Case Study: Pavement Management Implementation

Date:

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Presented by:

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Infrastructure Project Engineer
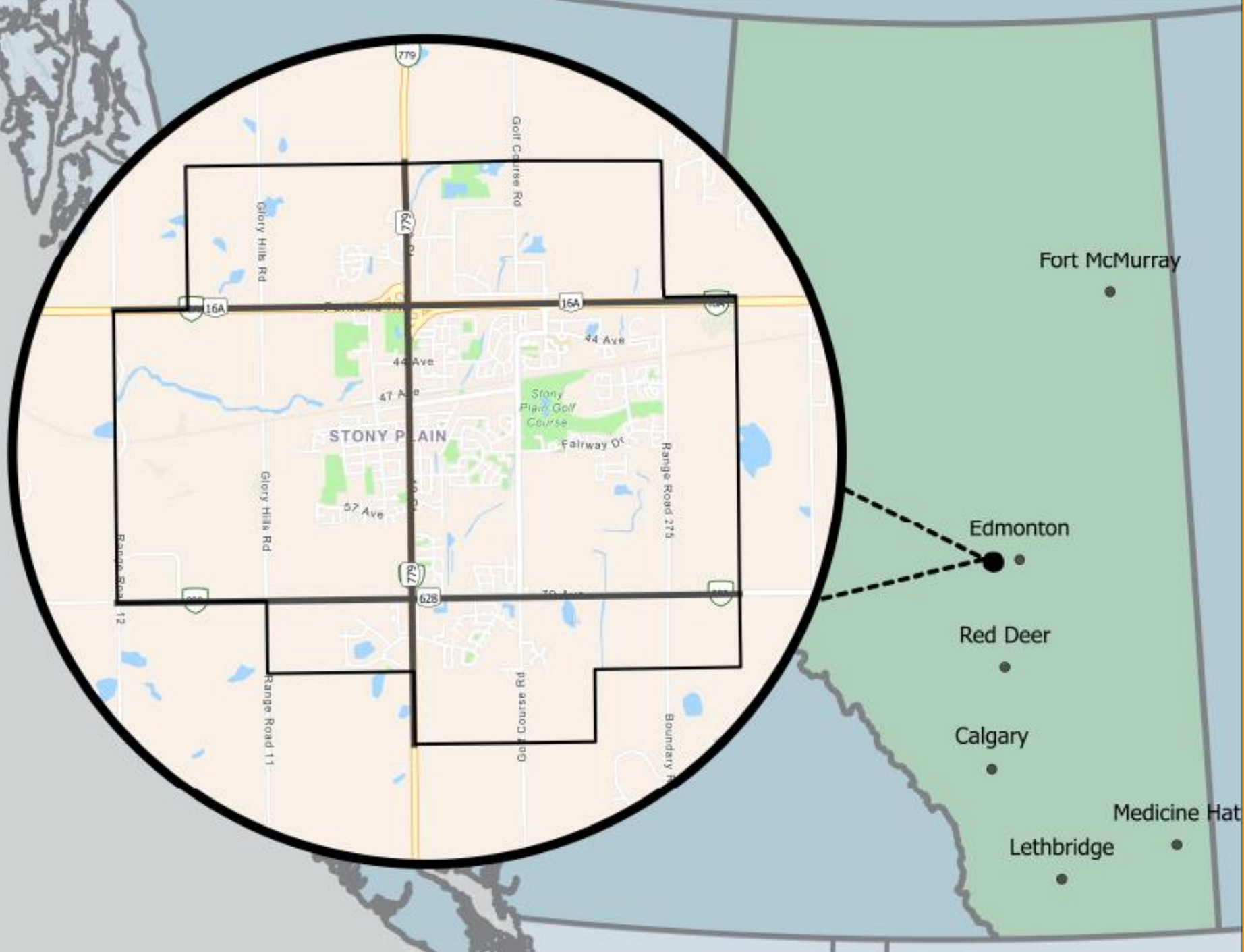**Town of Stony Plain**

TOWN OF
STONY
PLAIN

TOWN OF STONY PLAIN

Presentation Overview

- **Stony Plain Background**
- **Pavement Management Implementation**
  - **Condition Assessment**
  - **Council Education**
  - **Ground Penetrating Radar**
  - **Pavement Management Software**
- **Next Steps**
- **Questions**

Area: 37km²

Population: 17,993

TOWN OF STONY PLAIN

2020 - 2023 Strategic Plan

Corporate Plan

We commit to...

MANAGE COMMUNITY AND CORPORATE INFRASTRUCTURE AND ASSETS to ensure continued delivery of services.

KEY ACTIONS:

• Examine options for access to Westview Health Centre and surrounding neighbourhoods with the extension of South Park Drive.

• Complete a renewed Transportation Master Plan, including the role of Range Road 12 in the road network.

• Enhance infrastructure maintenance in a more sustainable and efficient manner with the development of an Asset Management Plan.

SUPPORTIVE INFRASTRUCTURE

TABLE 21

Initiative	Asset Management Implementation
Category	Departmental
Schedule	2020-2022
Cost	$325,000
Funding Source	Tax Levy Stabilization Reserve

Executive Summary

Asset Management provides an integrated process, bringing together skills, expertise, and activities of people; with Information about the Town's physical assets; and finances; so that informed decisions can be made, supporting sustainable service delivery. This initiative proposes an implementation of the program over 5 years.

2020	2021	2022
Condition Assessment Roads Assess Data Review Best Practices Total - $30,000	Condition Assessment Roads, Water, and Facilities Address information and data gaps Total - $110,000	Condition Assessment Roads, Water, Facilities, and Sanitary Build organization capacity Total - $185,000
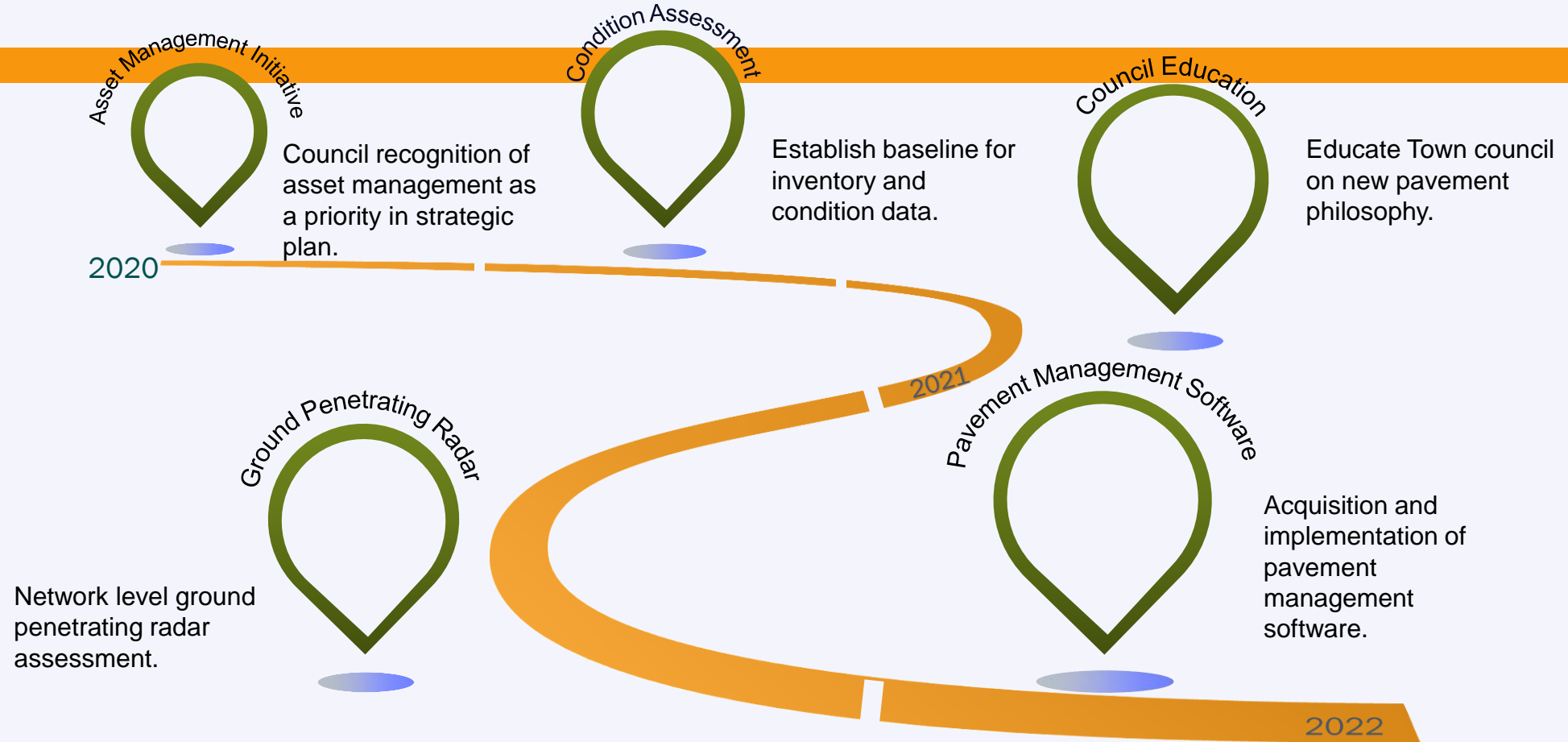
Pavement Condition Assessment - Project Scope

Goal

- Establish a baseline for the pavement condition and rehabilitation needs, as part of the Town's initiative to implement a dedicated pavement management program moving forward.

