuvenators

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Treatment Configuration

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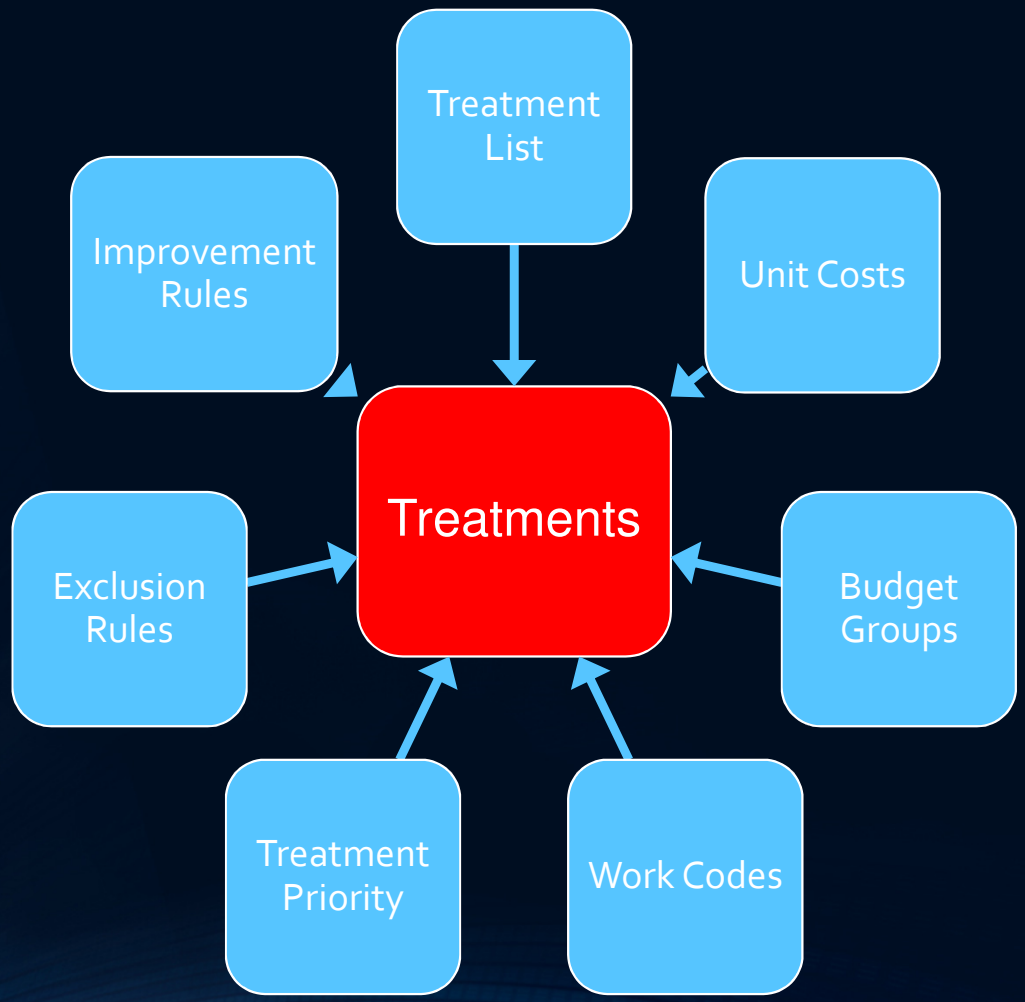
Treatment Configuration



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Treatment Configuration

Road Structure Category (RSC)	Treatment
	00 - Do Nothing
Crack Seal	01 - AC Crack Seal
Patching	03 - AC Patching
Preservation	15 – Microsurfacing
Rehabilitation (Functional)	04 - Functional Overlay
	06 – Mill and Overlay
	08 - AC Patch/Funct OL
Rehabilitation (Structural)	09 - Structural Overlay
	11 - AC Patch/Struct OL
	12 - Recycling
Reconstruction	13 - Reclamation
	14 - Reconstruct

