

Pavement Management Implementation Summary

Presentation to the Council of the City of Cold Lake, AB

February, 2019



Agenda

- Pavement Management, Definition & Benefits
- Pavement Management Process
- Road \ Sidewalk Network Inventory
- Performance Indices
- Data Collection
- Analysis Results
- Budget Effect on Performance
- M&R Recommendations
- A Final Remark

Pavement Management, Definition & Benefits

What is Pavement Management

Pavement Management is a process to plan the maintenance and rehabilitation of a road network, to **optimize** pavement condition **and** spending over the entire network.

- ❑ Research has shown that it is far less expensive to keep a road in good condition than it is to repair it once it has deteriorated.
- ❑ PMS places the priority on cost-effective solutions that provide the most benefit to the overall network. e.g. Preventative Maintenance

Benefits of PMS

- Provides Present Status for each section in the network and for the entire network.
- Justify maintenance & rehabilitation program expenditures.
- Realize magnitude of pavement investment.
- Better chance of correct decisions.
- Objective answers to effects of lower funds on condition, implications of deferred work and/or lower standards.
- Comparative view of network condition (current & future).
- Preserve knowledge for succession.

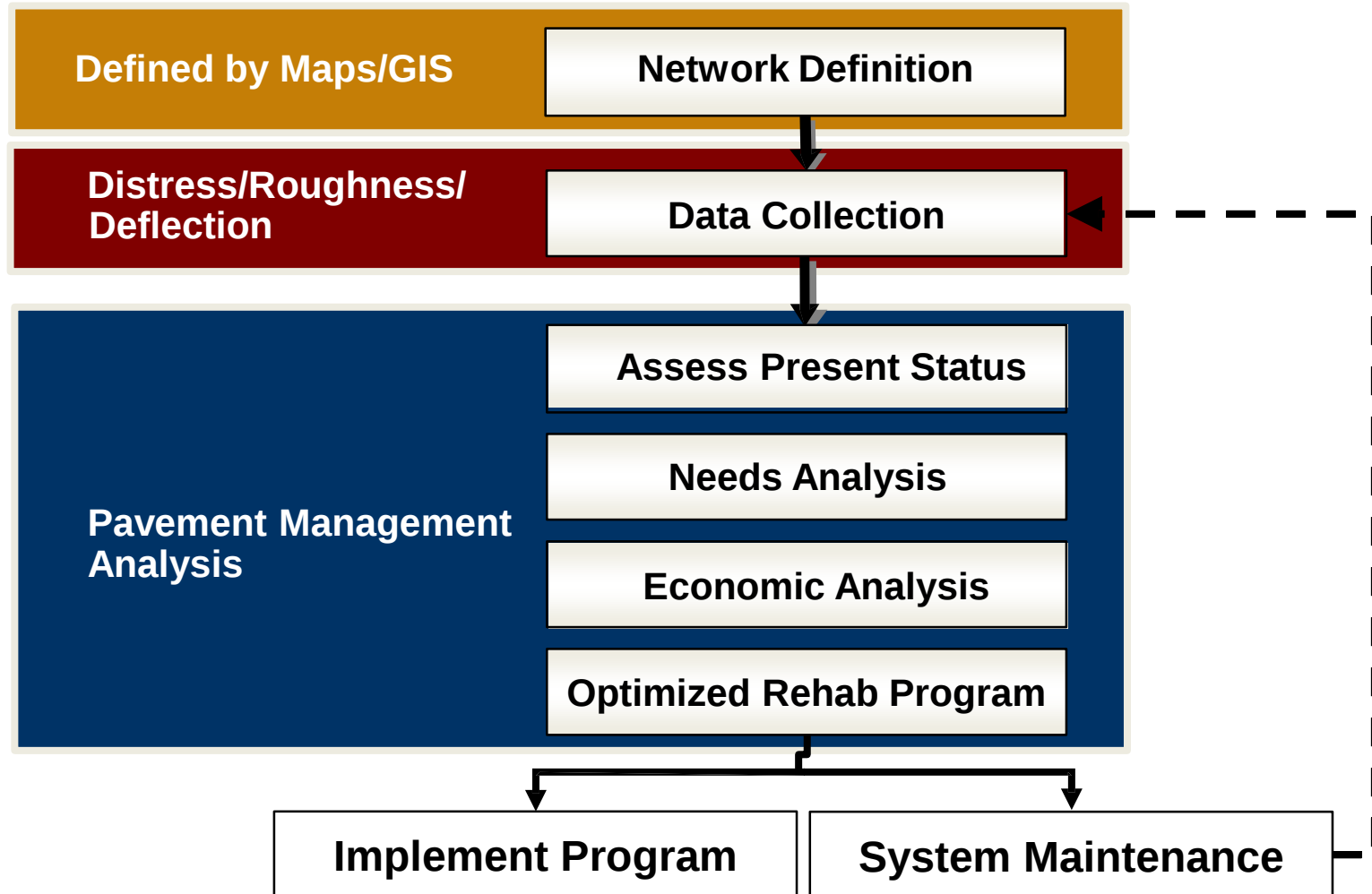
Pavement Management, Process

Asset Management Process

Five Questions to Answer

1. What have we got?
2. Where is it?
3. What is the Condition of It?
4. What Maintenance/Rehab is needed and when?
5. What investment is required?

Pavement Management Process, Cont.