Deliverables

- GIS network definition

- Network level pavement inspections

- Pavement analysis

- Project report

- Geodatabase

2020 Pavement Data Collection

MPE - Class I Profiler survey vehicle

West Coast Road Testing - van mounted
Falling Weight Deflectometer (FWD)

Key Performance Indicators

Strength	SAI – Structural Adequacy Index	Represents load-bearing capacity (traffic). **Calculated from the measured FWD deflections.**
+		
Bumpiness	RCI – Ride Comfort Index	Represents the roughness of a pavement. **Calculated from the measured IRI.**
+		
Cracking/Defects	VCI – Visual Condition Index	Represents the surface distress condition of a pavement. **Calculated from the rated distress.**
=		
Reported Quality	**PQI – Pavement Quality Index**	Represents the overall condition of a pavement. **Calculated as a function of VCI, RCI, and SAI.**

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2020 Performance Condition Results

FUNCTIONAL CLASS	LN-KM	PQI
Arterial Network	28.8	65
Collector Network	36.9	56
Local Network	115.0	53
Back Lane Network	8.5	43
Gravel Network	*18.7*	*-*
Paved Road Network	**189.2**	**55**

Study Average PQI = 65

Based on 2017 study containing 10 participants.

Network Present Status Distribution
Stony Plain Paved Road Network

PQI 55
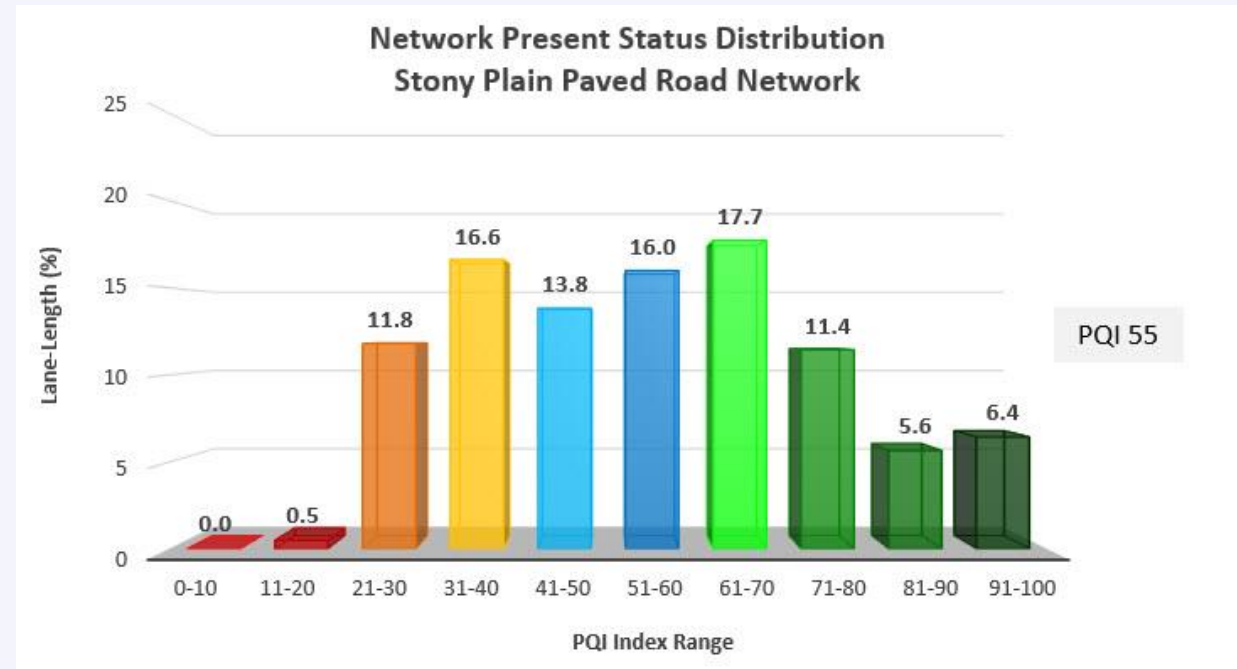
Council Education

What is Pavement Management?
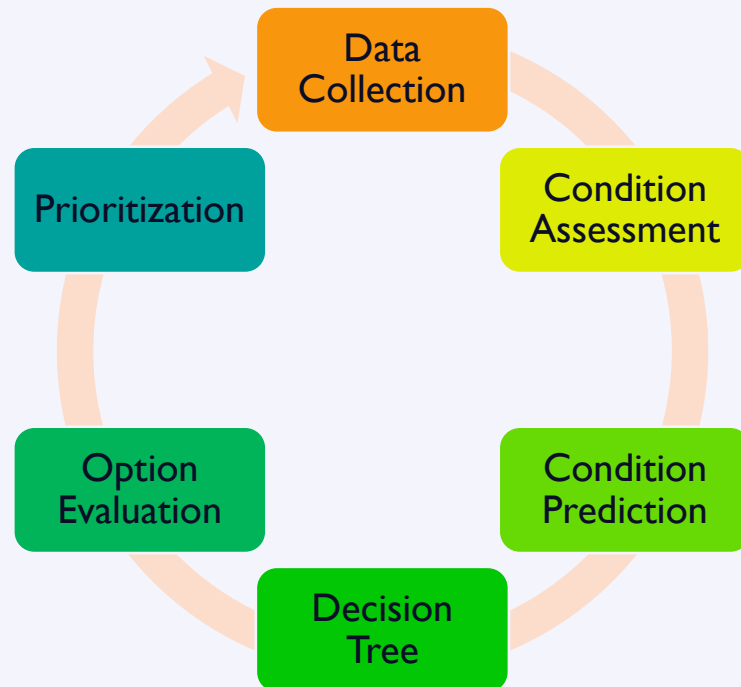
Pavement Management

is the practice of *optimizing* the condition of a road network while *maximizing* dollar value through planning rehabilitation and maintenance.

"Choosing the **right** treatment, for the **right** road, at the **right** time."

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Treatment Types

Microsurfacing

Asphalt Foaming

Preservation ($)

Designed to maintain the current road's quality and extend the time until the next treatment.

Restoration ($$)

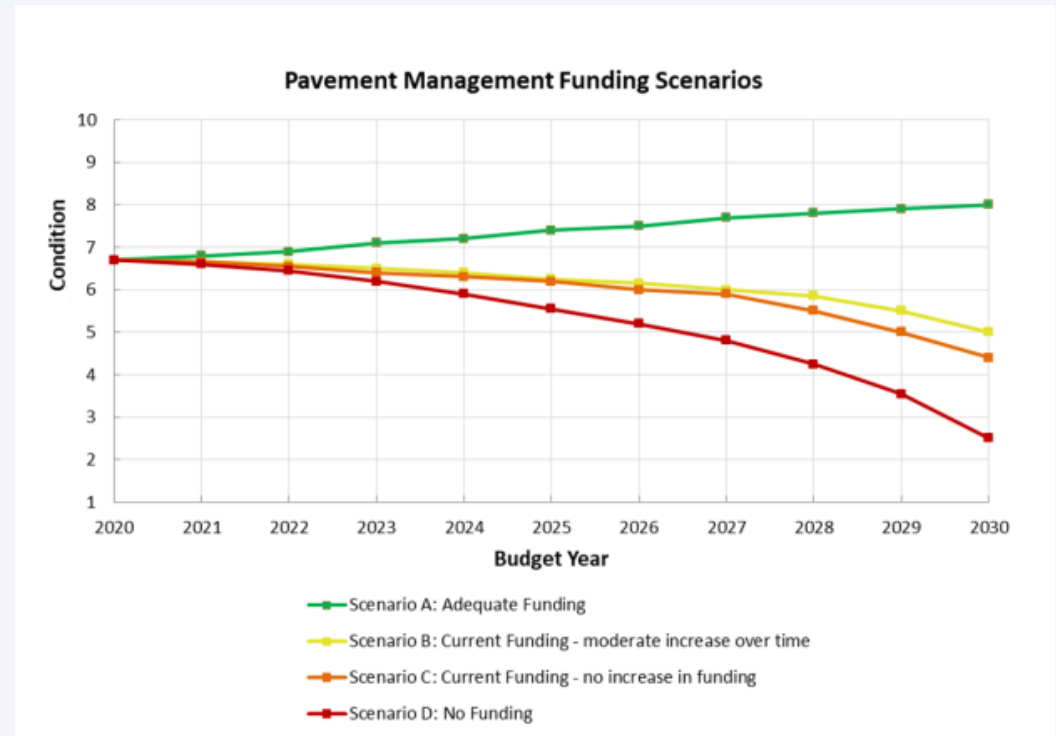Restoration treatments are used when the road's quality has deteriorated past the point of preservation.

