

Pavement Management Plan

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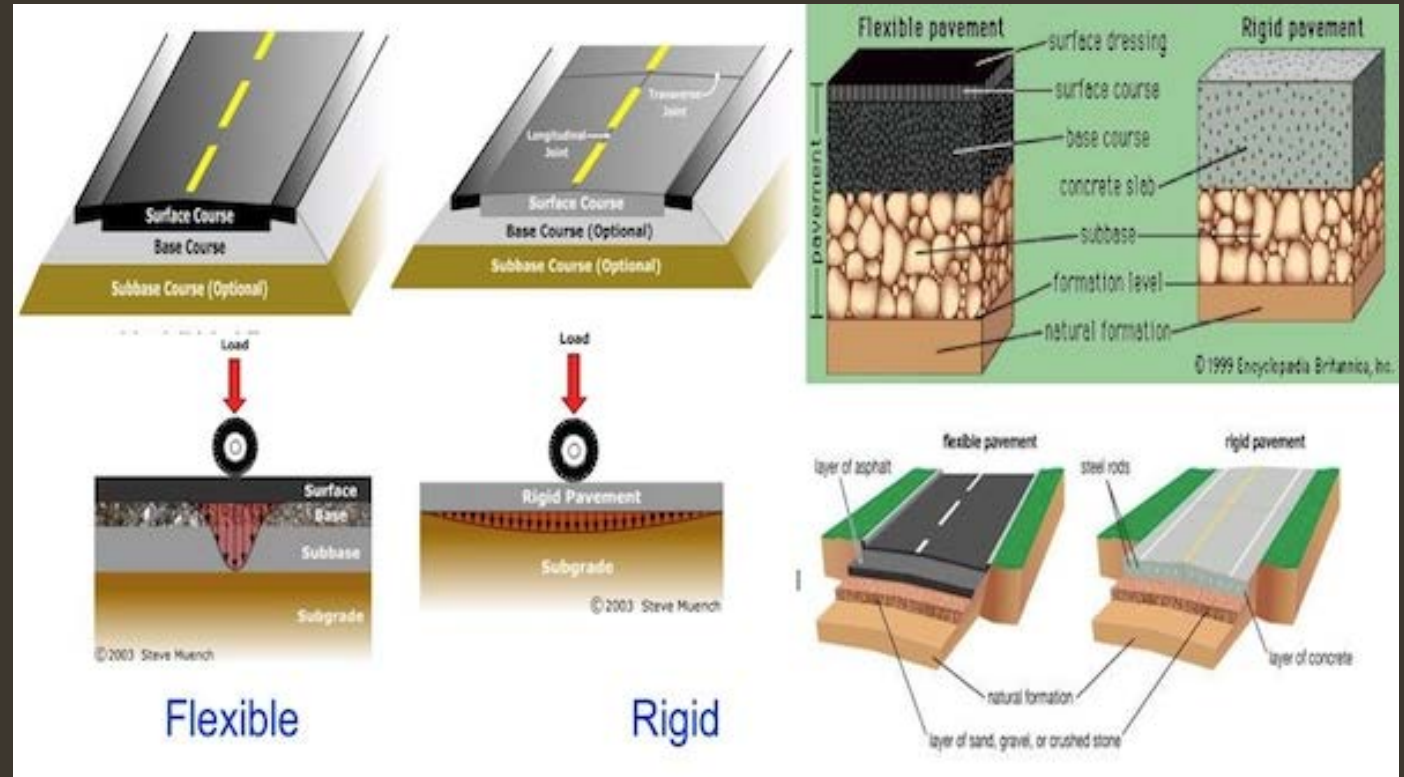


Agenda

- Pavements – What are They
- What is Pavement Management
- City's Current Pavement Maintenance Financing
- Project History
- City's Pavement Conditions
- Financial Planning
- Future Implementation Steps

Pavements – What Are They?

- A surface material that transfers load to the underlying soil.
- Can be made from gravel, asphalt, concrete, stone, or any other material that will transfer the load.
- Each material has its own engineering properties that require different designs to transfer the loads.



Pavements – What Are They?