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Performance Modeling

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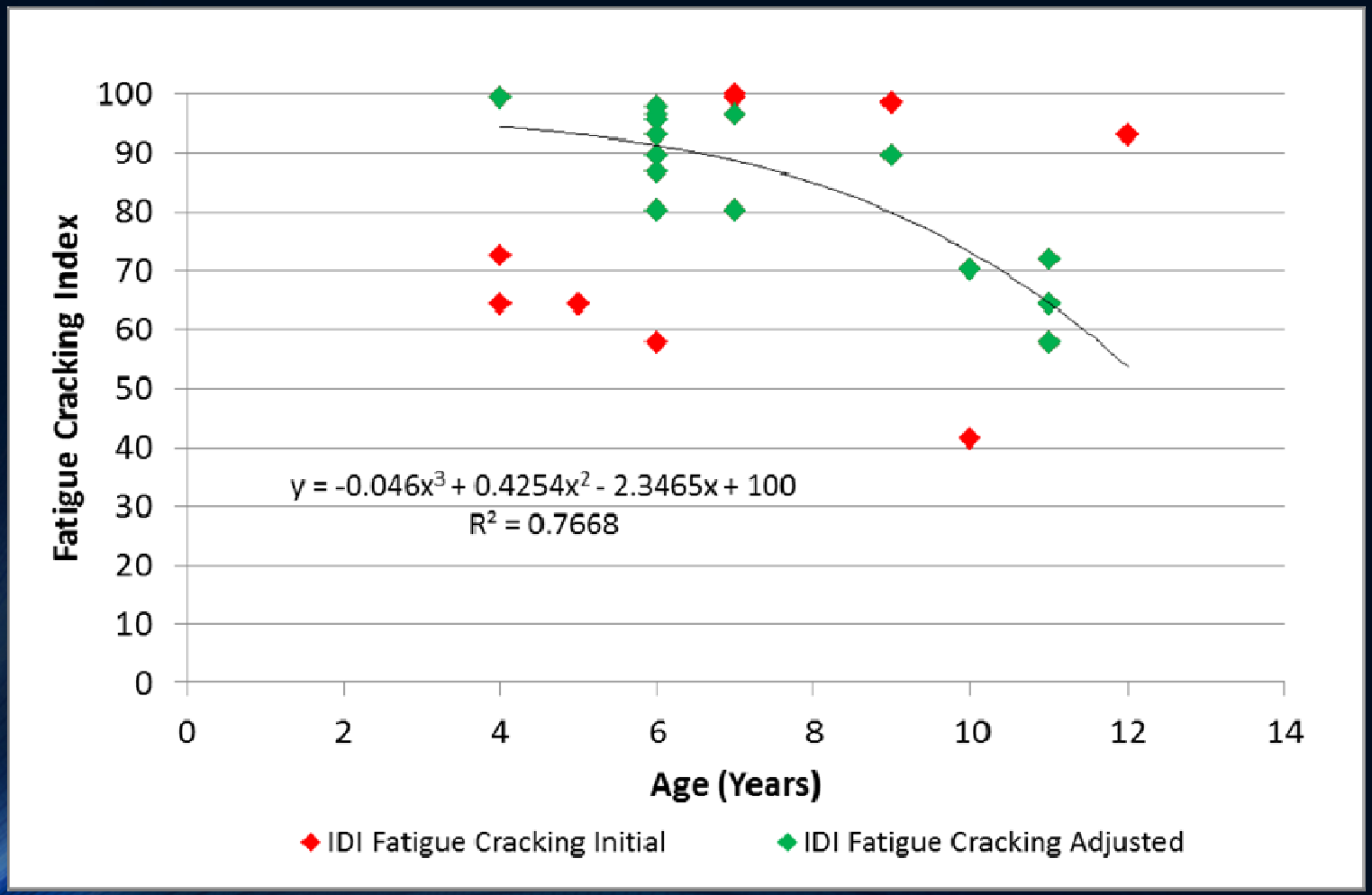
Performance Modeling



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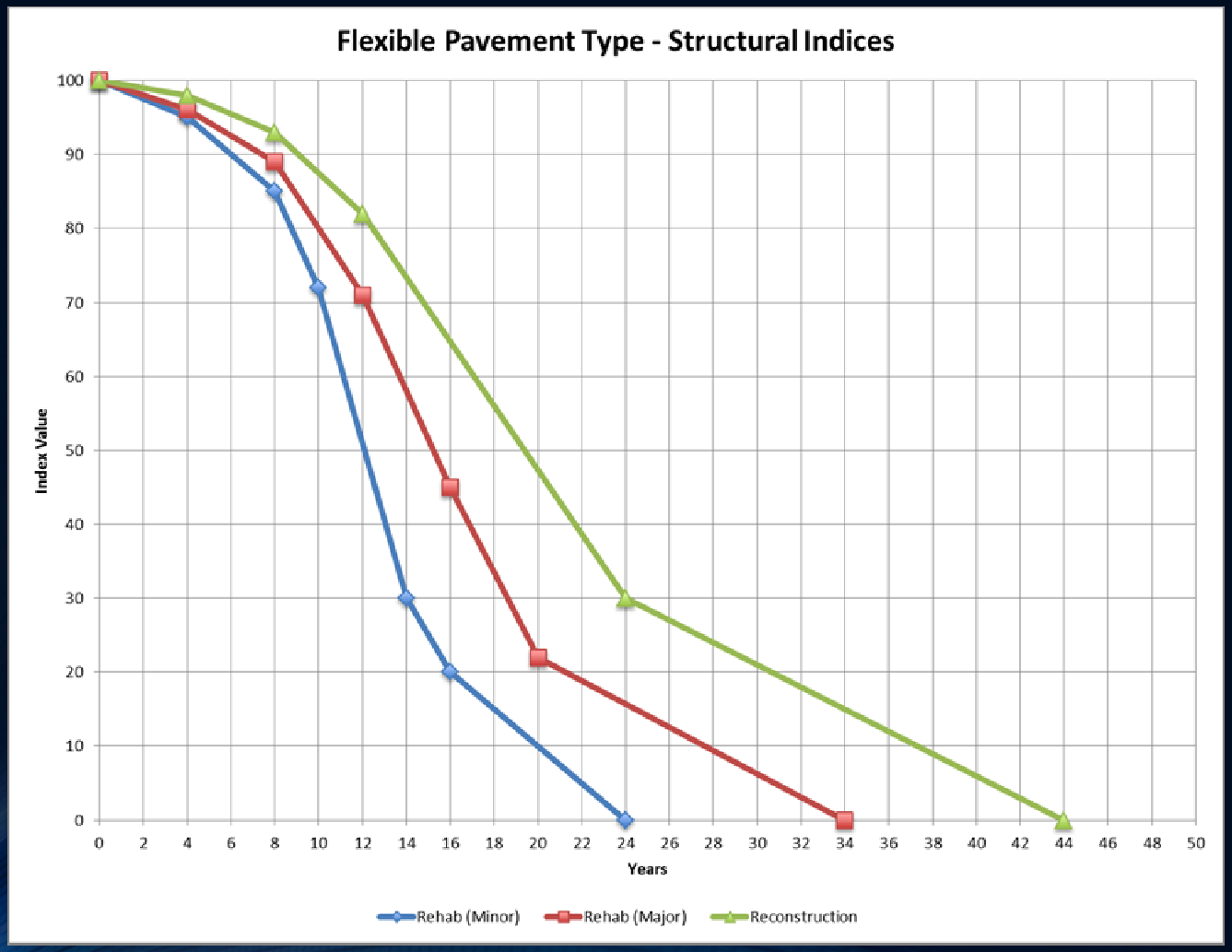
Performance Modeling