Rehabilitation ($$$)

Rehabilitation is used when the road is close or past the end of its life-cycle. When this occurs, there are very few other options except to fully reconstruct the road.
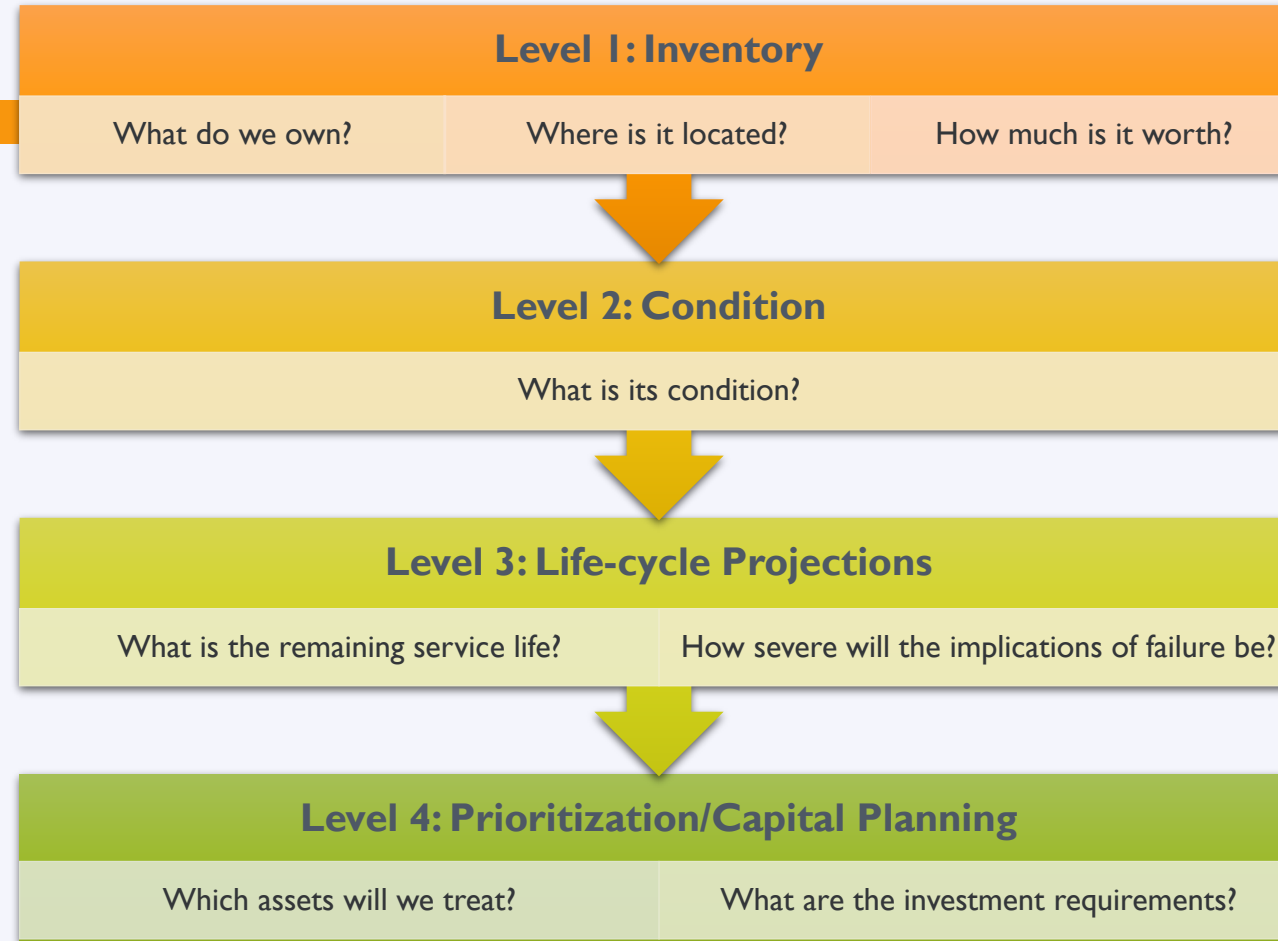
Pavement Quality Index Map

Budget Scenarios

Levels of Asset Maturity

Level 1: Inventory

| What do we own? | Where is it located? | How much is it worth? |

Level 2: Condition

What is its condition?

Level 3: Life-cycle Projections

| What is the remaining service life? | How severe will the implications of failure be? |

Level 4: Prioritization/Capital Planning

| Which assets will we treat? | What are the investment requirements? |

Levels of Asset Maturity

Level 1: Inventory

What do we own?	Where is it located?	How much is it worth?

↓

Level 2: Condition

What is its condition?

↓

Level 3: Life-cycle Projections

What is the remaining service life?	How severe will the implications of failure be?

↓

Level 4: Prioritization/Capital Planning

Which assets will we treat?	What are the investment requirements?

Inventory

- Asset types
- Asset quantities
- Dimensions
- Material
- Spatial data

Levels of Asset Maturity

Level 1: Inventory		
What do we own?	Where is it located?	How much is it worth?

↓

Level 2: Condition

What is its condition?

↓

Level 3: Life-cycle Projections

What is the remaining service life?	How severe will the implications of failure be?

↓

Level 4: Prioritization/Capital Planning

Which assets will we treat?	What are the investment requirements?

Condition

- Standardized condition rating criteria
- Data collection method/equipment
- Database/Repository Software
- Condition rating schedule/cycle

Levels of Asset Maturity

Level 1: Inventory

What do we own?	Where is it located?	How much is it worth?

↓

Level 2: Condition

What is its condition?

↓

Level 3: Life-cycle Projections

What is the remaining service life?	How severe will the implications of failure be?

↓

Level 4: Prioritization/Capital Planning

Which assets will we treat?	What are the investment requirements?

Life-cycle Projections

- Deterioration modelling
- Decision trees
- Life-cycle needs

Levels of Asset Maturity

Level 1: Inventory

| What do we own? | Where is it located? | How much is it worth? |

Level 2: Condition

What is its condition?

Level 3: Life-cycle Projections

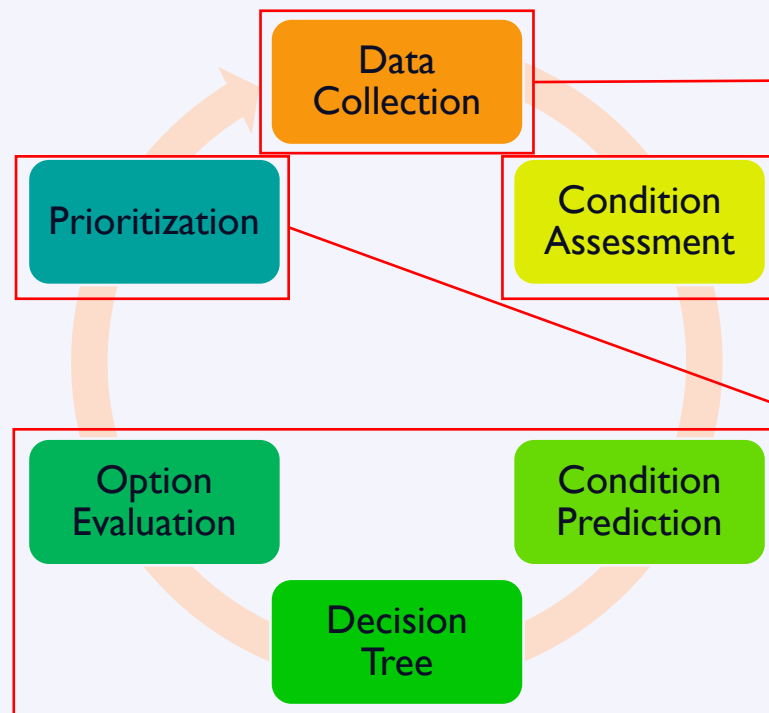| What is the remaining service life? | How severe will the implications of failure be? |

Level 4: Prioritization/Capital Planning

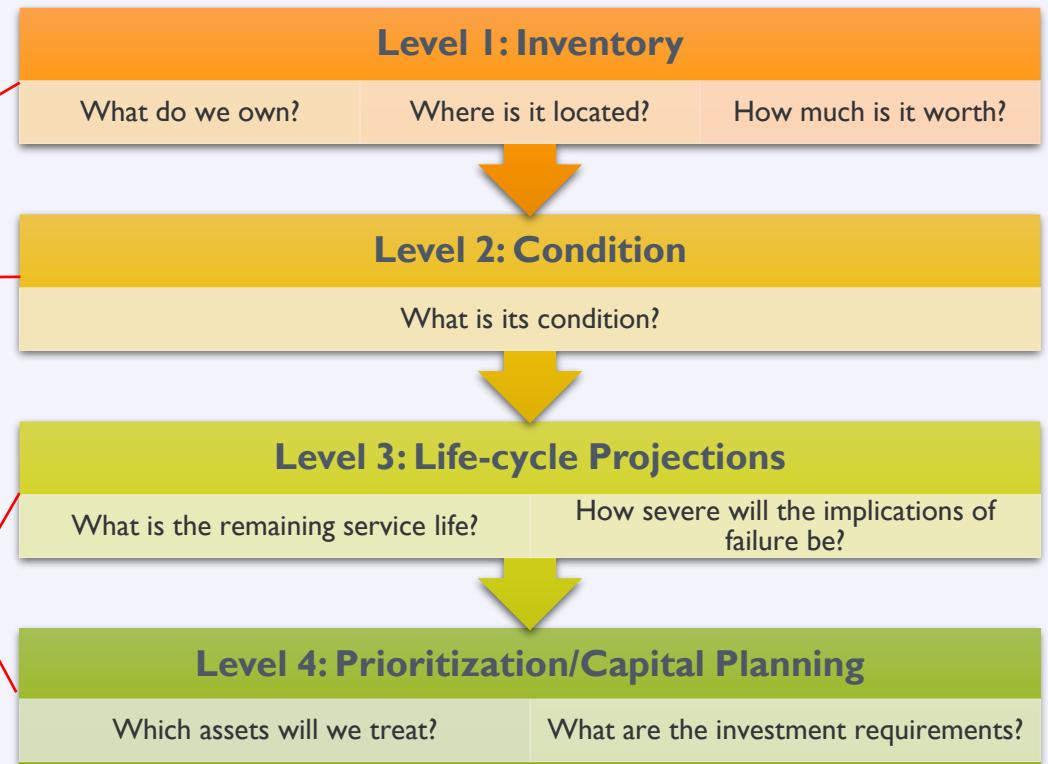| Which assets will we treat? | What are the investment requirements? |