- No matter how well the pavement is designed or constructed...it will fail
- Pavement distress falls into two main categories:



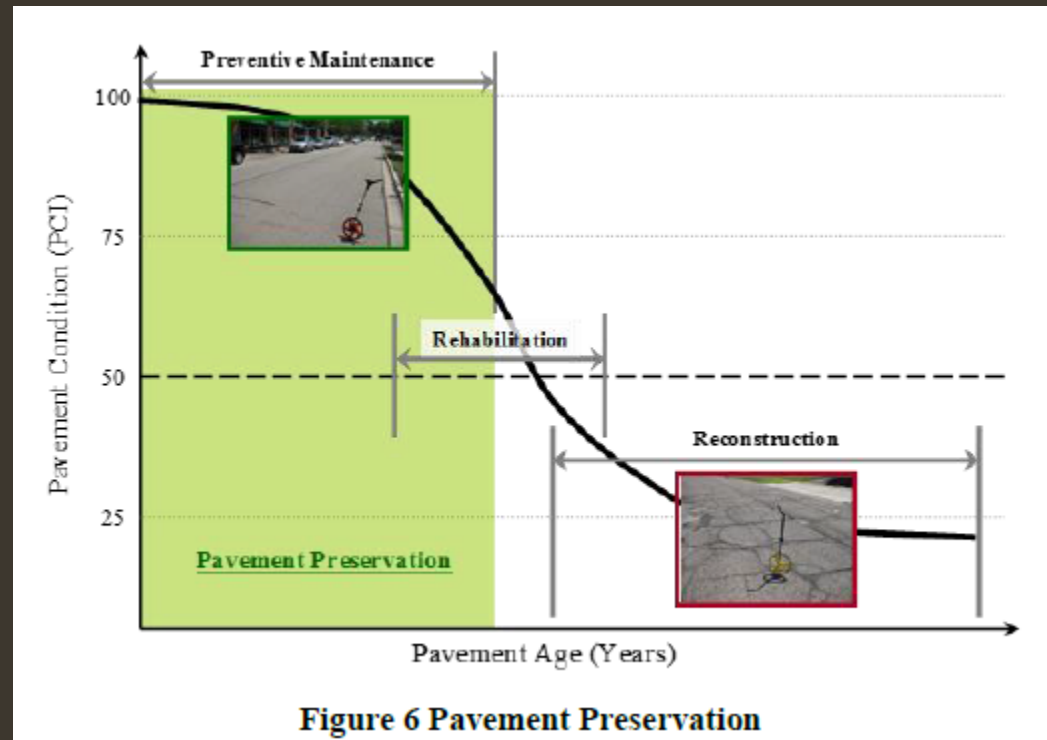
Weathering Failure



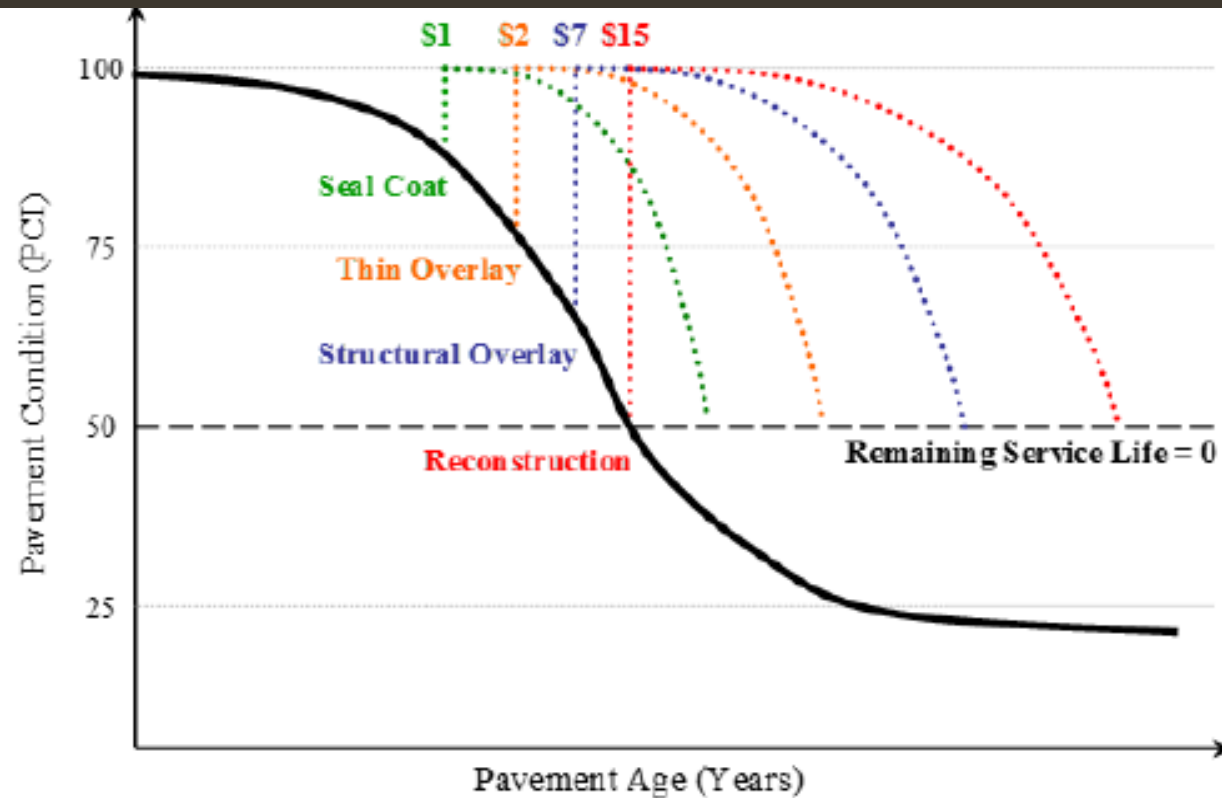
Load Failure

What is Pavement Management

- Systematic approach to forecast maintenance & rehabilitation (M&R) requirements, then optimize and prioritize available funding.
- Pavement failures can be delayed with proper pavement management



What is Pavement Management



**Figure 7 Increasing Price and Decreasing Relative Benefit of M&R as a Function of PCI
(Prices shown are for illustrative purposes only)**

City's Current Pavement Maintenance Financing

Street Maintenance Funding Background:

- Two primary street improvement programs:
 - Public Works Street Maintenance Budget (levy funded)
 - Street Improvement Program (funded by levy until 2011, then sales tax)
- **Public Works Street Maintenance**
 - \$1,075,000 total account budget
 - \$500,000 provides general street maintenance to streets and alleys
 - \$500,000 is dedicated to the street patching program designed by engineering (-12% engineering)
 - \$75,000 is dedicated to shared use path maintenance
- **New Arterial Street Construction**
 - Tracked separately and spent on a project by project basis (funded by highway bonds, paid back with levy)

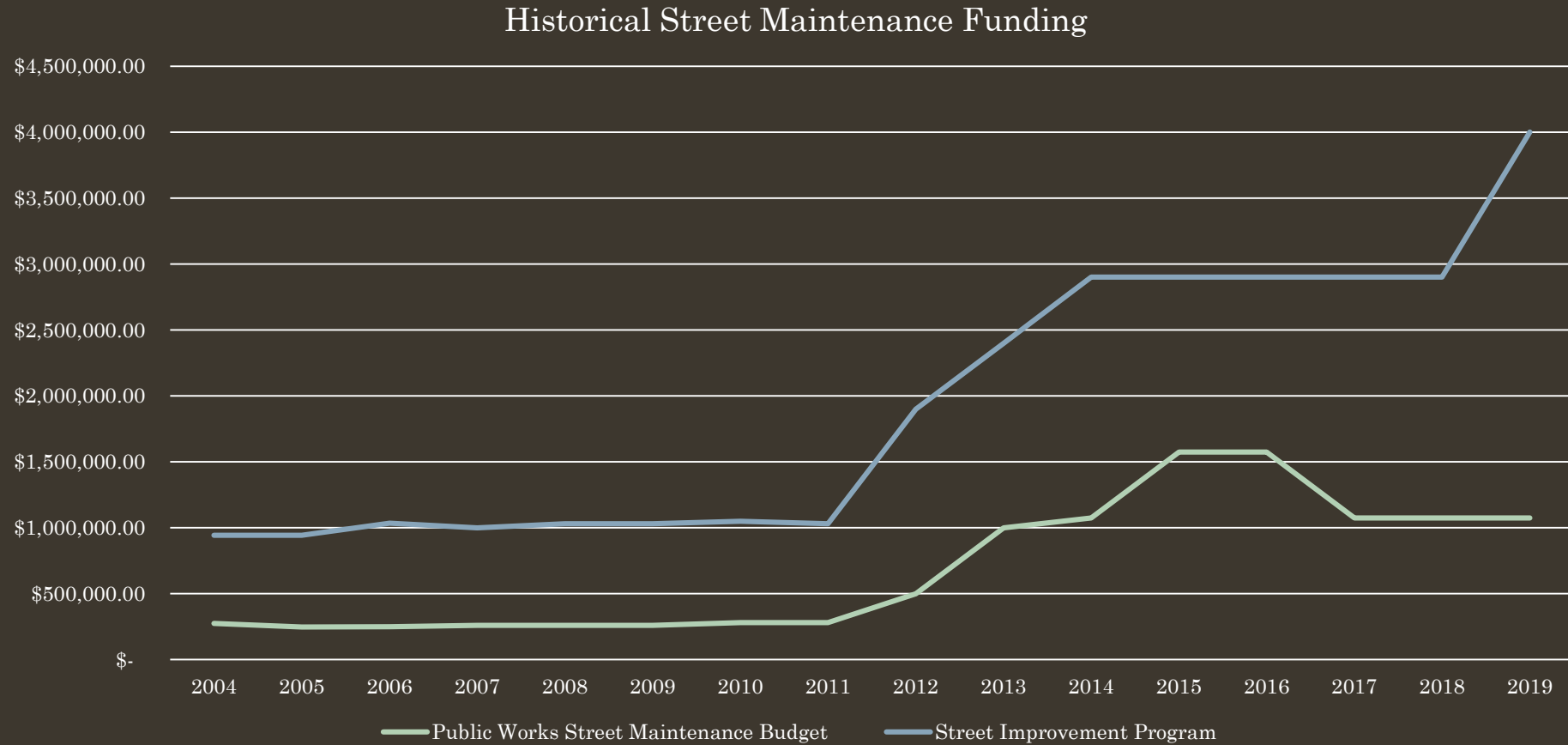
City's Current Pavement Maintenance Financing