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Decision Modeling

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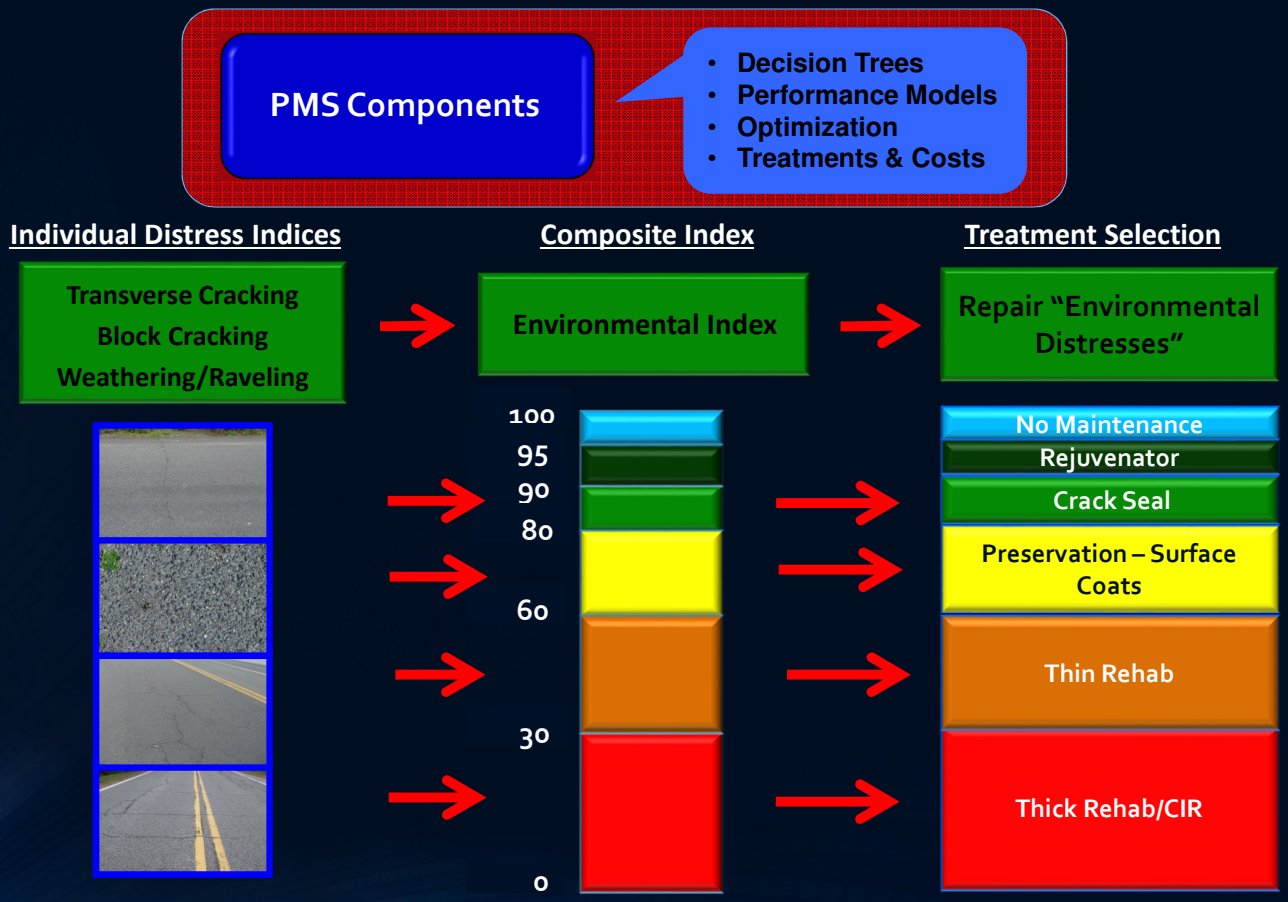
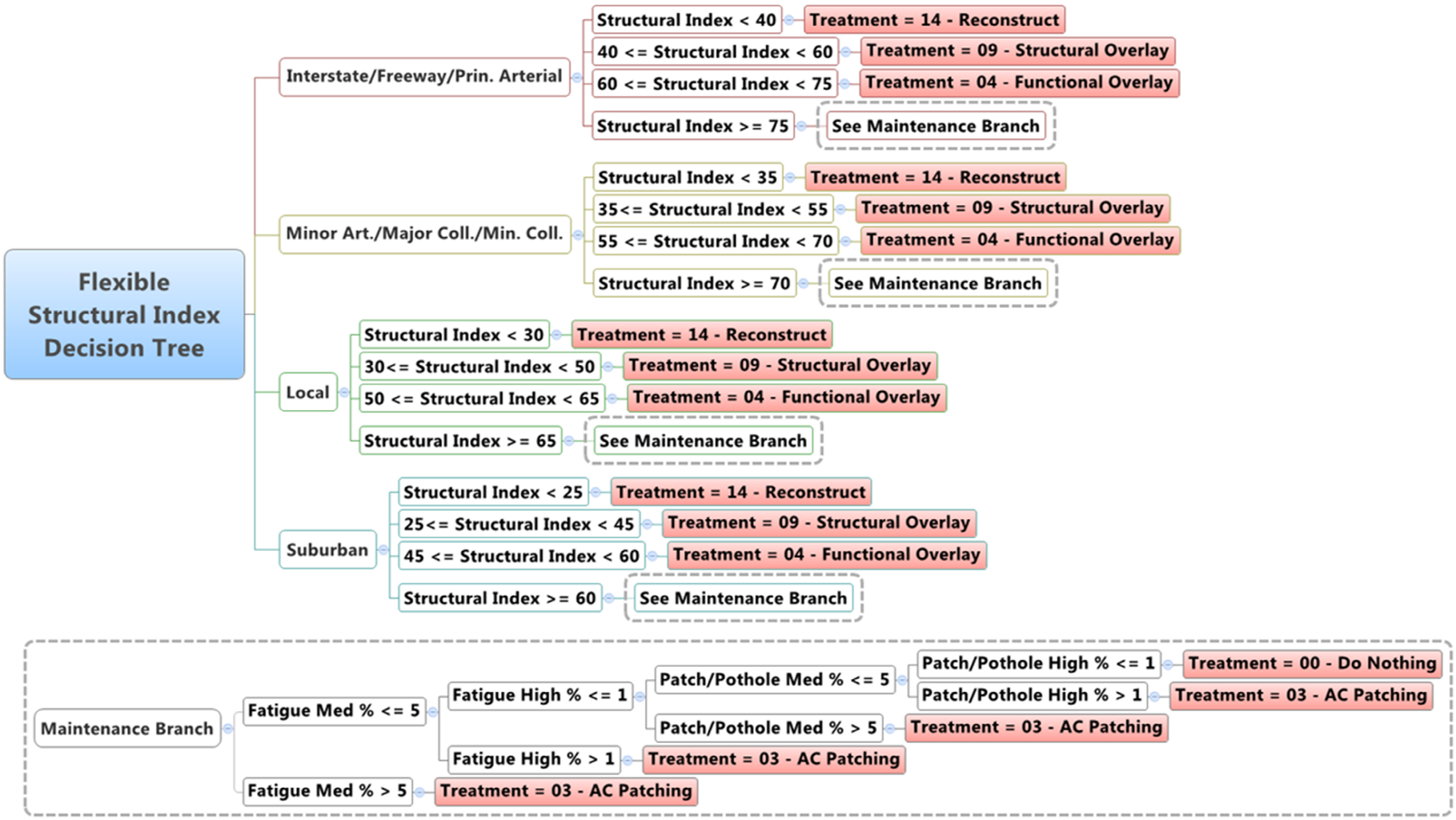
Decision Modeling – Treatment Selection Process