Prioritization/Capital Planning

- Risk-likelihood analysis
- Target service levels
- Life-cycle costing/Cost-benefit analysis
- Life-cycle alignment of peripheral assets
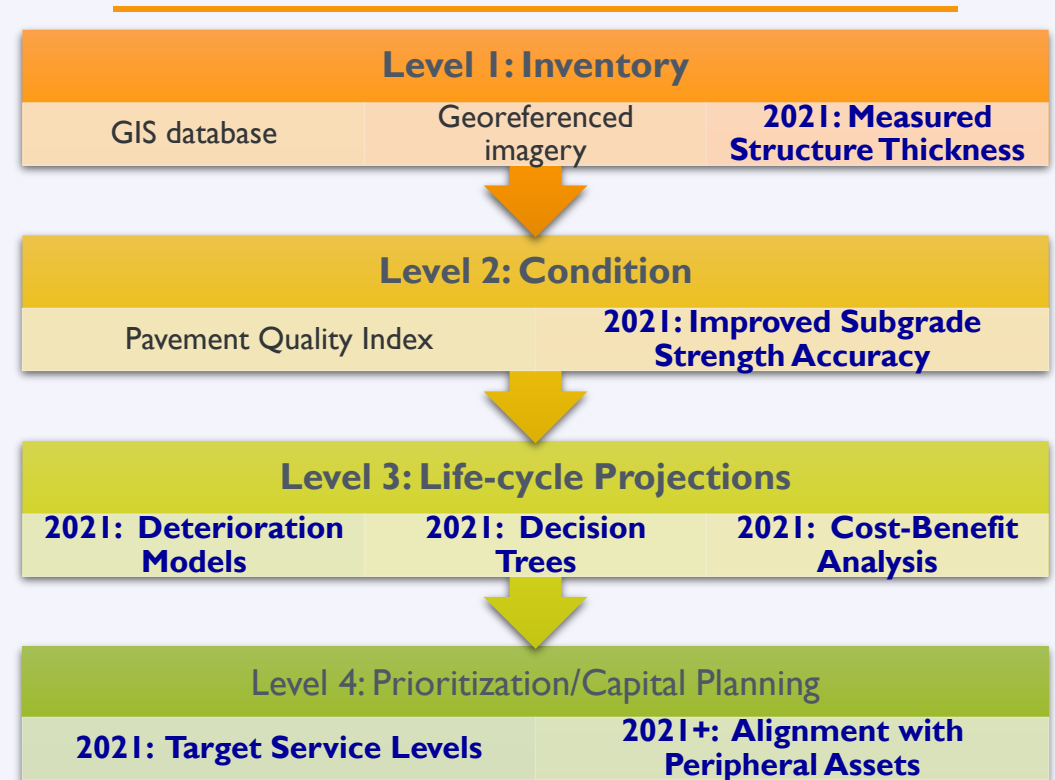
Typical Pavement Management Process

Asset Maturity Levels

Data Collection

Condition Assessment

Prioritization

Option Evaluation

Condition Prediction

Decision Tree

Level 1: Inventory

What do we own?	Where is it located?	How much is it worth?

Level 2: Condition

What is its condition?

Level 3: Life-cycle Projections

What is the remaining service life?	How severe will the implications of failure be?

Level 4: Prioritization/Capital Planning

Which assets will we treat?	What are the investment requirements?

Roads Asset Class

Asset Maturity Levels

Level 1: Inventory

| GIS database | Georeferenced imagery | **2021: Measured Structure Thickness** |

Level 2: Condition

| Pavement Quality Index | **2021: Improved Subgrade Strength Accuracy** |

Level 3: Life-cycle Projections

| **2021: Deterioration Models** | **2021: Decision Trees** | **2021: Cost-Benefit Analysis** |

Level 4: Prioritization/Capital Planning

| **2021: Target Service Levels** | **2021+: Alignment with Peripheral Assets** |

2021 Pavement Management System Updates

Asset Maturity Levels

Ground Penetrating Radar

Pavement Management Software

RoadMatrix™
PMS Software Engine (PSE)

Level 1: Inventory

| GIS database | Georeferenced imagery | **2021: Measured Structure Thickness** |

Level 2: Condition

| Pavement Quality Index | **2021: Improved Subgrade Strength Accuracy** |

Level 3: Life-cycle Projections

| **2021: Deterioration Models** | **2021: Decision Trees** | **2021: Cost-Benefit Analysis** |

Level 4: Prioritization/Capital Planning

| **2021: Target Service Levels** | **2021+: Alignment with Peripheral Assets** |

Condition Data

Infrastructure Capital Program

SAI – Structural Adequacy Index

RCI – Ride Comfort Index

VCI – Visual Condition Index

PQI – Pavement Quality Index

Level 2: Condition

Analysis

2021 Road Program
- Microsurfacing
- Crack Sealing
- Full Depth Reclaimation

Level 4: Prioritization/Capital Planning

Condition Data
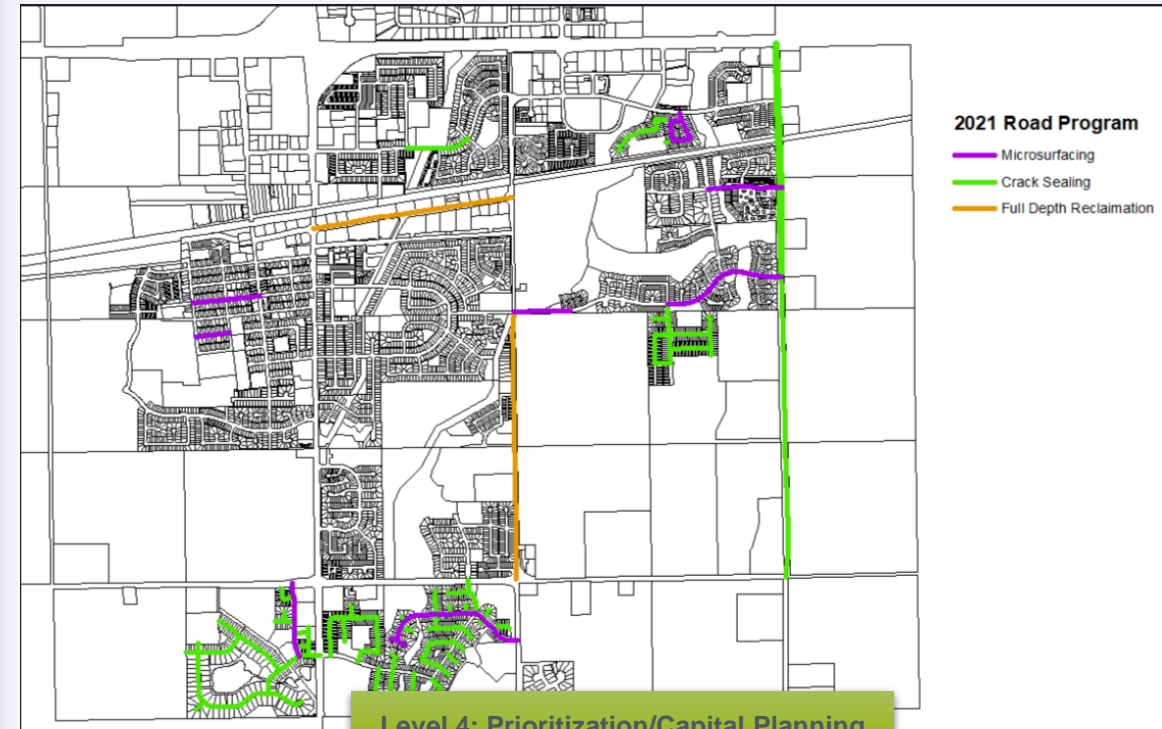
Infrastructure Capital Program

SAI – Structural Adequacy Index

Lower Confidence Level
- **Assumed Structure Thicknesses**

Level 2: Condition	Level 4: Prioritization/Capital Planning

↓ **confidence level** = ↓ **confidence level**

2021 Road Program
- Microsurfacing
- Crack Sealing
- Full Depth Reclaimation

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2021 Ground Penetrating Radar