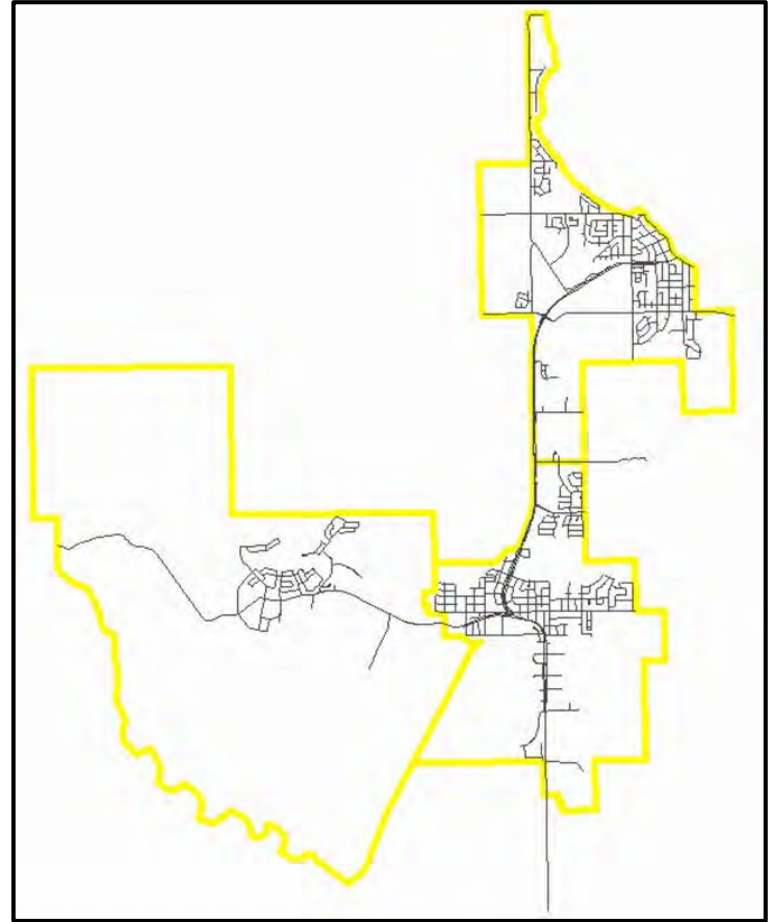


Road/Sidewalk Network Inventory

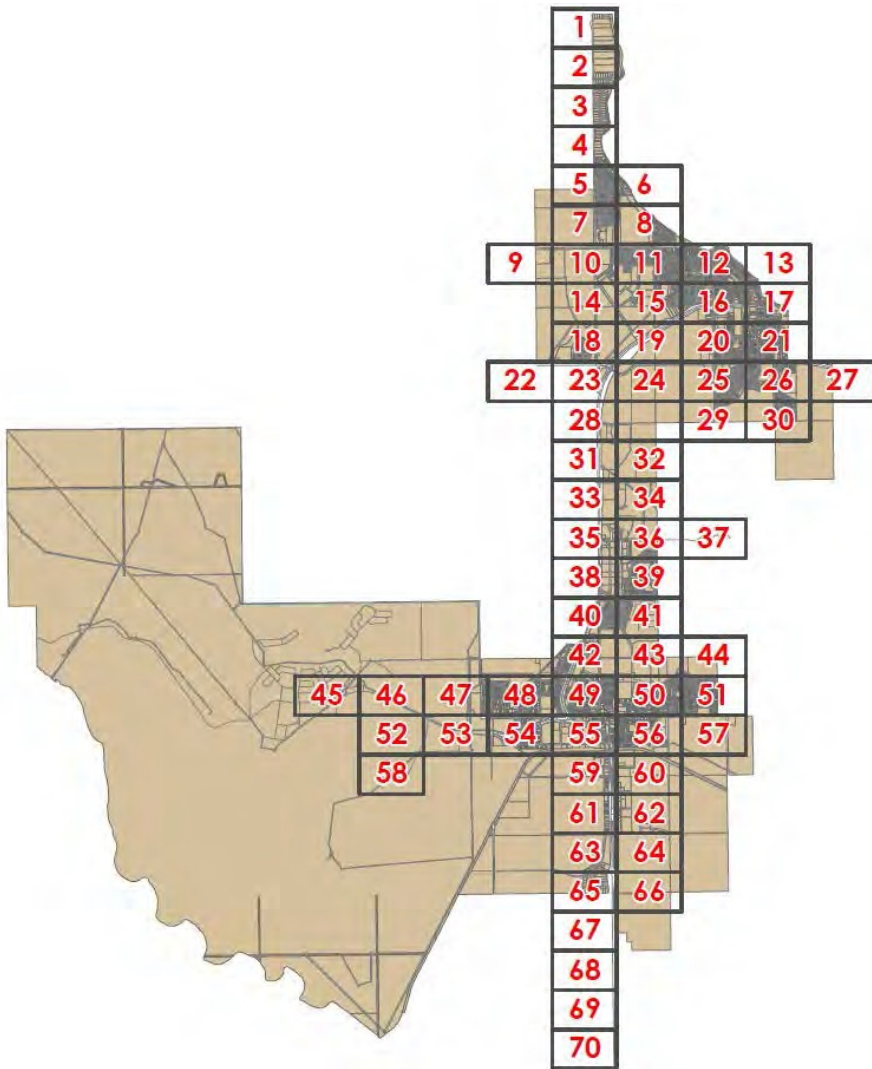
Road Network Inventory

Functional Class	No. of Sections	CL Length (km)	Lane Length (km)
Arterial	73	22	46
Collector	108	22	43
Local	546	74	149
Total*	727	118	238

* Intersections and Turning Lanes (7.8 CL kms) are excluded.



Sidewalk Network Inventory



116 survey-km of roads with no sidewalk

- Curb/Gutter records

110 survey-km of roads with sidewalk

- Curb/Gutter records
- Sidewalk Distresses
- Ramps/Walkability

2015 Sidewalk Survey Location Map

Performance Indices

Performance Indices

Pavement Performance Indices

- RCI (Ride Comfort Index)
- VCI (Visual Condition Index)
- SAI (Structural Adequacy Index)
- PQI (Pavement Quality Index)

$$\text{PQI} = f(\text{RCI}, \text{VCI}, \text{SAI})$$

Sidewalk Performance Index

- SCI (Sidewalk Condition Index)

PQI Representation



Excellent PQI ≈ 100

PQI Representation, Cont.



Good PQI ≈ 80

PQI Representation, Cont.



Fair PQI ≈ 70

PQI Representation, Cont.



Fair PQI ≈ 60

PQI Representation, Cont.



Poor PQI ≈ 40

PQI Representation, Cont.



Very Poor PQI ≈ 20

PQI Representation, Cont.



Failing PQI ≈ 0

Data Collection

Data Collection – Automated



- 
1. Rutting
 2. Alligator Cracking
 3. Longitudinal Cracking
 4. Edge Cracking
 5. Transverse Cracking
 6. Map Cracking
 7. IRI
 8. # of Pot Holes

- 
1. RCI (Riding Comfort Index)
 2. VCI (Visual Condition Index)
 3. SAI (Structural Adequacy Index)



PQI (Pavement Quality Index) =
 $f(RCI, VCI, SAI)$



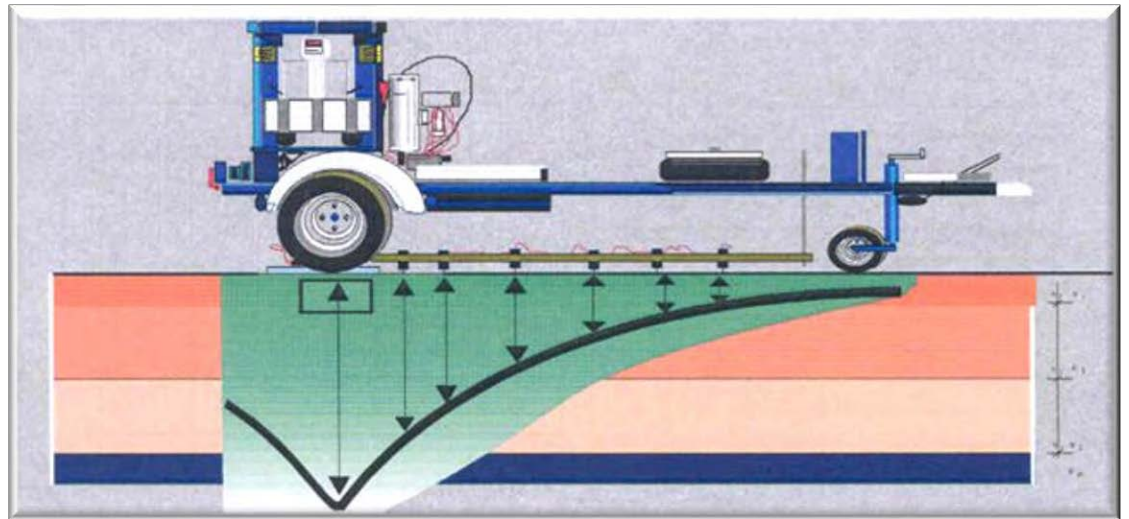
Data Collection – Falling Weight Deflectometer

- A non-destructive test device.
- Good repeatability, accurate & fast
- Wide loading range (1,500–27,000 lbf).



Use Deflection Data to Calculate:

1. Structural Adequacy Index (SAI)
2. Resilient Modulus (M_R) of Subgrade



Data Collection – Falling Weight Deflectometer



Data Collection – Falling Weight Deflectometer



Data Collection - Sidewalk

No SIM 2:34 PM 74%

Samples Static Dynamic -114.00056, 51.04930, ±65.0m, D:0.0 mi, #1 Save

Segment ID 0 WxL: 0 x 0 = 0 %: 0.0

Type SW NO-SW LatSeq 1 2 3 4

SW_Width SW_Width Slab_Leng Slab_Leng

SW_Type MONO SEPAR SW_Materia Asph PCC Stone Masn Ruber

Curb_Type Cr_Glr Barr Mntbl Mower Other Curb_Other Curb_Other

Curb_Mat Asph PCC Stone Masn Ruber Curb_Cond Poor Fair Good

Blockface N S E W P_Speed P_Speed

Adj_prop None Office Retail Resid Indus T_S_Imped Yes No

Blvd_Width Blvd_Width Blvd_Mat Asph PCC Stone Masn Ruber

Surface Fault Shatter C-Break C-Spall J-Spall Lg-Pat Sm-Pat L-Crack Scaling
D-Crack Misc