Decision Modeling – Structural Distress



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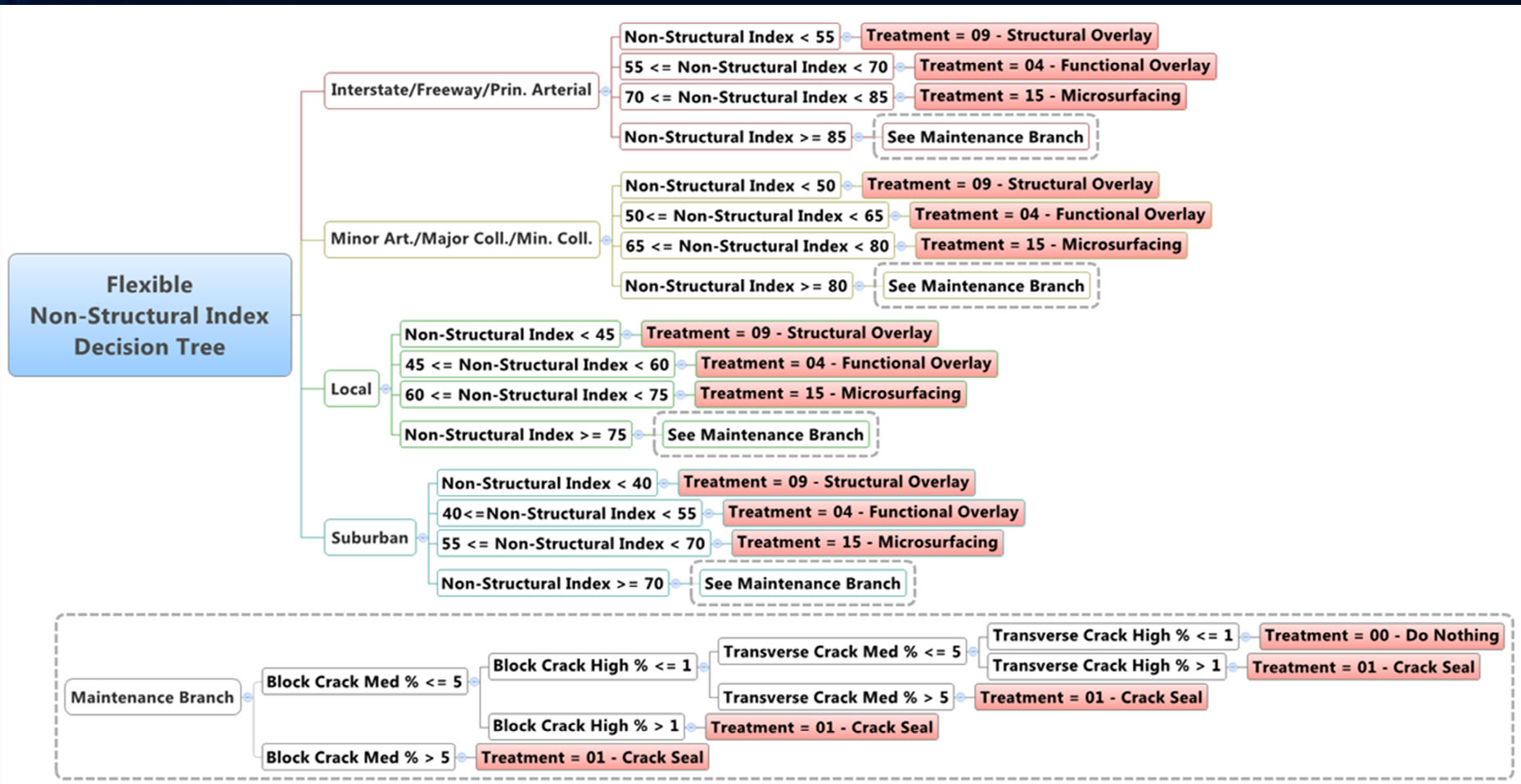
Decision Modeling – Non-Structural Distress