Street Maintenance Funding Background:

- Street Improvement Program
 - \$2,900,000 is currently dedicated to the program and paid by sales taxes
 - 12% engineering is subtracted from this overall budget and transferred to engineering as revenue
 - Remaining \$2,552,000 funds the street seal and street improvement projects

City's Current Pavement Maintenance Financing

Street Maintenance Funding Background:



City's Current Pavement Maintenance Financing

Street Maintenance Funding Background:

- Program Initiatives Besides Funding
 - Minimum street section re-engineered in 2010. Thicker, able to withstand more loading.
 - From 2012 budget on, funding levels have increased to the point tolerable with other city funding priorities.
 - New engineering policy enacted that arterial roads with high ADTs will be constructed with concrete pavement.
 - Going forward, street improvement selection will be driven by asset management data, not ad hoc.

Project History

- City engineering staff performed a basic pavement survey in 2010 using the PASER method. While basic in nature, FEMA did accept this study and provided funding to restore flood damaged roads to the previous or better condition.
- The data collection consumed one staff members time for 6 months
- It was impossible to update after 2010 due to the workload in the department.
- In 2017, council approved a full scale study of every paved street in Minot to build a baseline dataset for a pavement management program.
- The survey was done in October 2017 with analysis taking place in 2018

City's Pavement Conditions

- Statistical Breakdown
 - 405 Branches (Streets)
 - 2,558 Sections (Blocks)
 - 249 Centerline Miles
 - 532 Lane Miles
 - 42,112,382 square feet of pavement

City's Pavement Conditions

City's Pavement Inventory

Table 4 City's Pavement Inventory per Pavement Class

Pavement Class	Centerline Mile	Lane Mile	Number of Sections	Area	% Area
P – Principal Arterial	21.2	53.1	144	3,953,290	9.4%
A – Minor Arterial	39.4	104.6	334	7,676,675	18.2%
C – Major Collector	12.0	25.1	108	2,236,834	5.3%
N – Minor Collector	21.2	42.5	213	3,407,760	8.1%
O – Local	155.1	306.6	1,759	24,837,823	59.0%
Total	248.9	531.9	2,558	42,112,382	100.0%

Table 5 City's Pavement Inventory per Surface Type

Surface Type	Centerline Mile	Lane Mile	Number of Sections	Area	% Area
Asphalt	228.2	479.9	2,374	38,134,163	90.6%
Concrete	19.4	49.3	179	3,668,221	8.7%
Gravel	1.3	2.7	5	309,998	0.7%
Total	248.9	531.9	2,558	42,112,382	100.0%

City's Pavement Conditions

- Analysis Methods:
 - All streets were driven with state of the art pavement survey equipment
 - Arterials were driven in two directions
 - Local streets were driven in one direction
 - 100% of pavement is surveyed in 20 ft. frames. A sample rate of 33% is used.
 - Thus, in a 250 ft. section 1 out of 3 frames is used to provide the condition assessment. Follows ASTM standards for sampling.