Fault 1 Low Med High

Distress Cross Dip Pop PCC-Grind F-AC F-PCC Misalign Veget

Cross Yes No

Trip Trip-haz Yes No

Para_Ramp Beg End Int Beg None Pass Fail

Bus Stop Bus_stop Bench Shelter Grbg_bin Bus_... Yes No

Crossing X_Provide Paint_wlk OH_Flash Half_Sign OH_F... Yes No X_Pr... Yes No

Images

Faulting

Linear Cracking

Shattering

Durability

Cracking

Scaling

Corner Breaks

Joint Spalling

Corner Spalling

Patching – Large

Patching – Small



SCI (Sidewalk Condition Index)

Sidewalk Condition Assessment

Distress Types Related to Sidewalks

1) Faulting

Low Severity



Medium Severity



High Severity



Sidewalk Condition Assessment

Distress Types Related to Sidewalks

2) Linear Cracking

Low Severity



Medium Severity



High Severity



Sidewalk Condition Assessment

Distress Types Related to Sidewalks

3) Shattering

Low Severity



Medium Severity



High Severity



Sidewalk Condition Assessment

Distress Types Related to Sidewalks

4) Durability Cracks

Low Severity



Medium Severity



High Severity



Sidewalk Condition Assessment

Distress Types Related to Sidewalks

5) Scaling

Low Severity



Medium Severity



High Severity



Sidewalk Condition Assessment

Distress Types Related to Sidewalks

6) Corner Breaks

Low Severity



Medium Severity



High Severity



Sidewalk Condition Assessment

Distress Types Related to Sidewalks

7) Joint Spalling

Low Severity



Medium Severity



High Severity

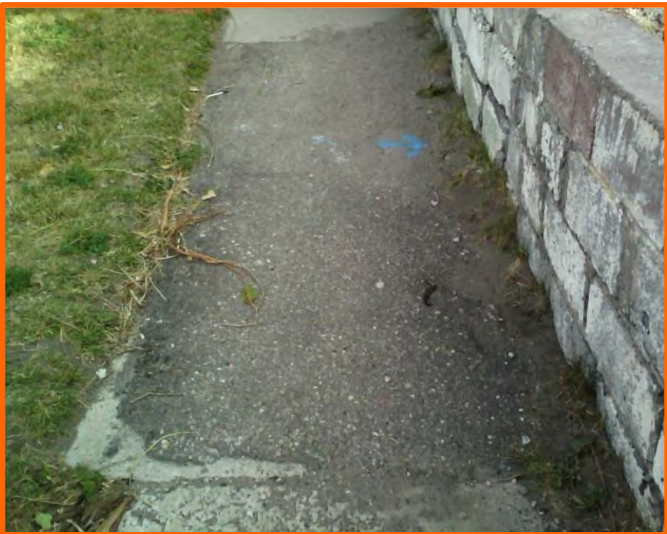


Sidewalk Condition Assessment

Distress Types Related to Sidewalks

9) Patching – Large ($\geq 3.0\text{m}$)

Low Severity



Medium Severity



High Severity



Analysis Results - Roads

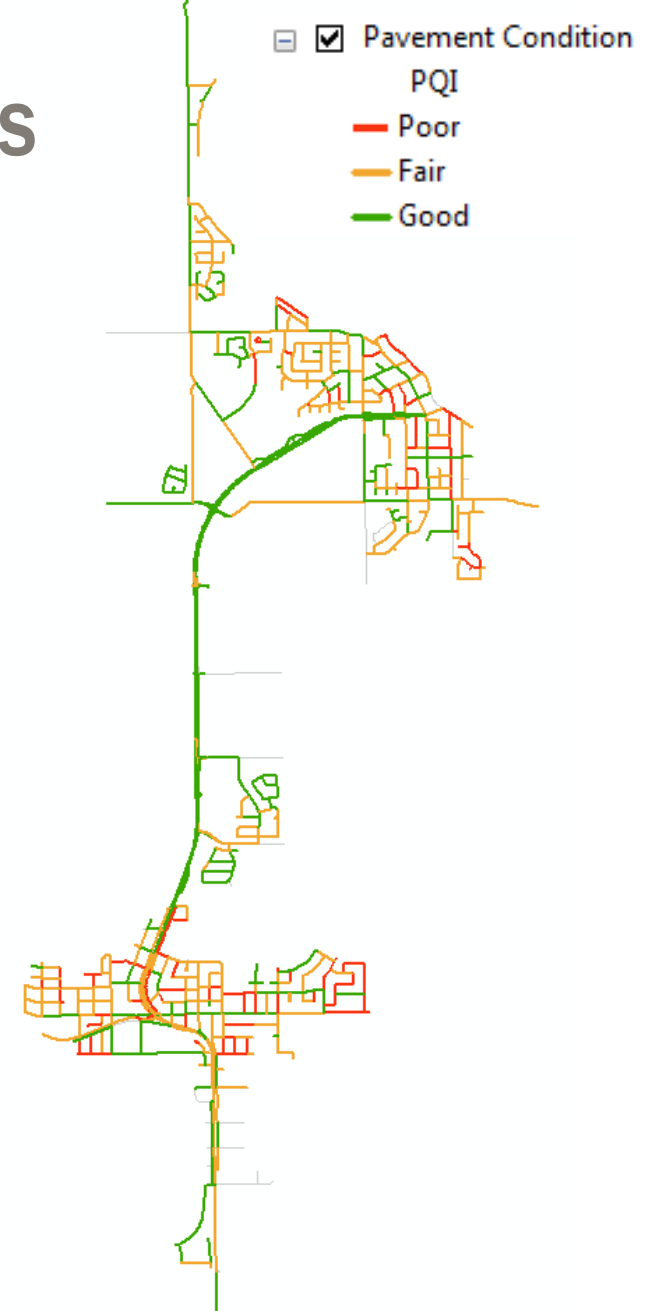
Roads Network 2016 Status

2016 Performance

Functional Class	Min PQI	RCI	VCI	SAI	PQI
Arterial	65	63	70	88	79
Collector	60	56	66	74	69
Local	55	44	63	--	59
Paved Network	--	50	65	81	65

2016 Needs

Functional Class	Min PQI	LL-KM	% Deficiency
Arterial	65	12.5	27
Collector	60	11.8	27
Local	55	63.8	46
Paved Network	--	50	38