Interpreted Bottom of Asphalt Layer
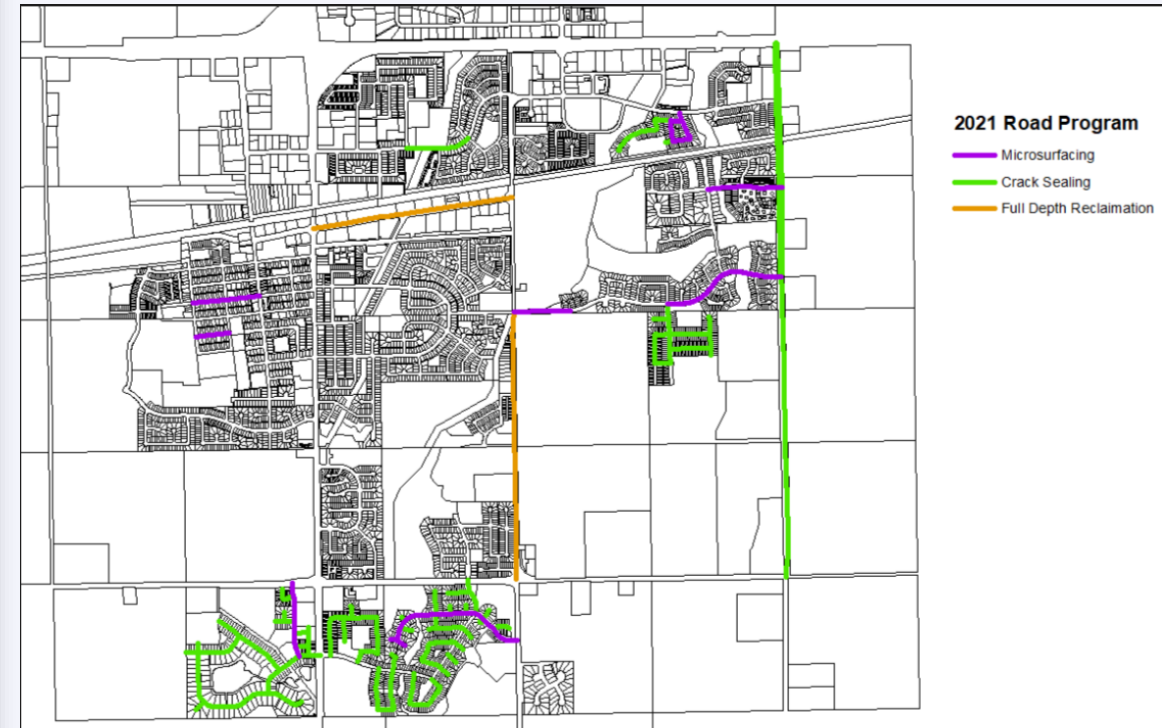
Interpreted Bottom of Granular Base Layer

- Ground Penetrating Radar (GPR) is a non-destructive test that allows the Town to identify what road structures exist below the asphalt

- Increases accuracy in three key areas:
  - SAI / subgrade strength
  - Deterioration modelling
  - Project level planning
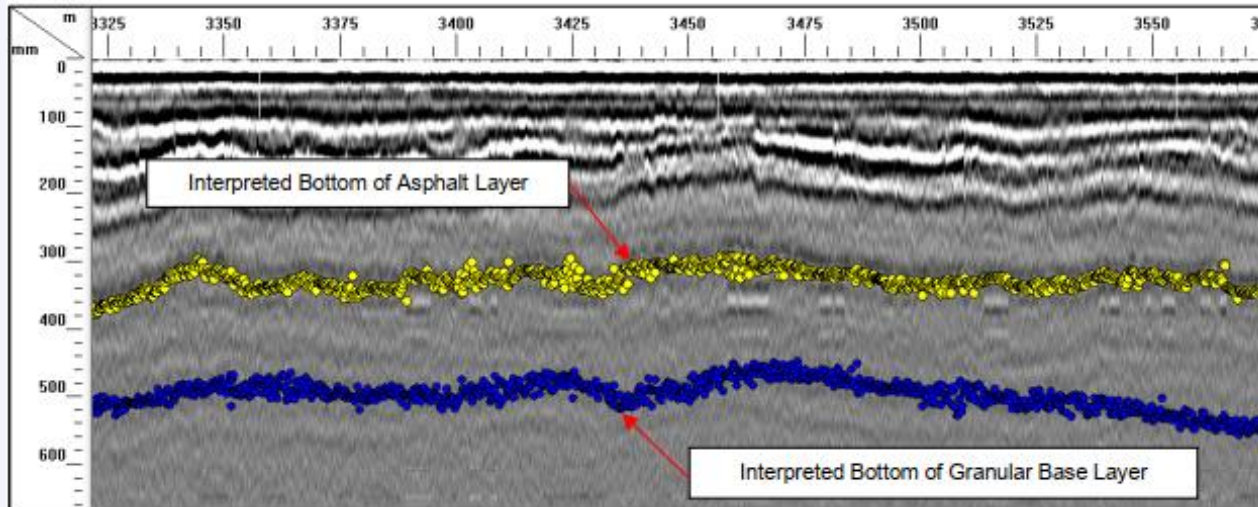
2021 Ground Penetrating Radar Results
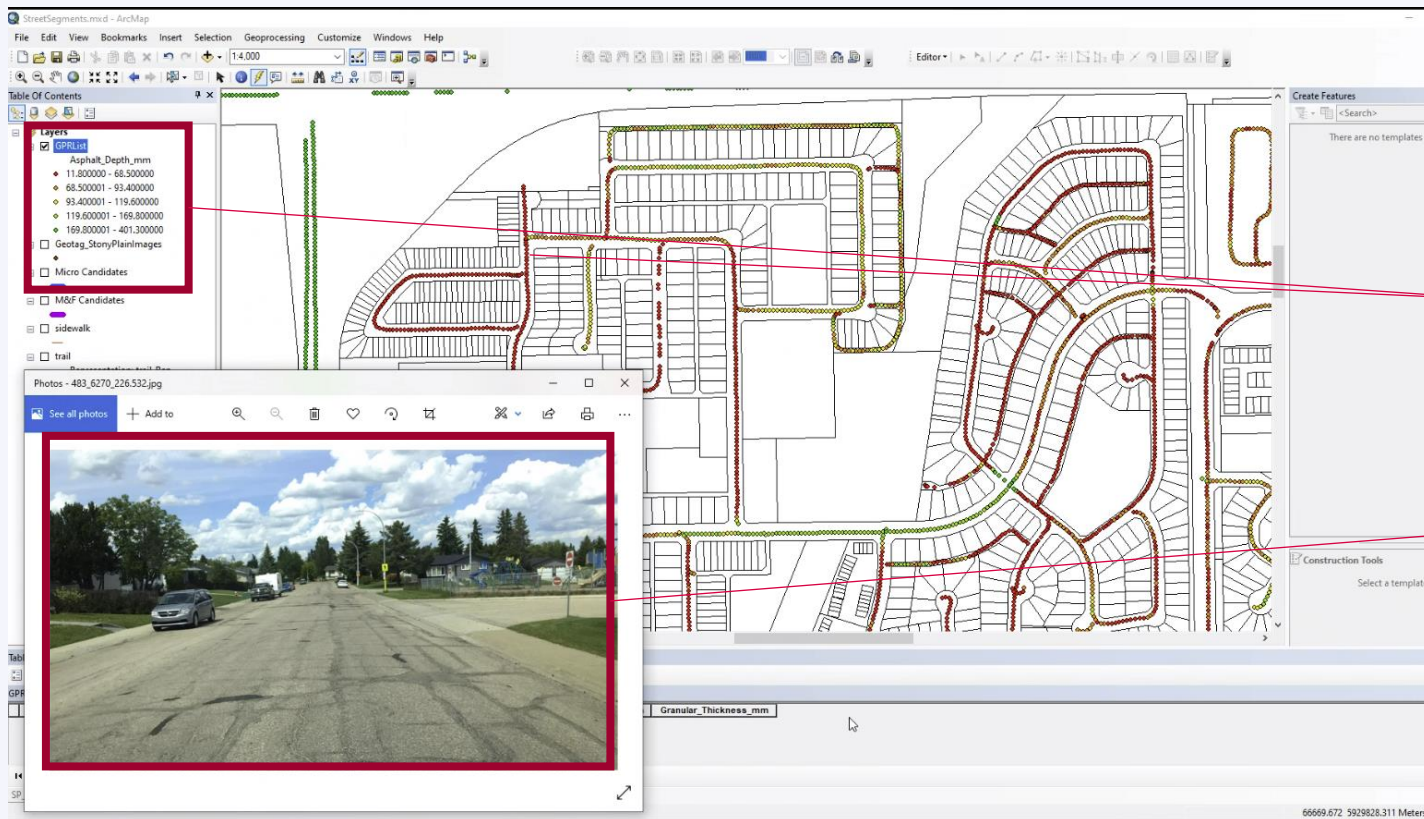
Geodetic points with measured road thickness and material types