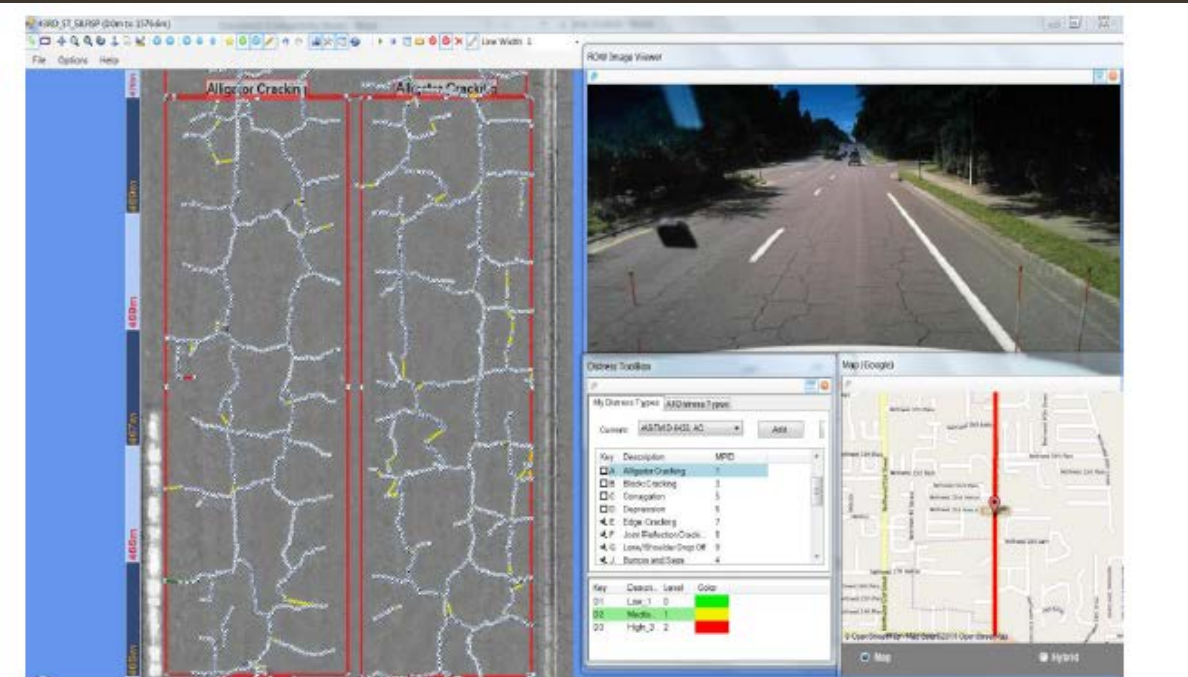


Figure 11 Components of the DE DRM Software

City's Pavement Conditions

City's Pavement Condition Index

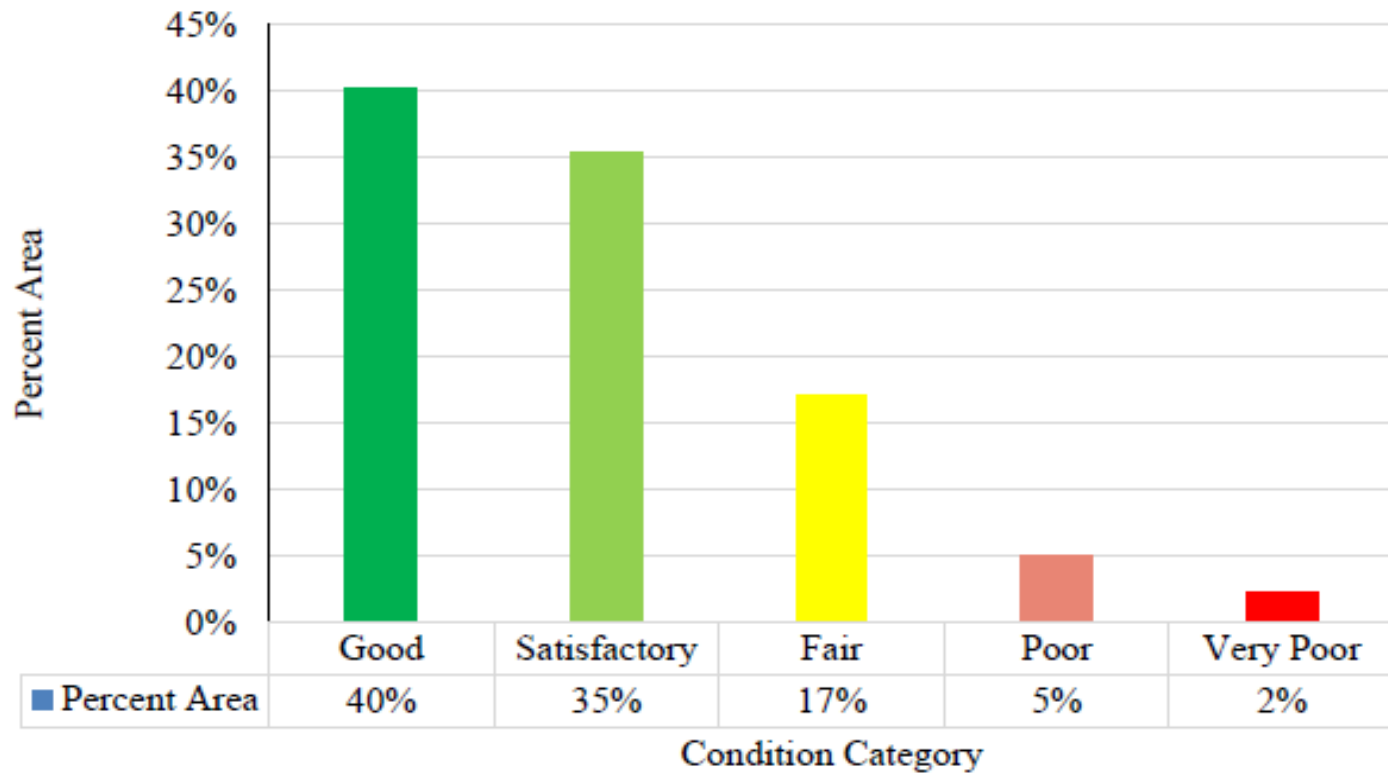


Figure 12 Overall Pavement Condition Distribution

Table 1 City's PCI Categories

Condition Assessment	PCI Value
Good	86 – 100
Satisfactory	71 – 85
Fair	56 – 70
Poor	41 – 55
Very Poor	0 – 40

City's Pavement Conditions

City's Pavement Condition Index

Table 6 Pavement Condition Distribution by Pavement Rank

Pavement Class	Area Weighted Average PCI	Percentage Area				
		Good	Satisfactory	Fair	Poor	Very Poor
P – Principal Arterial	81.1	50%	24%	22%	3%	1%
A – Minor Arterial	82.4	50%	32%	14%	4%	0%
C – Major Collector	80.8	52%	26%	16%	2%	4%
N – Minor Collector	78.9	47%	28%	14%	5%	6%
O – Local	77.8	34%	40%	18%	6%	2%
Total	79.2	40%	35%	17%	5%	2%

Table 7 Pavement Condition Distribution by Surface Type

Surface Type	Area Weighted Average PCI	Percentage Area				
		Good	Satisfactory	Fair	Poor	Very Poor
Asphalt	78.5	37%	37%	18%	5%	2%
Concrete	87.0	71%	17%	5%	4%	4%
Gravel	99.4	100%	0%	0%	0%	0%
Total	79.2	40%	35%	17%	5%	2%

City's Pavement Conditions

City's Pavement Distress Summary

Table 8 Categorization of Observed Pavement Distresses

Distress Category	Example Distresses	Percentage of Observed Distresses
Load Related	Asphalt pavement distresses such as rutting and alligator cracking. Concrete pavement distresses such as corner breaks and divided slabs.	22%
Climate/ Durability Related	Asphalt pavement distresses such as weathering, longitudinal and transverse cracking, and block cracking. Concrete pavement distresses such as joint and corner spalling and joint seal damage.	71%
Other	Pavement distresses such as bleeding, patching, and slippage cracking for asphalt pavements. Popouts and scaling for concrete pavements.	7%

City's Pavement Conditions

City's Pavement Condition Summary

Good News:

- 75% of the City's pavement is in good or satisfactory condition
- The City's pavement has an overall Pavement Condition Index (PCI) of 79 in 2018
- The City's arterial network is generally well maintained

Bad News:

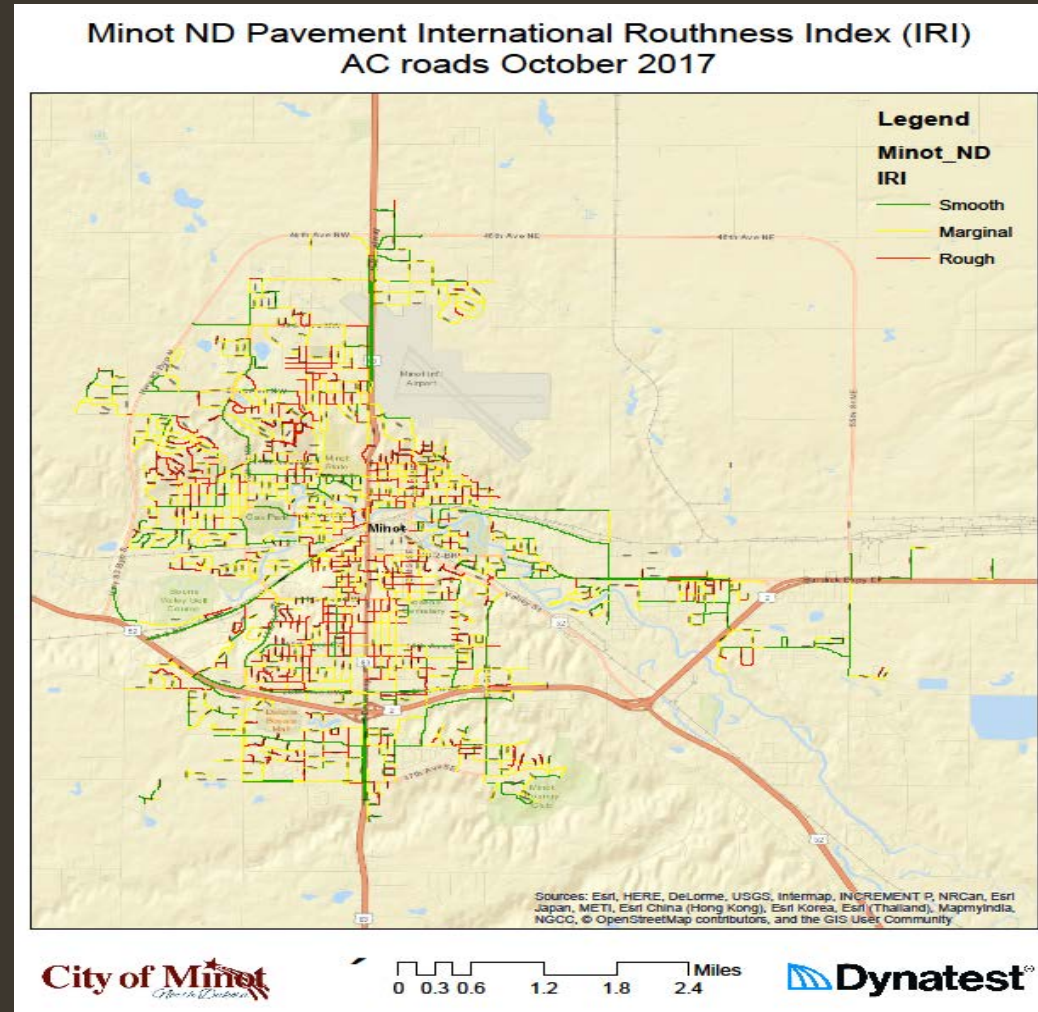
- Local streets are in worse shape and need significant funding to rehabilitate
- On average, the City is losing 2 PCI points/year with current funding levels
- Majority of pavement distress is weathering related (lack of sealing)
- Majority of asphalt pavement ride quality is marginal or rough

City's Pavement Conditions

City's Pavement Condition Summary

A note about roughness:

- A pavement could have a good or satisfactory condition, but may have a high roughness score
- Most of citizen complaints come from roughness issues
- Patch after patch after patch will cause these issues, as will manholes, gate valves, and service line settlements
- Mill and overlay construction can solve these issues, but are twice the cost of a chip seal.



Financial Planning

M & R Budget Analysis

- Future M&R financial analysis can be performed based on different funding scenarios. Staff chose these scenarios to analyze:
 - Effect of current \$3M budget
 - Required budget to maintain PCI of 77
 - Effect of performing no major or global work (street patching only)
 - Required budget to eliminate major M&R backlog in 5 years
 - Effect of City's projected budget increase over 5 years