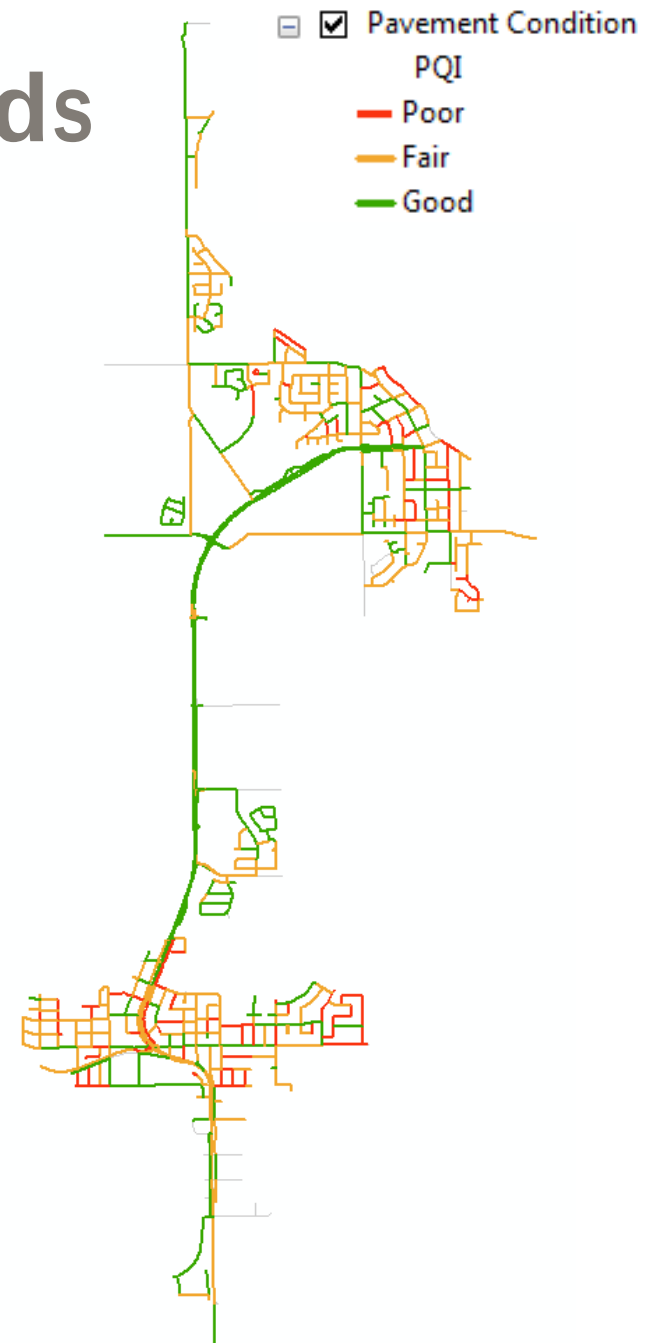
Roads Present Status/Needs

2019 Performance

Functional Class	Min PQI	RCI	VCI	SAI	PQI
Arterial	65	65	78	90	84
Collector	60	54	65	74	67
Local	55	42	60	--	56
Paved Network	--	54	68	82	69

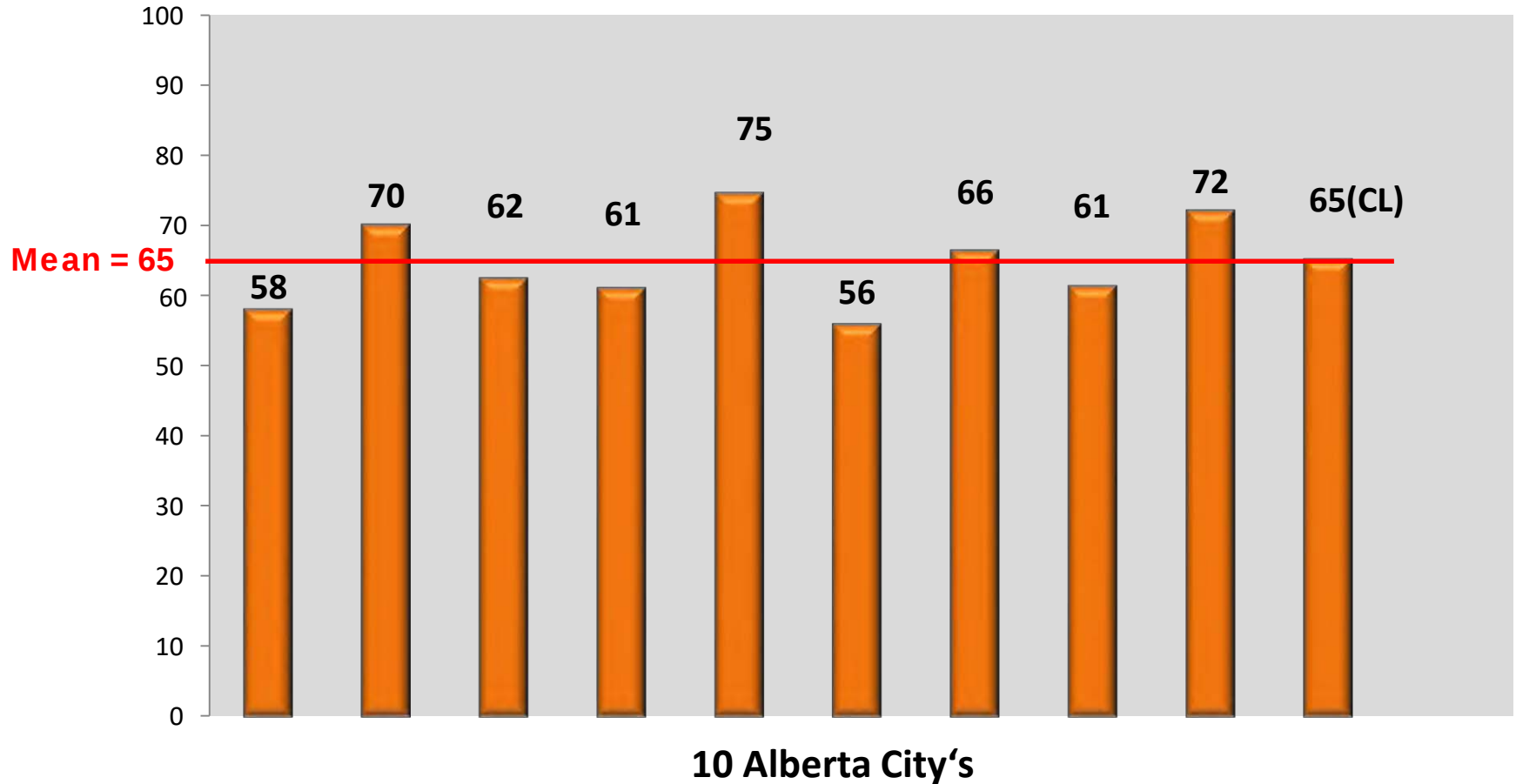
2019 Needs

Functional Class	Min PQI	LL-KM	% Deficiency
Arterial	65	4.5	10
Collector	60	11.5	26
Local	55	72.1	51
Paved Network	--	88.1	29



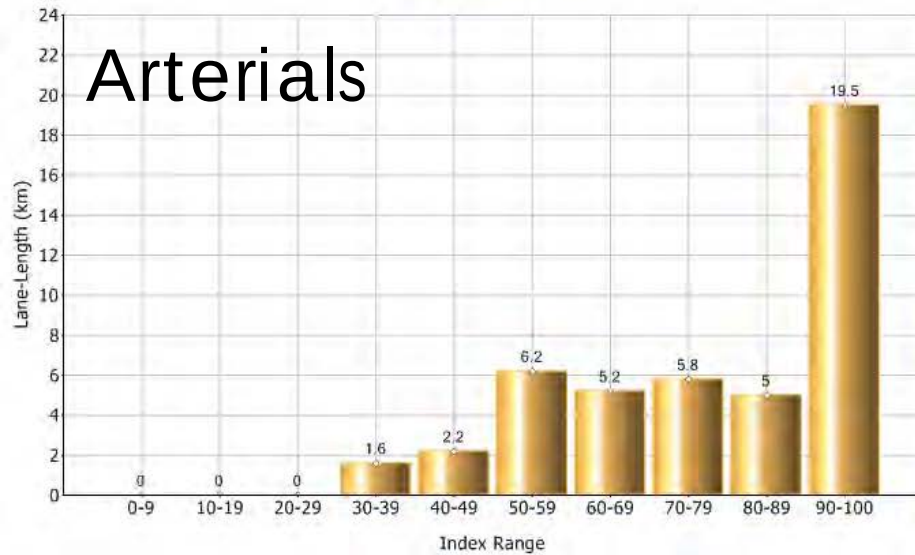
Roads 2016 Status – How do we Compare?