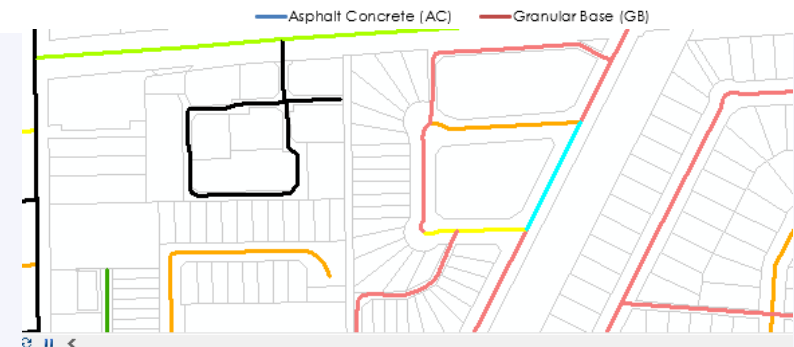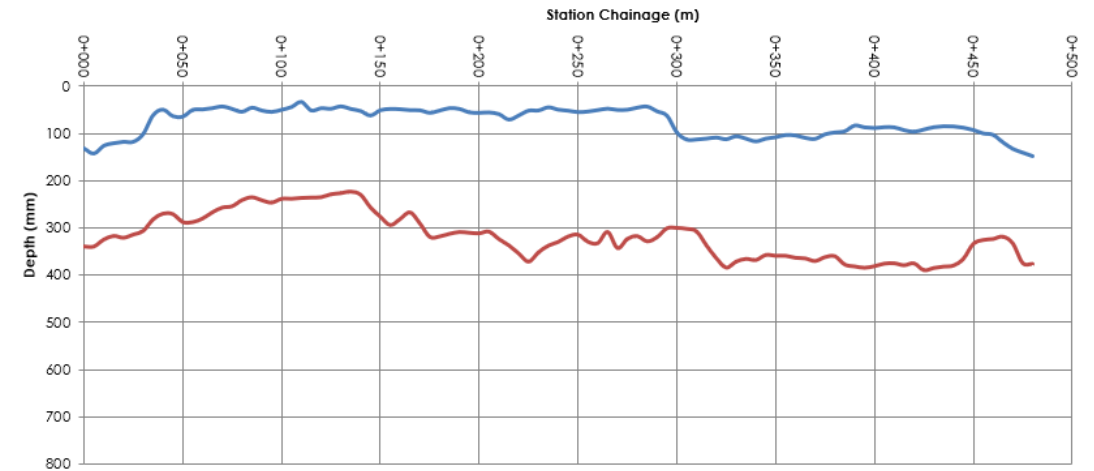Updated photos of all paved roads

Ground Penetrating Radar – Project Level Applications

Pavement Quality Index: 39

GPR Layer Profile - Brown Street, 52 Avenue to 49 Avenue
Northbound Lane 1 - Stations: 0+000 to 0+480

Asphalt Concrete (AC) Granular Base (GB)

valid	pavement_type	laneway	FWD_Tests	SNeff_mm	Mr_MPa	%_truck	AADT	EGT
2	1 AC		3	136	20.7	0	200	350

Condition Data

Infrastructure Capital Program

SAI – Structural Adequacy Index

Increased Confidence Level

- **Measured Structure Thicknesses**

RCI – Ride Comfort Index

Analysis

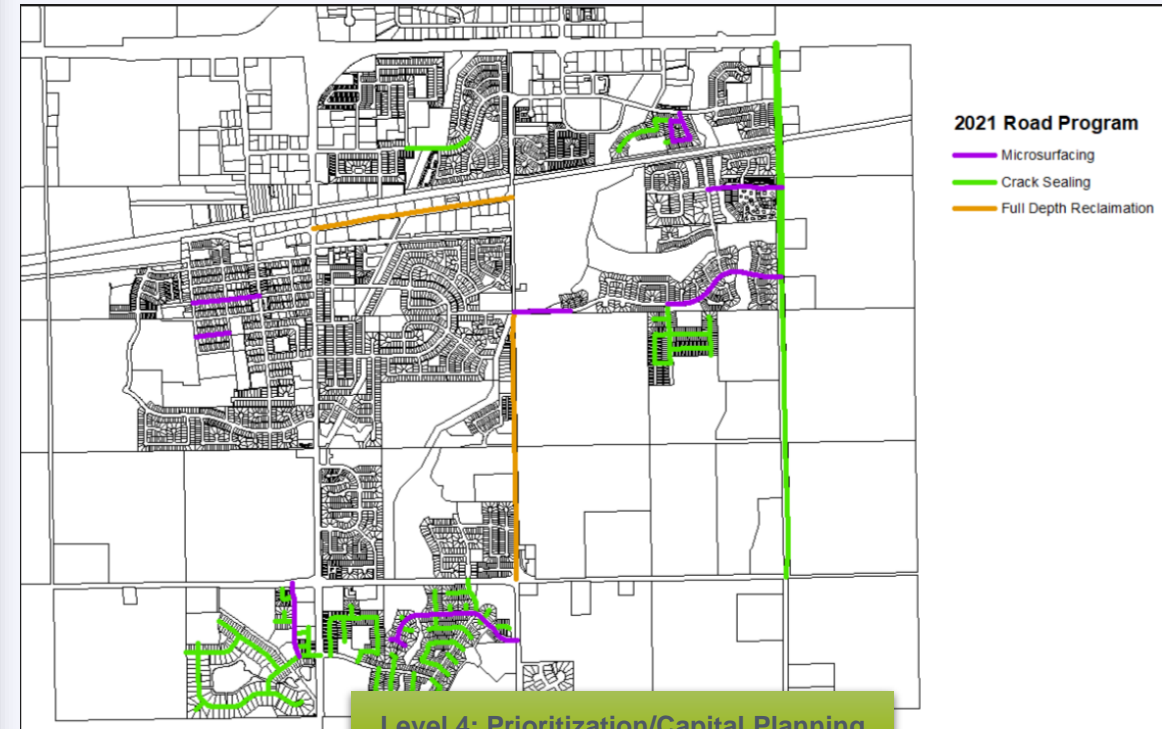PCI – Pavement Condition Index

PQI – Pavement Quality Index

Level 2: Condition

2021 Road Program
- Microsurfacing
- Crack Sealing
- Full Depth Reclaimation

Level 4: Prioritization/Capital Planning

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Condition Data

Infrastructure Capital Program

SAI – Structural Adequacy Index

RCI – Ride Comfort Index

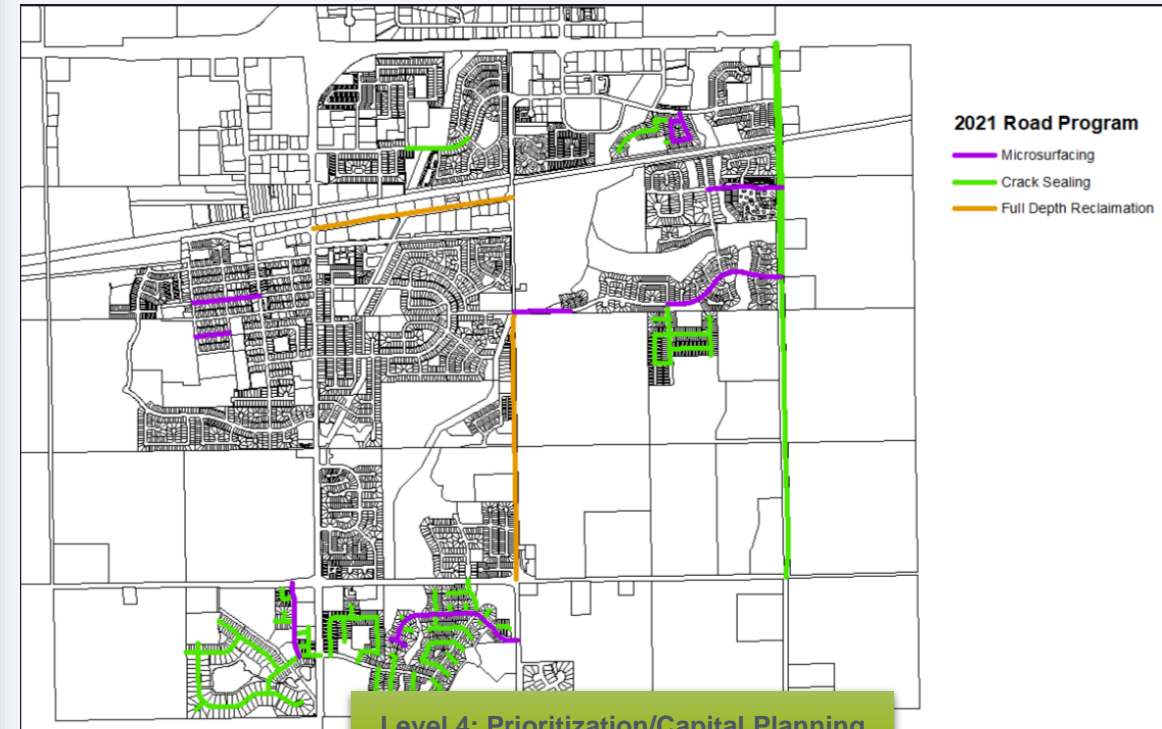PCI – Pavement Condition Index

PQI – Pavement Quality Index

Analysis

Performed by consultant

2021 Road Program
- Microsurfacing
- Crack Sealing
- Full Depth Reclaimation

Level 4: Prioritization/Capital Planning

Level 2: Condition

Level 3: Life-cycle Projections

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2021 RoadMatrix Pavement Management Software

Level 3: Life-cycle Projections

- **Road Matrix is a pavement management software used by many agencies in Alberta, including St. Albert, Leduc and Strathcona County.**