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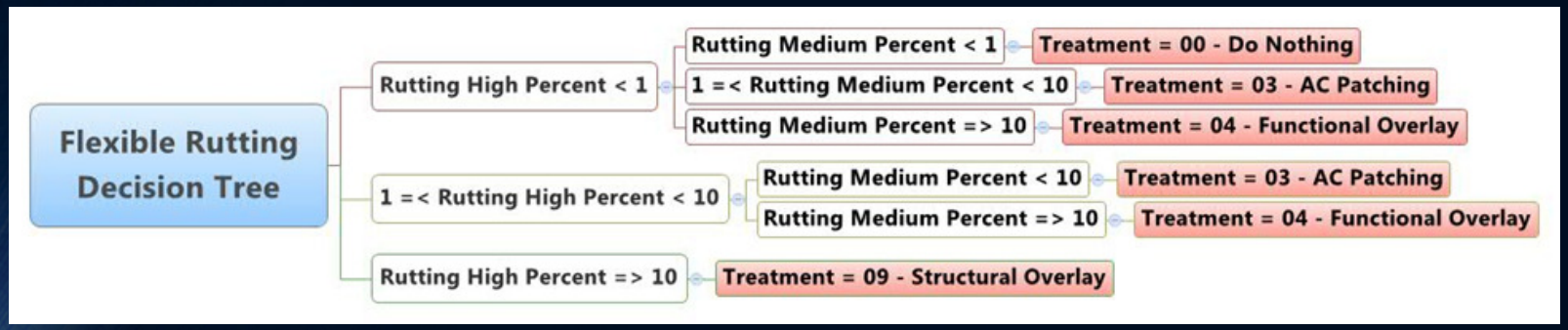
Decision Modeling – Other Distresses



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Data Governance

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Data Governance – Imports/Procedures/Functions

ManagementSectionsScript.sql * | New 1 *

```
                    AND a.loc_ident = sla.loc_ident
                    AND sla.sourse_table = ''PMS_DE_MGMT_SEC_AGG''
                    AND sla.route_id = sli.route_id
                    AND (sla.lane_dir = sli.lane_dir OR sla.lane_dir = 0 OR sli.lane_dir = 0)
                    AND (sla.lane_id = sli.lane_id OR sla.lane_id = 0 OR sli.lane_id = 0)
                    AND sla.offset_from + sla.offset_to < 2 * sli.offset_to
                    AND sla.offset_from + sla.offset_to >= 2 * sli.offset_from','CONFIG',sysdate,'PMS_DE_MGMT_SEC_AGG','LAST_REHAB_YEAR';

    EXECUTE IMMEDIATE 'UPDATE SETUP_TABLE_COLUMNS SET UPDATE_ORDER_ID=:1,UPDATE_SOURCE=:2,USER_UPDATE=:3,DATE_UPDATE=:4 WHERE TABLE_NAME=:5 AND COLUMN_ID=:6' USING 3,'greatest(
nvl(
(SELECT max(t.eff_year)
             FROM pms_tcplan_loc_year t,
                  setup_loc_ident la,
                  setup_loc_ident lb
            WHERE la.loc_ident = a.loc_ident and t.eff_year<=(select max(eff_year) from network_master)
              AND lb.sourse_table = ''PMS_TCPLAN_LOC''
              AND lb.loc_ident = t.loc_ident
              AND lb.route_id = la.route_id
              AND (   lb.lane_dir = la.lane_dir
                   OR lb.lane_dir = 0
                   OR la.lane_dir = 0
                  )
              AND (   lb.lane_id = la.lane_id
                   OR lb.lane_id = 0
```

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Optimization Analysis Configuration

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Optimization Analysis – Work Plans

Setup | Results | Constr Results | Report | Summary Reports

Work Plan Results Actions ▾

Plan Year	Budget Group	Treatment	Estimated Cost	Route	Direction	Lane	Offset	Begin Mile	End Mile	MWP Project St...	Benefit	Lane Miles
1	General Budget	PM-BIT	$12,580.00	SR00005EB	All	All	0	4.84	5.53	Scenario Reco...	81.04	1.38
1	General Budget	PM-BIT	$10,392.00								81.04	1.14
1	General Budget	PM-BIT	$10,392.00								81.04	1.14
1	General Budget	PM-BIT	$37,193.00								81.04	4.08
1	General Budget	PM-BIT	$57,248.00								81.04	6.28
1	General Budget	PM-BIT	$65,179.00								81.04	7.15
1	General Budget	PM-BIT	$68,005.00								118.46	7.46
1	General Budget	PM-BIT	$17,138.00								81.04	1.88
1	General Budget	PM-BIT	$55,516.00								81.04	6.09
1	General Budget	PM-BIT	$30,447.00								81.04	3.34
1	General Budget	PM-BIT	$61,806.00								81.04	6.78
1	General Budget	PM-BIT	$17,083.00								81.04	1.874
1	General Budget	PM-BIT	$18,414.00								81.04	2.02
1	General Budget	PM-BIT	$46,856.00								81.04	5.14
1	General Budget	PM-BIT	$21,878.00								81.04	2.4
1	General Budget	PM-BIT	$8,569.00								81.04	0.94
1	General Budget	PM-BIT	$36,464.00	US00058EB	Increasing	All	0	435.24	437.24	Scenario Reco...	95.92	4
1	General Budget	PM-BIT	$34,276.00	US00058WB	Decreasing	All	0	367.17	369.05	Scenario Reco...	81.04	3.76
1	General Budget	PM-BIT	$55,425.00	US00058WBALT001	Decreasing	All	0	70.12	73.16	Scenario Reco...	81.04	6.08

Floating Map

Map Actions ▾

Layers ▾ OpenStreets Tiles ▾

Manage Layers

Add Layer

Highlighted features

11695 m 23390 m

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Optimization Analysis – Performance Reports