PQI - Paved Network 2016 (CL – Cold Lake)

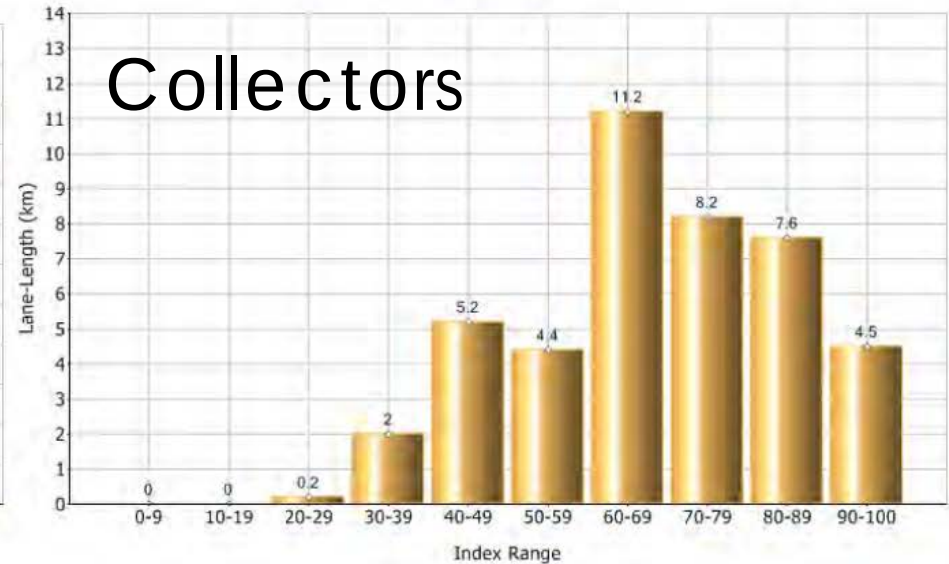


PQI Distribution by Functional Class 2016

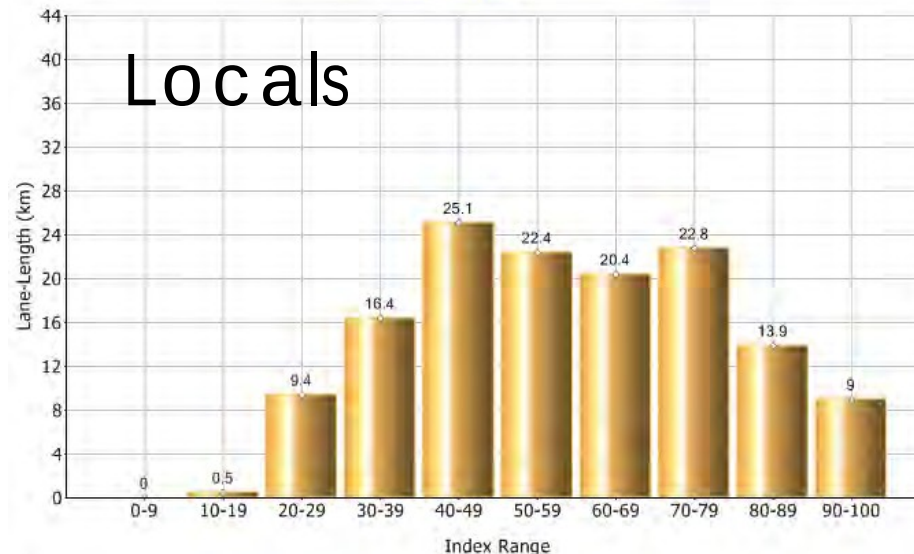
Network Present Status Distribution – 2016
Arterials, Paved



Network Present Status Distribution – 2016
Collectors, Paved

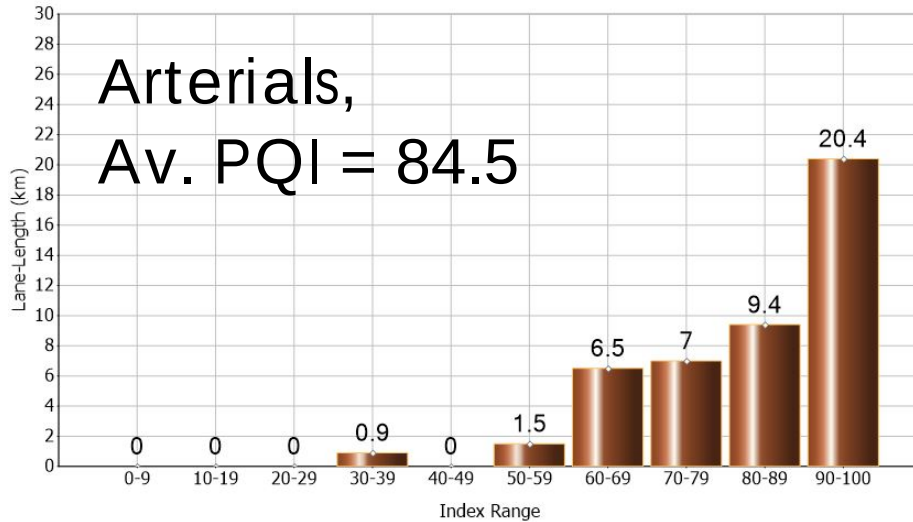


Network Present Status Distribution – 2016
Locals, Paved

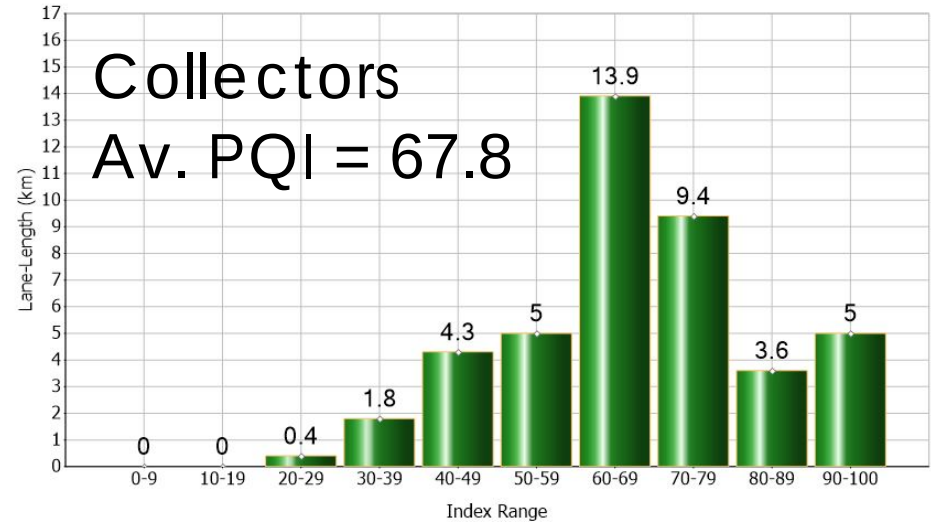


PQI Distribution by Functional Class 2019

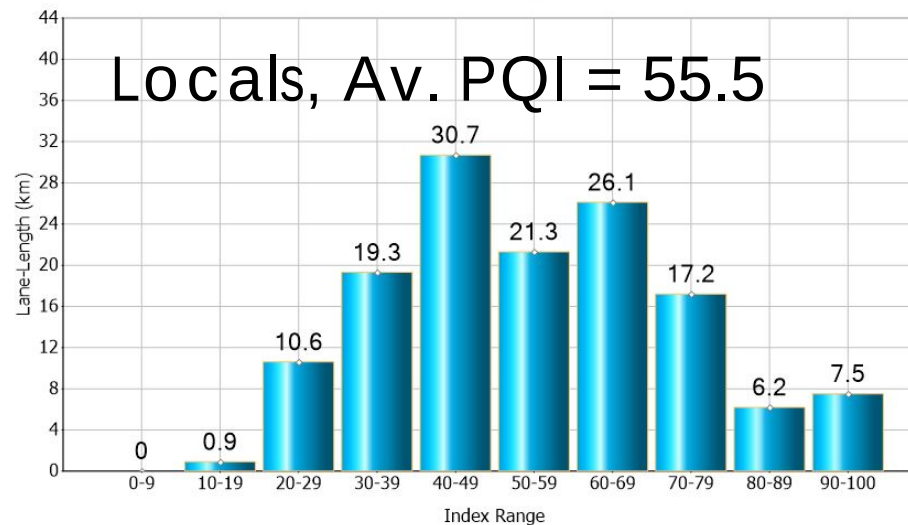
Network Present Status Distribution – 2019
Arterials, Paved