- **This software was acquired with the FCM Asset Management Grant**
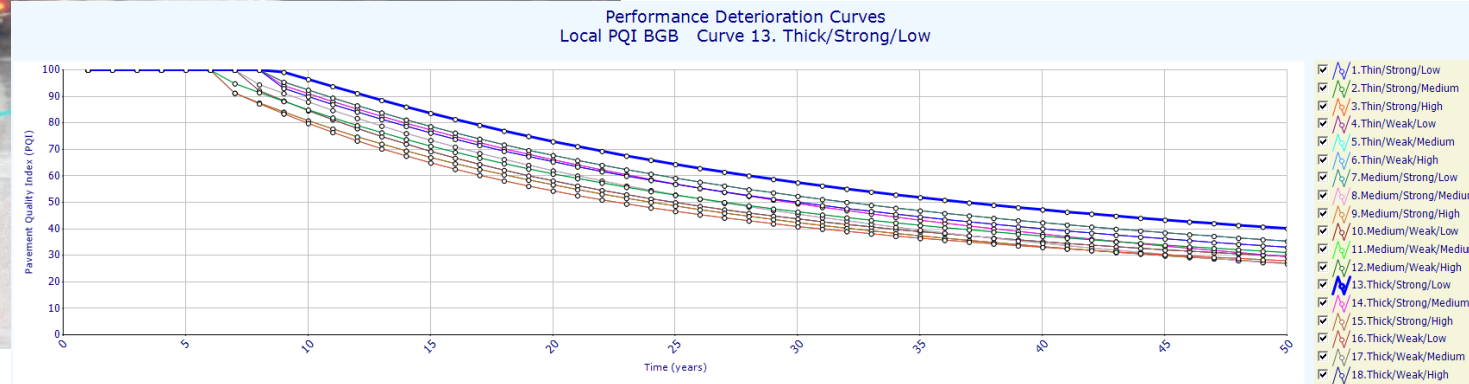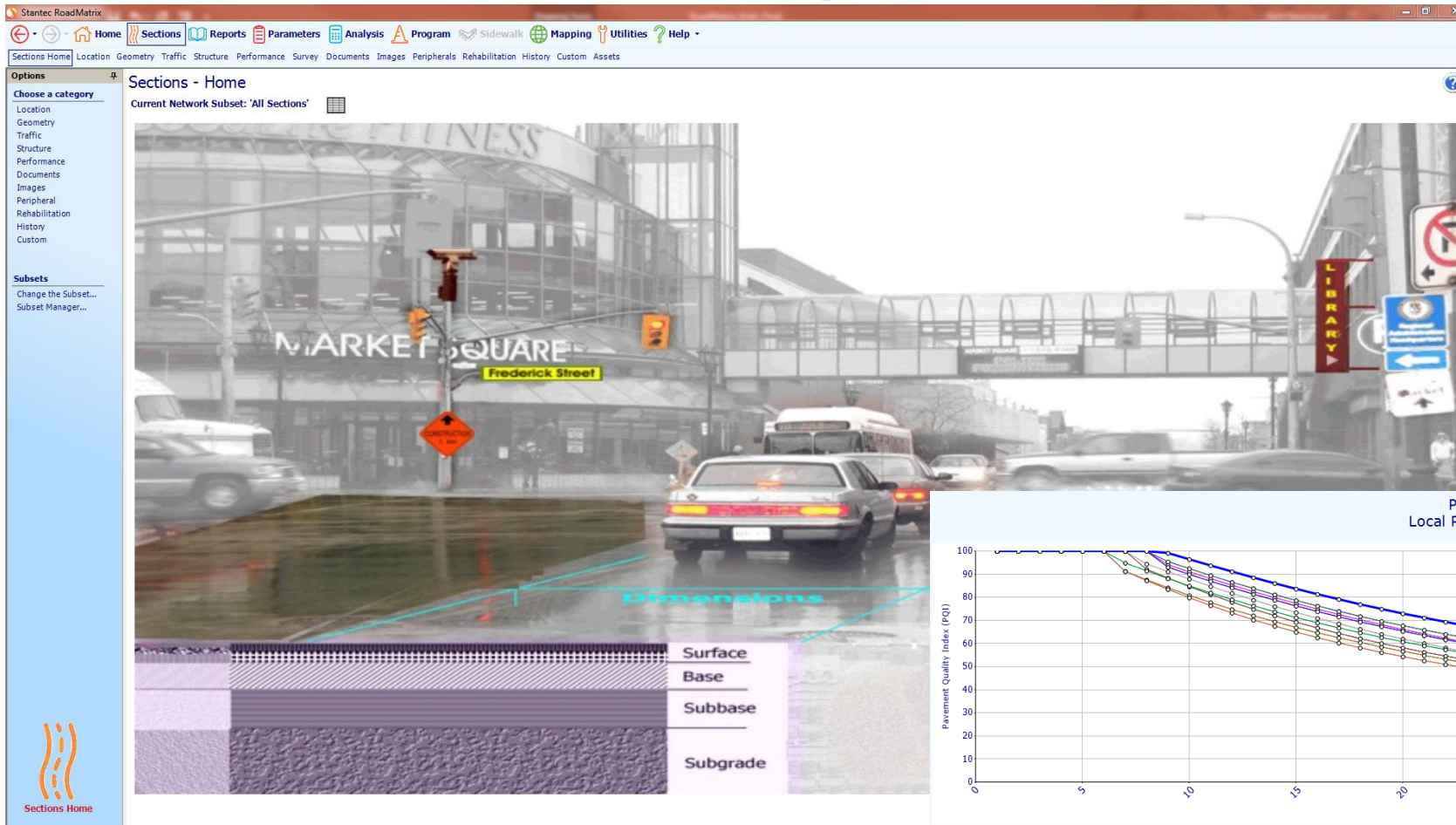
RoadMatrix Applications

Enterprise GIS

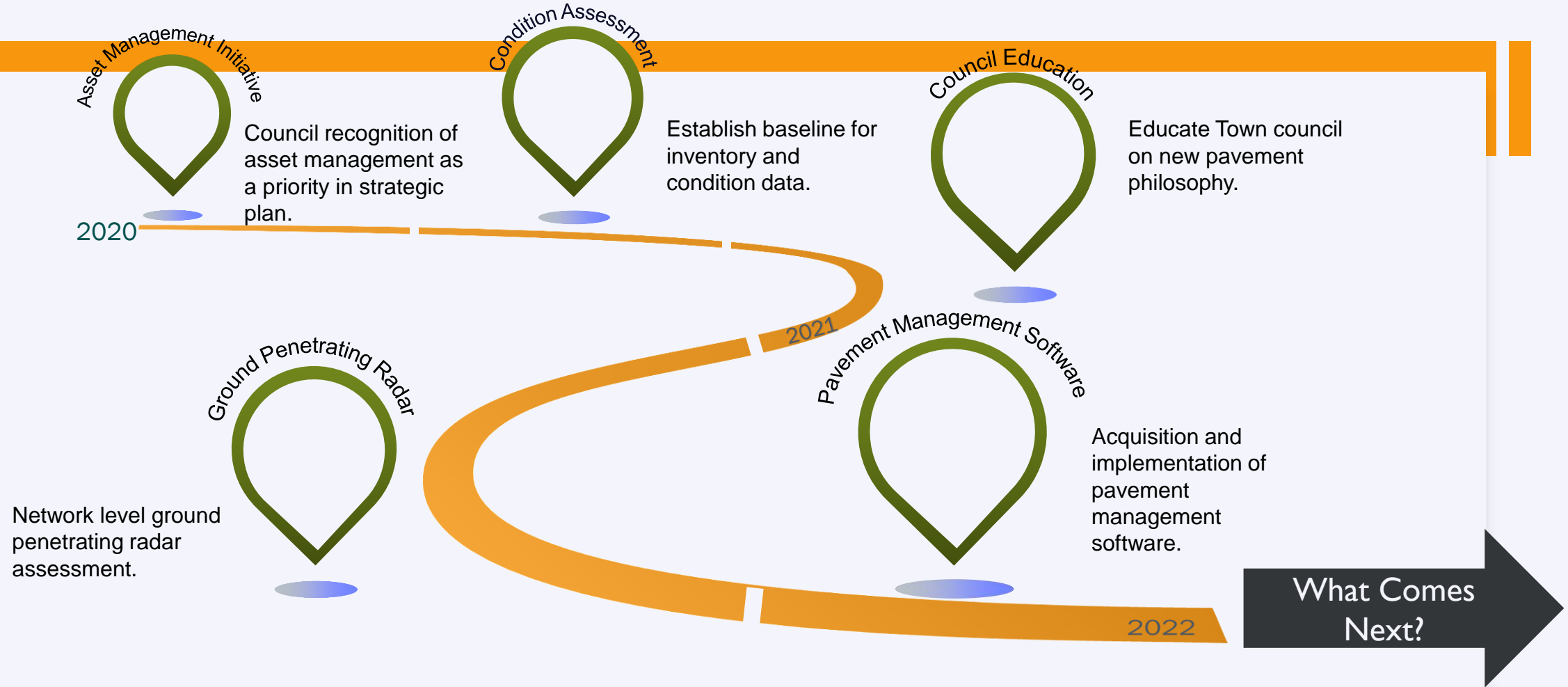- Network Definition
- Segment Attributes
- Spatial Reference
- Ground Penetrating Radar

Network Updates

Condition Surveys

RoadMatrix - Data Repository

- Pavement Network Inventory
- Pavement Condition Data
- Data Analysis & Reporting
- Maintenance History

Unit Rates

Maintenance History

Network Deterioration Projections

Forcasted Budget Needs

Multi-year Capital Programs

Current Year Budget Allocations

Performance Deterioration Curves
Local PQI BGB   Curve 13. Thick/Strong/Low

1.Thin/Strong/Low
2.Thin/Strong/Medium
3.Thin/Strong/High
4.Thin/Weak/Low
5.Thin/Weak/Medium
6.Thin/Weak/High
7.Medium/Strong/Low
8.Medium/Strong/Medium
9.Medium/Strong/High
10.Medium/Weak/Low
11.Medium/Weak/Medium
12.Medium/Weak/High
13.Thick/Strong/Low
14.Thick/Strong/Medium
15.Thick/Strong/High
16.Thick/Weak/Low
17.Thick/Weak/Medium
18.Thick/Weak/High

Pavement Management Funding Scenarios

- Scenario A: Adequate Funding
- Scenario B: Current Funding - moderate increase over time
- Scenario C: Current Funding - no increase in funding
- Scenario D: No Funding

Pavement Management Implementation Timeline

Asset Management Initiative
Council recognition of asset management as a priority in strategic plan.