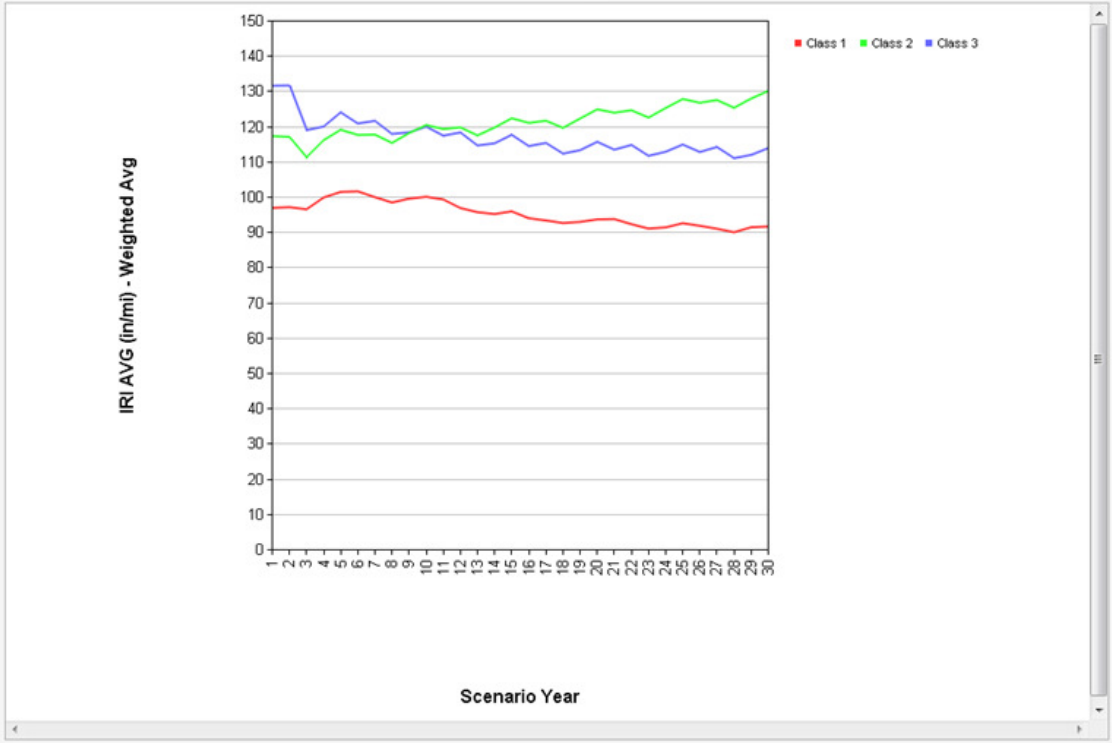
Setup | Results | Constr Results | Report | Summary Reports

Constraint Report Actions ▾

Constraint Column	Constr. Type	Scenario Year	Resulting Value	Condition Thr...	Constraint Subdivision
IRI AVG (in/mi)	Weighted Avg	1	96.83		Constraint Subdivision
IRI AVG (in/mi)	Weighted Avg	2	97.02		Class 1
IRI AVG (in/mi)	Weighted Avg	3	96.43		Class 1
IRI AVG (in/mi)	Weighted Avg	4	99.75		Class 1
IRI AVG (in/mi)	Weighted Avg	5	101.36		Class 1
IRI AVG (in/mi)	Weighted Avg	6	101.51		Class 1
IRI AVG (in/mi)	Weighted Avg	7	99.87		Class 1
IRI AVG (in/mi)	Weighted Avg	8	98.35		Class 1
IRI AVG (in/mi)	Weighted Avg	9	99.44		Class 1
IRI AVG (in/mi)	Weighted Avg	10	99.97		Class 1
IRI AVG (in/mi)	Weighted Avg	11	99.21		Class 1
IRI AVG (in/mi)	Weighted Avg	12	96.78		Class 1
IRI AVG (in/mi)	Weighted Avg	13	95.60		Class 1
IRI AVG (in/mi)	Weighted Avg	14	95.08		Class 1
IRI AVG (in/mi)	Weighted Avg	15	95.83		Class 1
IRI AVG (in/mi)	Weighted Avg	16	93.89		Class 1
IRI AVG (in/mi)	Weighted Avg	17	93.25		Class 1
IRI AVG (in/mi)	Weighted Avg	18	92.53		Class 1
IRI AVG (in/mi)	Weighted Avg	19	92.85		Class 1

<< < 29 30 31 32 33 34 35 36 37 38 > >> Rows 631-649 of 900 total rows

Constraint Column:IRI AVG (in/mi) - Constr. Type:Weighted Avg - Add Constr.:Pavement Class