Network Present Status Distribution – 2019
Collectors, Paved

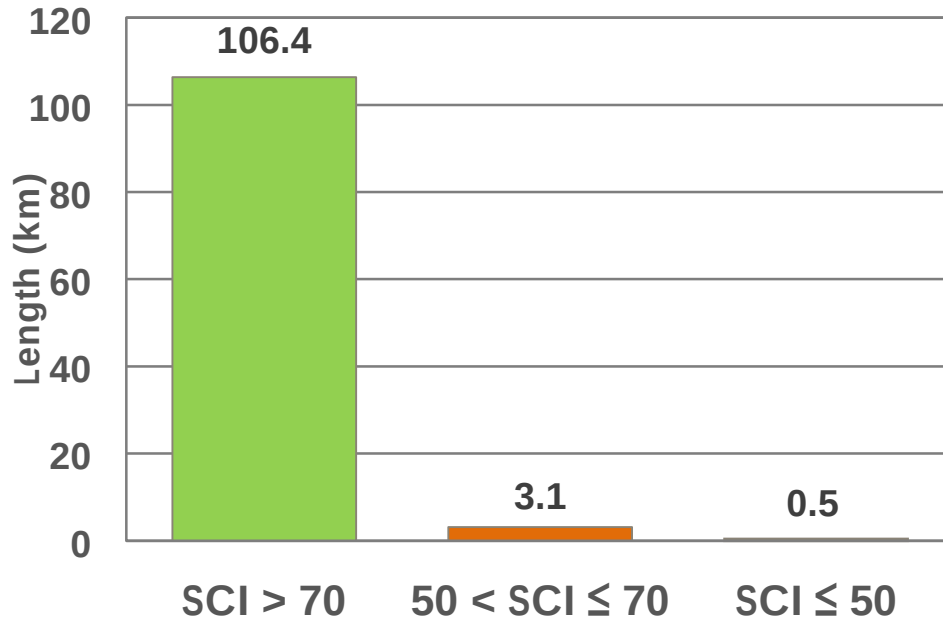


Network Present Status Distribution – 2019
Locals, Paved



Analysis Results - Sidewalks

Sidewalks Condition Status 2016



**City-wide
Average SCI: 93**

Distress Rating	Section Count	Percent (%)	Length (km)
Low (SCI > 70)	821	95	106.4
Medium (50 < SCI ≤ 70)	32	4	3.1
High (SCI ≤ 50)	7	1	0.5
Total	860	100	110

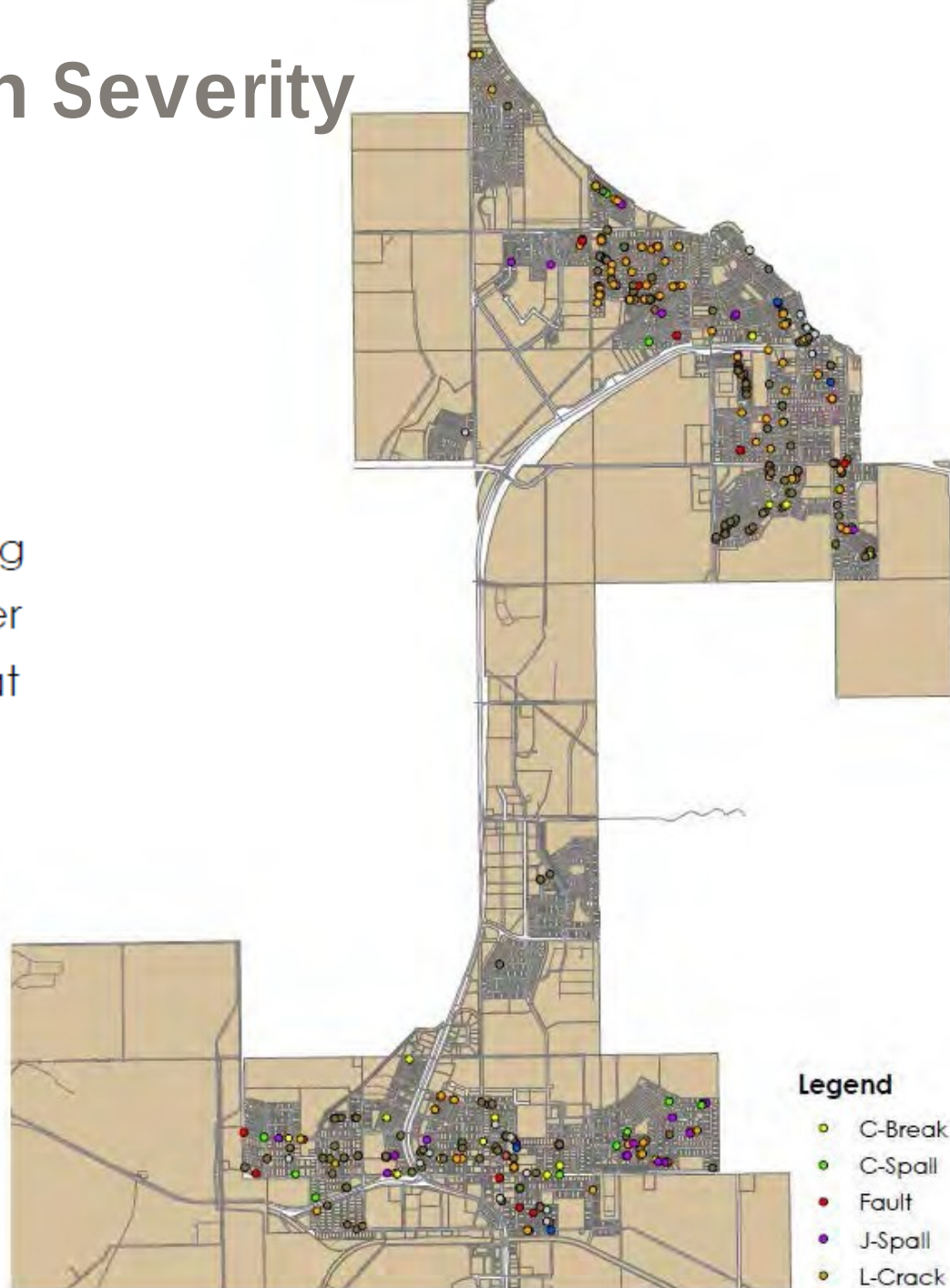
Treatment Slabs and Funding by Neighborhood

Neighborhood	Average SCI	# of Slabs	# of Slabs in Need	Treatment Cost
Chelsea Court	72	205	23	\$ 20,000
Davie's Place	79	736	43	\$ 18,000
Forest Heights	83	2,539	119	\$ 60,000
Westlawn	86	813	8	\$ 500
Nelson Heights	86	6,918	644	\$ 132,000
Grand Centre West	91	6,912	99	\$ 64,000
Lefebvre Heights	91	2,350	64	\$ 18,000
Grand Centre East	92	6,757	170	\$ 68,000
Lakeside Country Estates	92	691	30	\$ 12,000
Brady Heights	92	7,101	79	\$ 33,000
Lakeridge Estates	93	1,336	19	\$ 5,000
Highway Commercial Central	93	1,085	16	\$ 11,000
Delta Lands	93	540	10	\$ 1,000
Dominic School Area	94	2,208	33	\$ 3,000
Colonial Estates	94	806	9	\$ 1,000
Lakeshore Development Area	94	7,876	233	\$ 72,000
Miron / Adeena	95	985	26	\$ 7,000
1 Ave / Beach Front	95	1,653	86	\$ 16,000
Park Estates	96	626	7	\$ 6,000
Downtown Commercial	96	1,993	18	\$ 17,000
36 Lot Subdivision	97	258	1	\$ 1,000
Lakewood Estates	99	2,553	13	\$ 1,000
Creekside	99	1,502	1	\$ 500
Tri City Estates	100	4,267	11	\$ 4,000
Meadows	100	2,606	4	\$ 1,000
Parkview Estates	100	2,402	6	\$ 3,000
Hwy North Commercial	100	73	1	\$ 1,000
Tri City Mall	100	151	0	-
Horseshoe Bay Estates	100	172	0	-
Cold Lake Central South	100	322	0	-
Uplands	100	413	0	-
Skyrider	100	592	0	-
Aspen Ridge	100	1,150	0	-
Total		69,868	1,773	\$ 577,000