Condition Assessment
Establish baseline for inventory and condition data.

Council Education
Educate Town council on new pavement philosophy.

2020

Ground Penetrating Radar
Network level ground penetrating radar assessment.

Pavement Management Software
Acquisition and implementation of pavement management software.

2021

2022

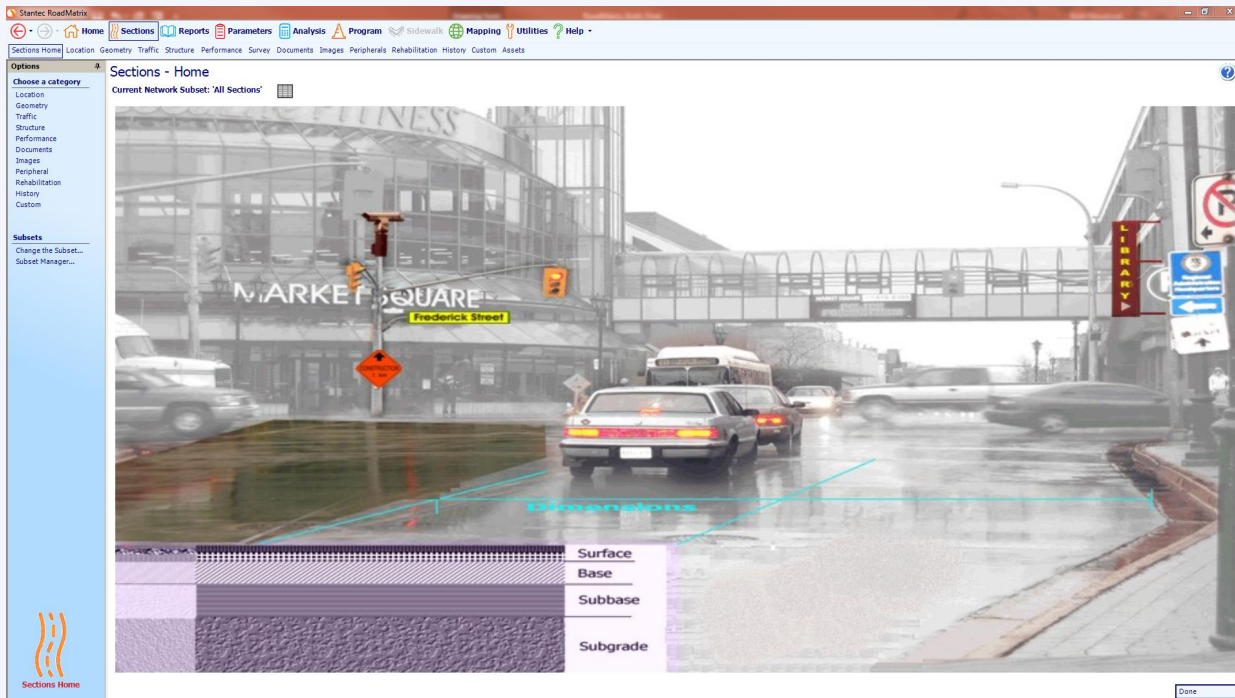What Comes Next?

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Continued Data Collection

- Condition assessment every 3 years for full paved network
- Ground Penetrating Radar on newly developed roads at Final Acceptance Certificate

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RoadMatrix Updates

Completed Annually:

- Continue to update and improve decision trees

- Add new roads at Final Acceptance Certificate to database

- Input historical road maintenance and rehabilitation records

- Update traffic volumes

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# Infrastructure Capital Planning - Strategy

Short Term

- Create defined restoration and preservation plans over the next 5 to 7 years

- Reduce backlog of preservation and restoration and implement staged approach

- Make best use of grants and other provincial funding

Long Term

- Focus on rehabilitation treatments

- Align rehabilitation program with masterplans

- Work with Council to set targeted services levels

- Create infrastructure renewal plans to address life-cycle of peripheral assets

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Harmonized Infrastructure Treatments
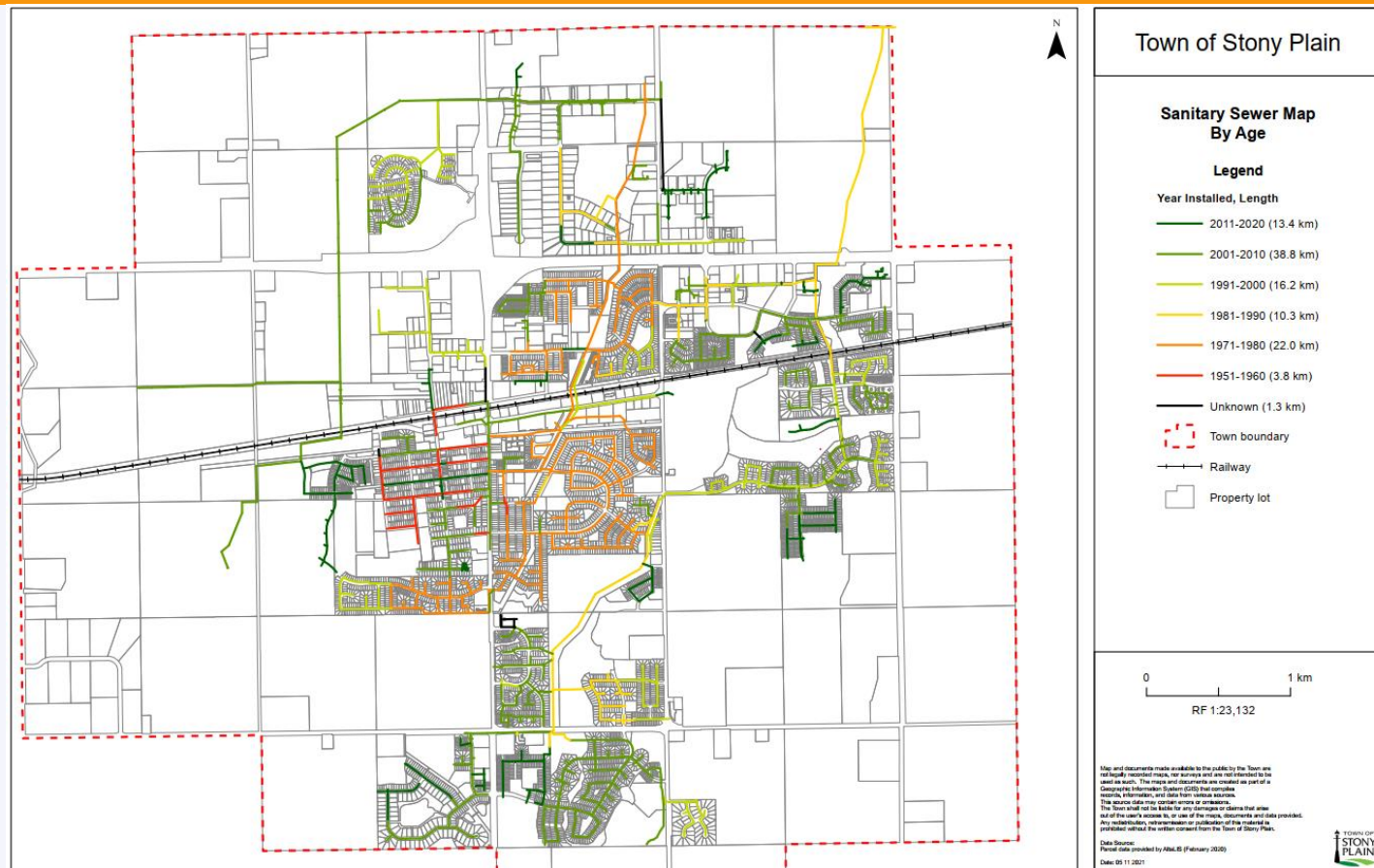
Currently combining utility attribute information with road condition data to prioritize implementation of Pipeline Assessment Certification Program.

Likelihood of Failure (Utilities)

+

Consequence of Failure (Utilities)

+

Structurally Deficient (Road Network)

=

HIT Locations

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