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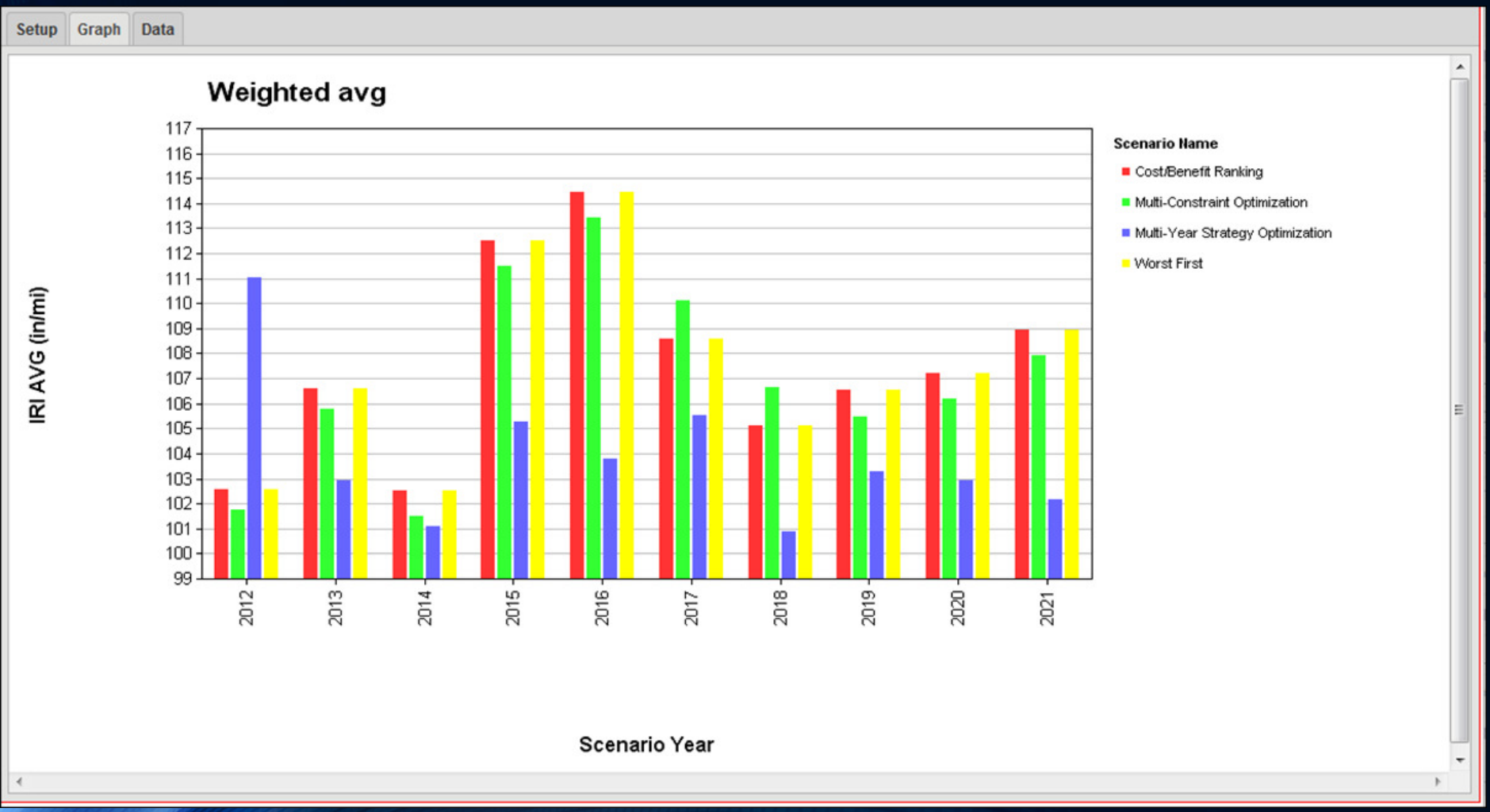
Optimization Analysis – Scenario Comparisons



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Performance Measurements (Statewide and FHWA)

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Performance Measurements

§ 490.307 Performance Measures

Pavement Condition Measures	
Interstate System	**Non-Interstate NHS**
Percentage of pavements of the Interstate System in **Good** condition	Percentage of pavements of the non-Interstate NHS in **Good** condition
Percentage of pavements of the Interstate System in **Poor** condition	Percentage of pavements of the non-Interstate NHS in **Poor** condition

U.S. Department of Transportation
Federal Highway Administration

Performance Measurements

TPM
HOW WE GET THERE

§ 490.311 Metric Thresholds in Final Rule

Rating	Good	Fair	Poor
IRI *(inches/mile)*	<95	***95-170***	***>170***
PSR* *(0.0-5.0 value)*	≥4.0	2.0-4.0	≤2.0
Cracking Percent *(%)*	<5	***CRCP: 5-10*** ***Jointed: 5-15*** ***Asphalt: 5-20***	***>10*** ***>15*** ***>20***
Rutting *(inches)*	<0.20	0.20-0.40	>0.40
Faulting *(inches)*	***<0.10***	0.10-0.15	>0.15

*PSR may be used only on routes with posted speed limit < 40mph.

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Federal Highway Administration

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Data Quality Management Plan

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Data Quality Management Plan

TPM
HOW WE GET THERE

§ 490.319(c) Data Quality Management Program

- Required for each State DOT, one year after effective date
- Addresses quality of all data collected to report pavement metrics
- Includes, at minimum, methods and processes for:
  - Data collection equipment calibration and certification
  - Certification process for performing manual collection
  - Data quality control measures before and during collection
  - Data sampling, review and checking processes
  - Error resolution procedures and data acceptance criteria
- Submit any proposed significant change for approval

U.S. Department of Transportation
Federal Highway Administration

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Data Quality Management Plan

Data Elements	Protocol	Resolution	Accuracy (mean over 10 runs compared to reference value)	Repeatability (for 10 replicate runs)
Block Cracking	DelDOT Pavement Data Dictionary version 2.1 or latest iteration. (for Fatigue Cracking, also HPMS Field Manual)	1 SqFt (per Severity Level)	± 50 SqFt	Std. dev. < 5 SqFt
Crown / Cross-Slope		1 Ft	± 50 Ft	Std. dev. < 5 Ft
Edge Cracking		1 Ft (per Severity Level)	± 50 Ft	Std. dev. < 5 Ft
Fatigue Cracking		1 SqFt (per Severity Level)	± 50 SqFt	Std. dev. < 5 SqFt
Faulting	AASHTO R36-13 (also HPMS Field Manual)	1 Count (per Severity Level), 0.01 Inches (for Average fault height Right Wheel Path)	± 50 Count	Std. dev. < 5 Count
International Roughness Index (IRI)	AASHTO R43-13 (also HPMS Field Manual)	1 inch per mile (for Left Wheel Path, Right Wheel Path)	± 10 inches per mile	Std. dev. < 5 inches per mile