Sidewalk High Severity Distress Map

Legend

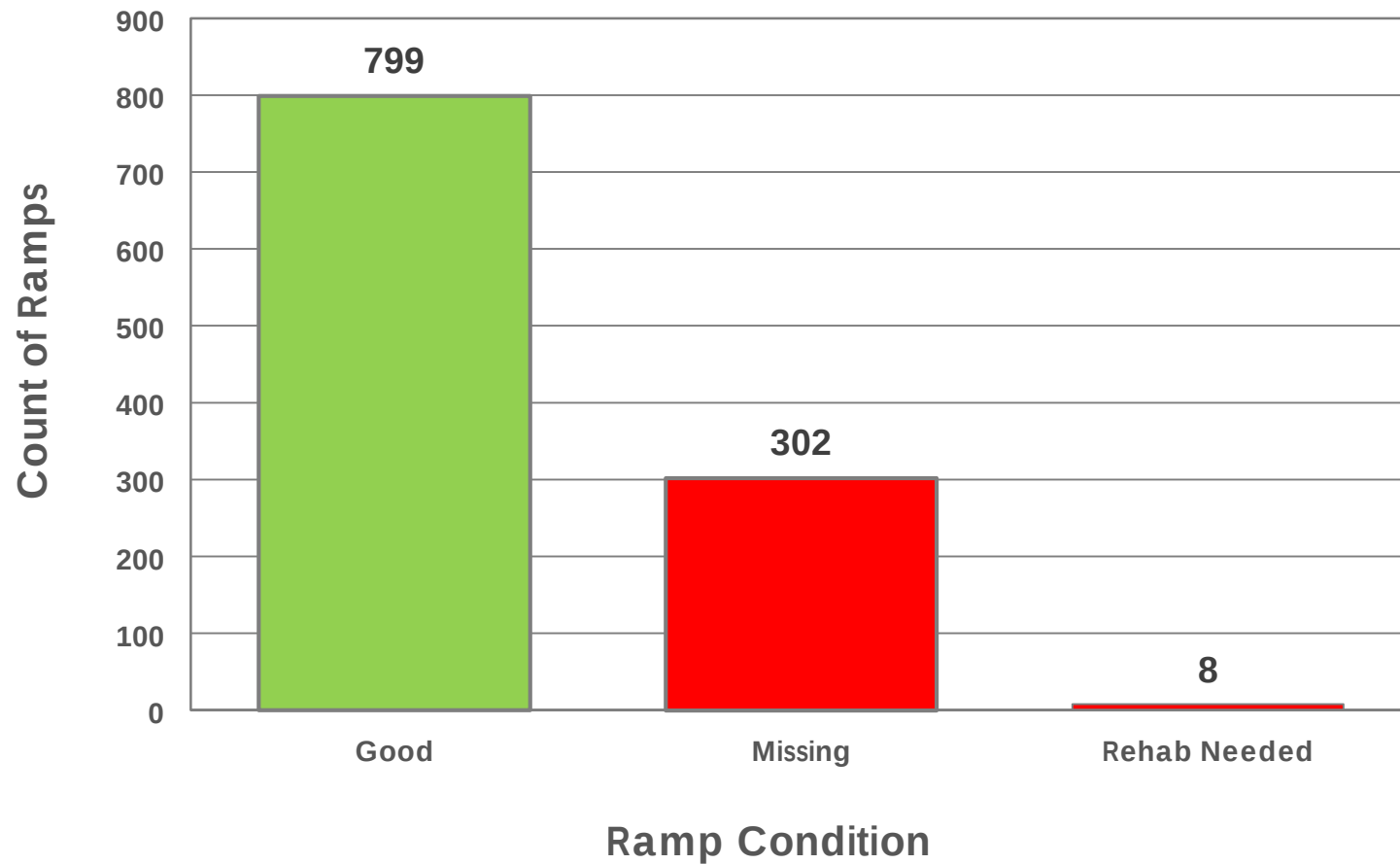
- | | |
|-----------|-----------|
| ● C-Break | ● Misc |
| ● C-Spall | ● Scaling |
| ● Fault | ● Shatter |
| ● J-Spall | ● Sm-Pat |
| ● L-Crack | |



Legend

- | | |
|-----------|-----------|
| ● C-Break | ● Misc |
| ● C-Spall | ● Scaling |
| ● Fault | ● Shatter |
| ● J-Spall | ● Sm-Pat |
| ● L-Crack | |

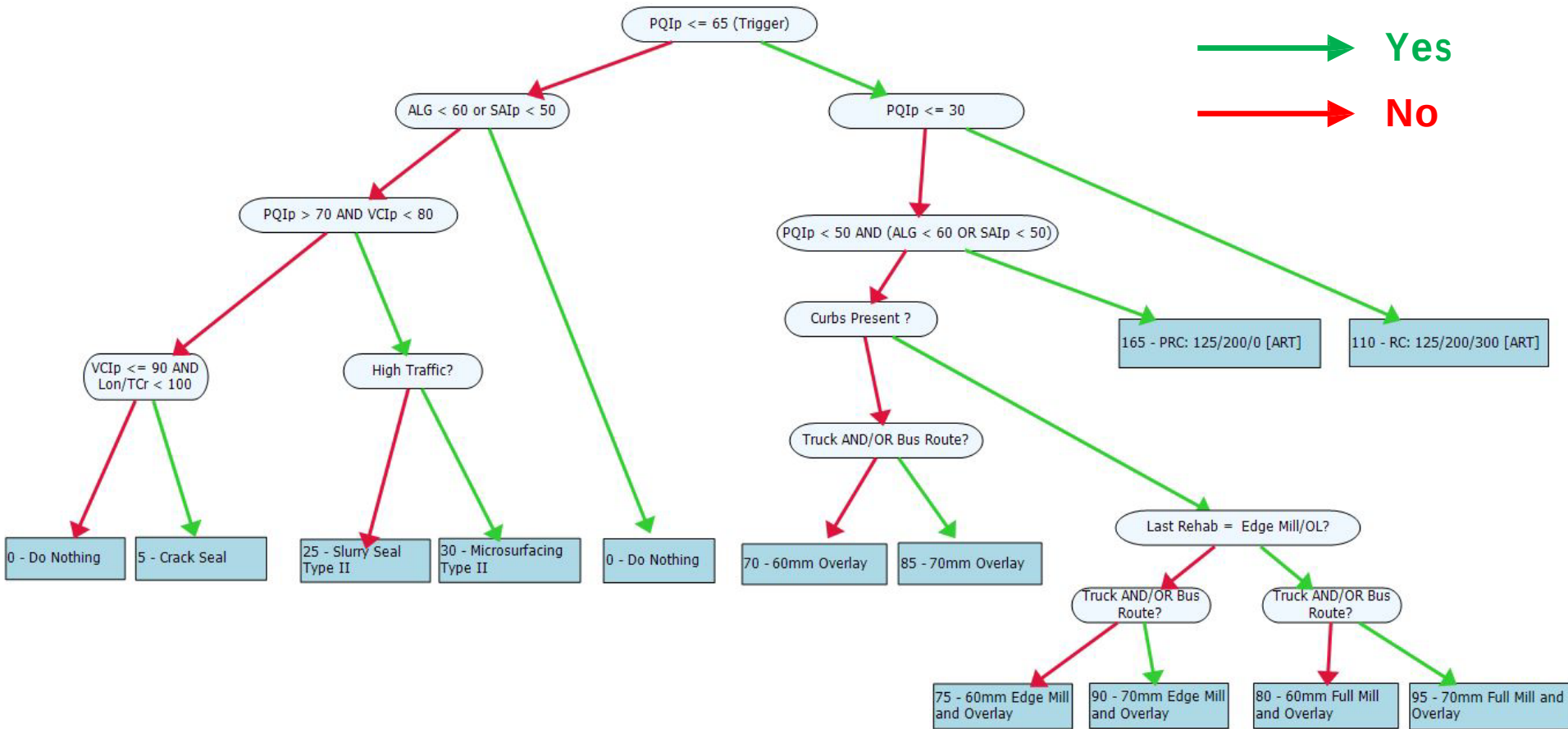
Sidewalk Ramps Condition Status



M&R Recommendations - Roads

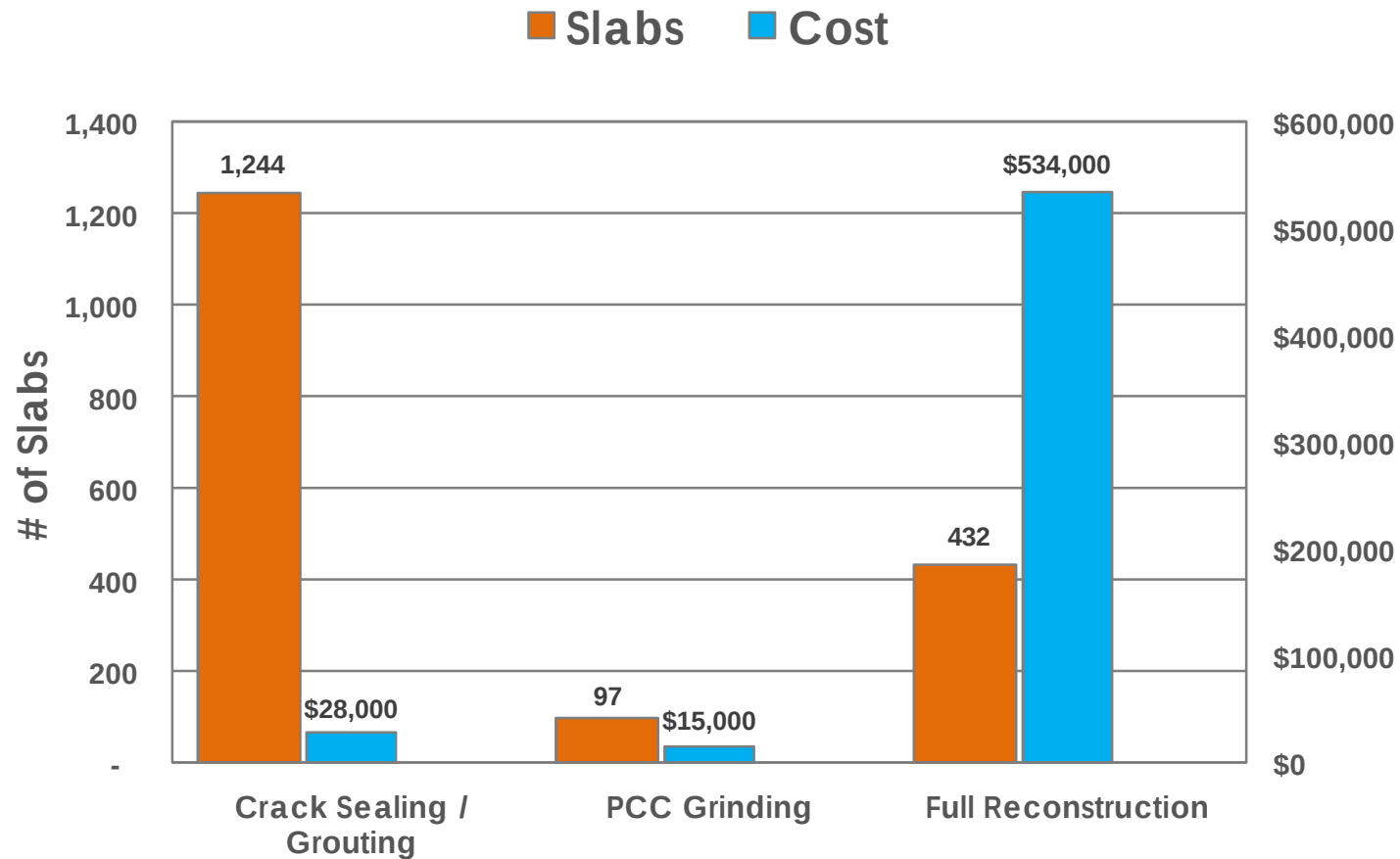
Decision Trees – Arterial Roads Example

→ Yes
→ No



M&R Recommendations - Sidewalks

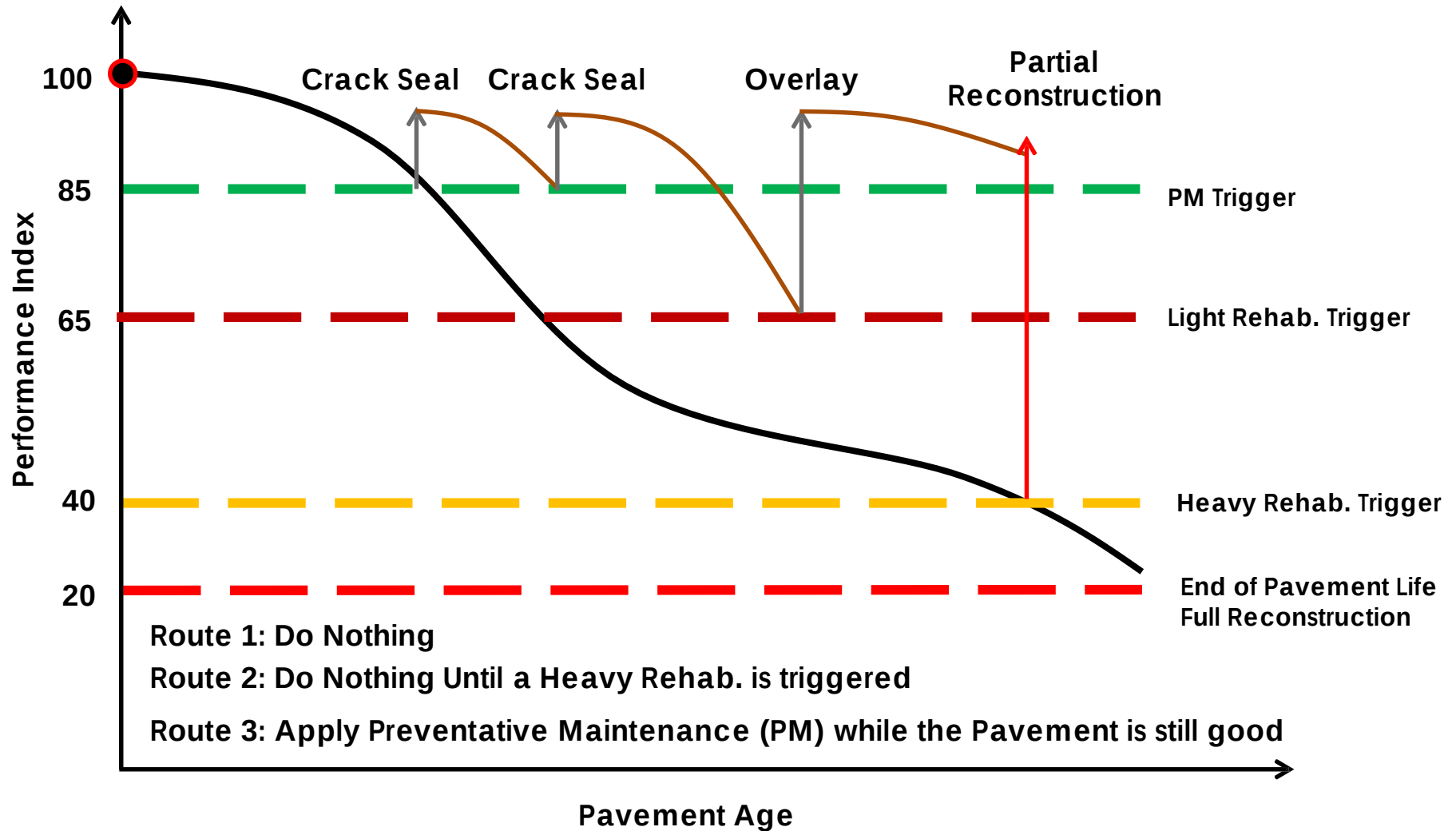
Sidewalk M&R Recommendations



A Final Remark

Three Routes M&R

Three Routes to Pavement Maintenance



Not-To-Scale

Thank You