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SOP Development

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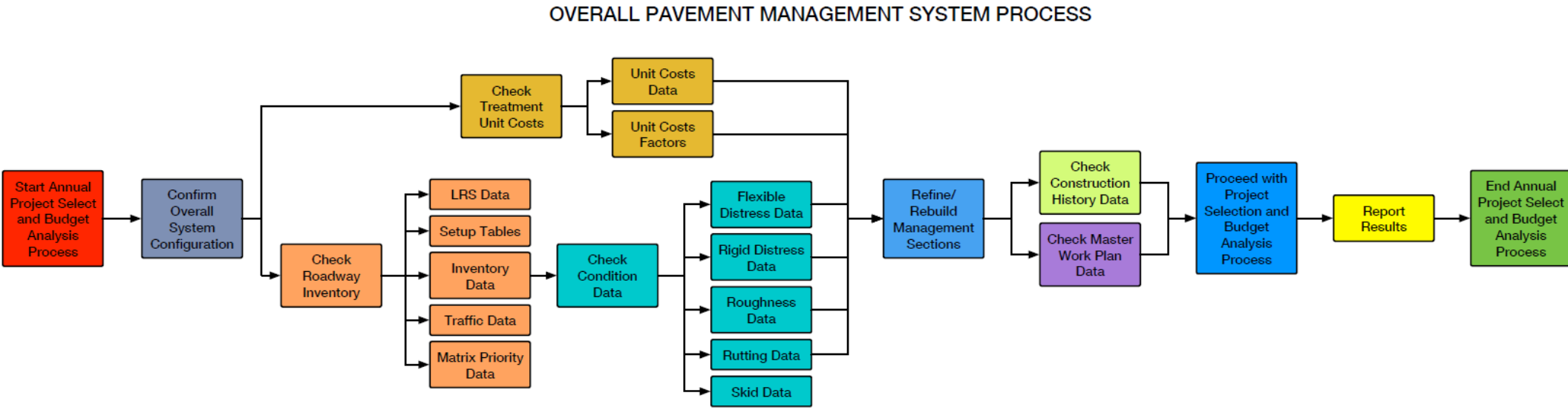
Standard Operating Procedure (SOP) Development



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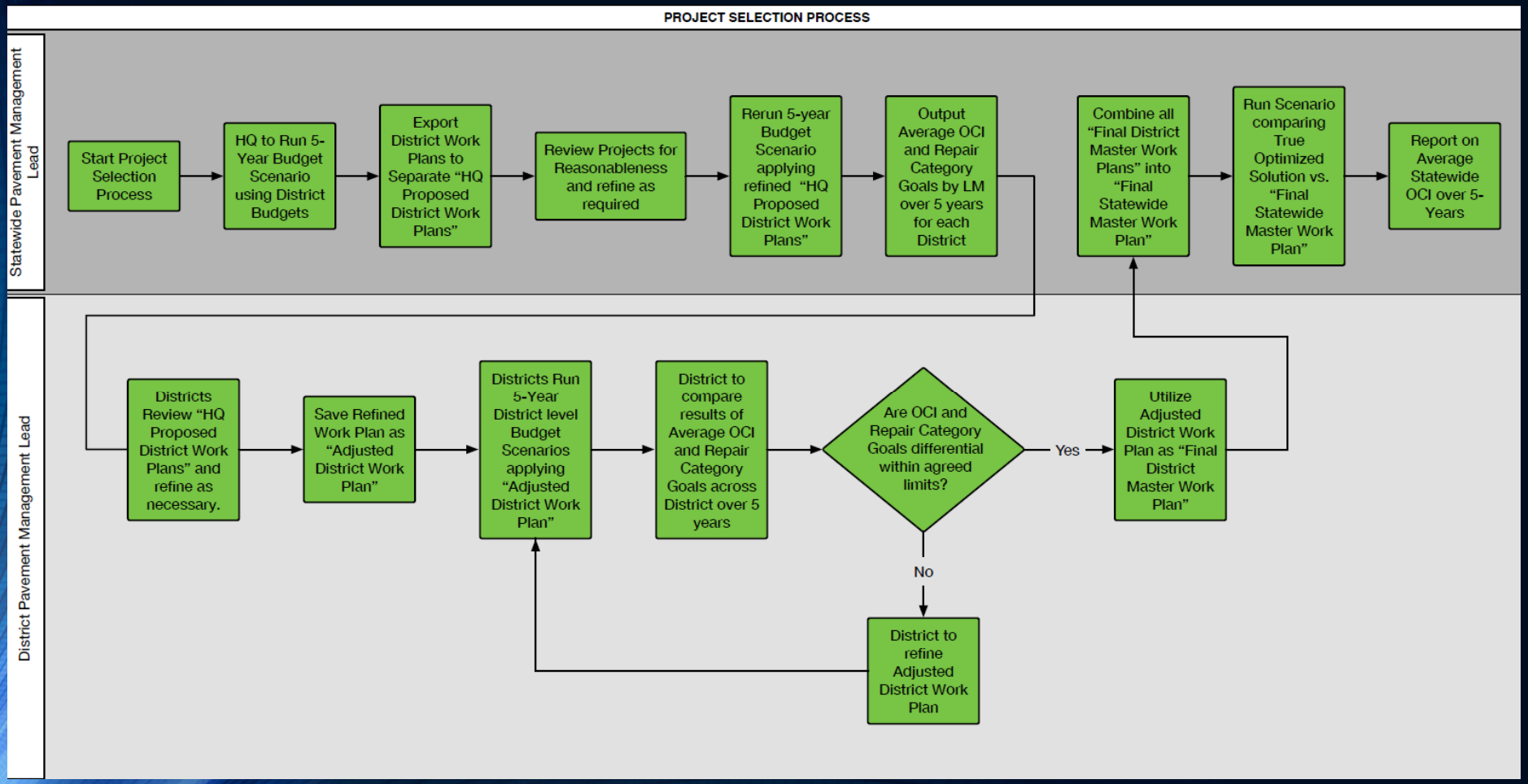
Standard Operating Procedure (SOP) Development



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Thank You!

For more information:

Aaron D. Gerber, P.E.
adgerber@kerchergoup.com