Financial Planning

Assumption for Analysis

- 2019 PCI will start at 77 based on funding
- Critical PCI set at 75, after which there is a rapid decline in PCI for a roadway
- Software prioritizes any safety M&R work first, then localized preventative M&R (patching). Then global (street sealing), Major M&R above 75 PCI, then Major M&R below 75.
 - Using this priority of projects the funding is further prioritized by street rank
 - Also by proximity to critical PCI. A street with a 65 PCI is ranked higher than a 10 PCI
- Costs for budgeting and planning are taken from actual bid projects.
- Unit costs are gradually increased as the PCI decreases.
- Unit costs are higher for arterial and collector streets to account for added work.
- 3% inflation was used in all budget analyses

Financial Planning

5 Year Budget Scenario Analysis

Table 17 Estimated Five-Year Roadway Pavement Major M&R Budget Costs

Budget Scenario / Cost breakdown	Total Funded M&R	Major M&R Backlog ¹	Total five-year Cost ²	Cost Differential	Annualized Agency Cost	PCI
Current Budget (~\$3M/Yr)	\$14.8M	\$50.1M	\$64.9M	Baseline	\$13.0M	75.4
Maintain Current PCI (~\$5.9M/Yr)	\$29.6M	\$32.3M	\$62.0M	-\$2.9M	\$12.4M	79.6
No Major or Global Work (~\$400k/Yr)	\$2.0M	\$77.6M	\$79.6M	\$14.7M	\$15.9M	69.5
Eliminate Backlog in 5 Yrs (~\$11.6M/Yr)	\$57.2M	\$0.0M	\$57.2M	-\$7.7M	\$11.4M	89.0
Projected Budget (\$3.3M/Yr to \$7.4M/Yr)	\$26.9M	\$36.6M	\$63.5M	-\$1.4M	\$12.7M	78.5

- 1) "Major M&R Backlog" equals the lump-sum cost to resurface/reconstruct all pavements at or below the critical PCI value.
- 2) "Total five-year cost" equals the sum of the five-year Major M&R expenditures plus the remaining Major M&R backlog at the end of the five-year analysis period.

Financial Planning

5 Year Budget Scenario Analysis

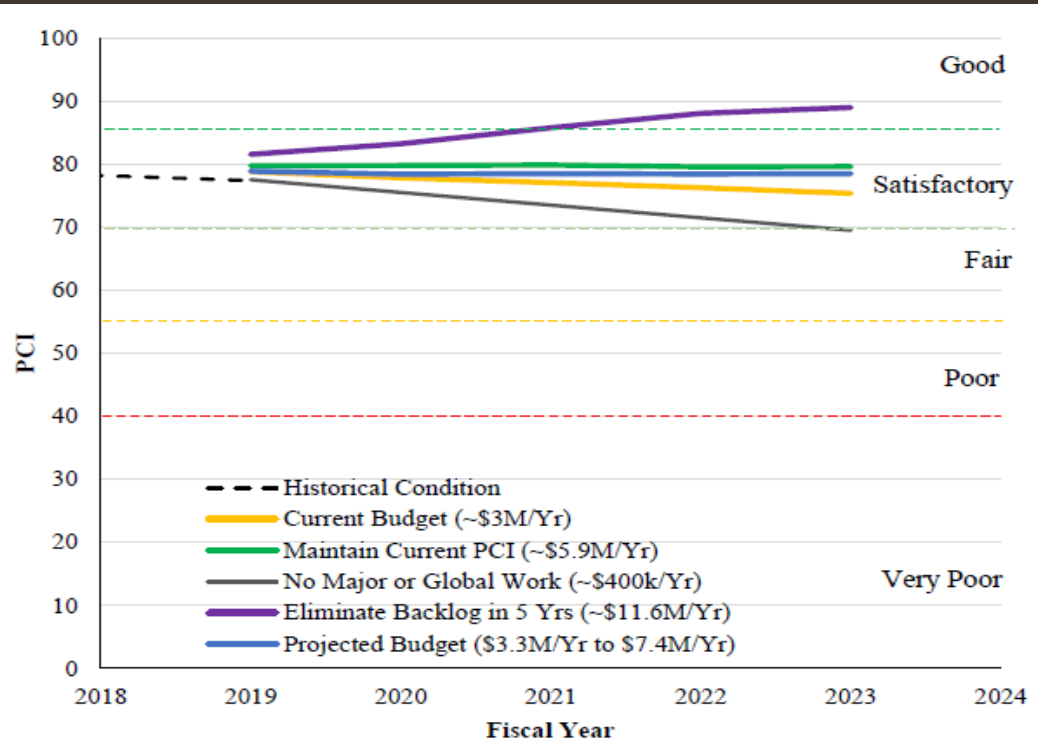


Figure 19 Effect of Budget on Overall Roadway Pavement Conditions

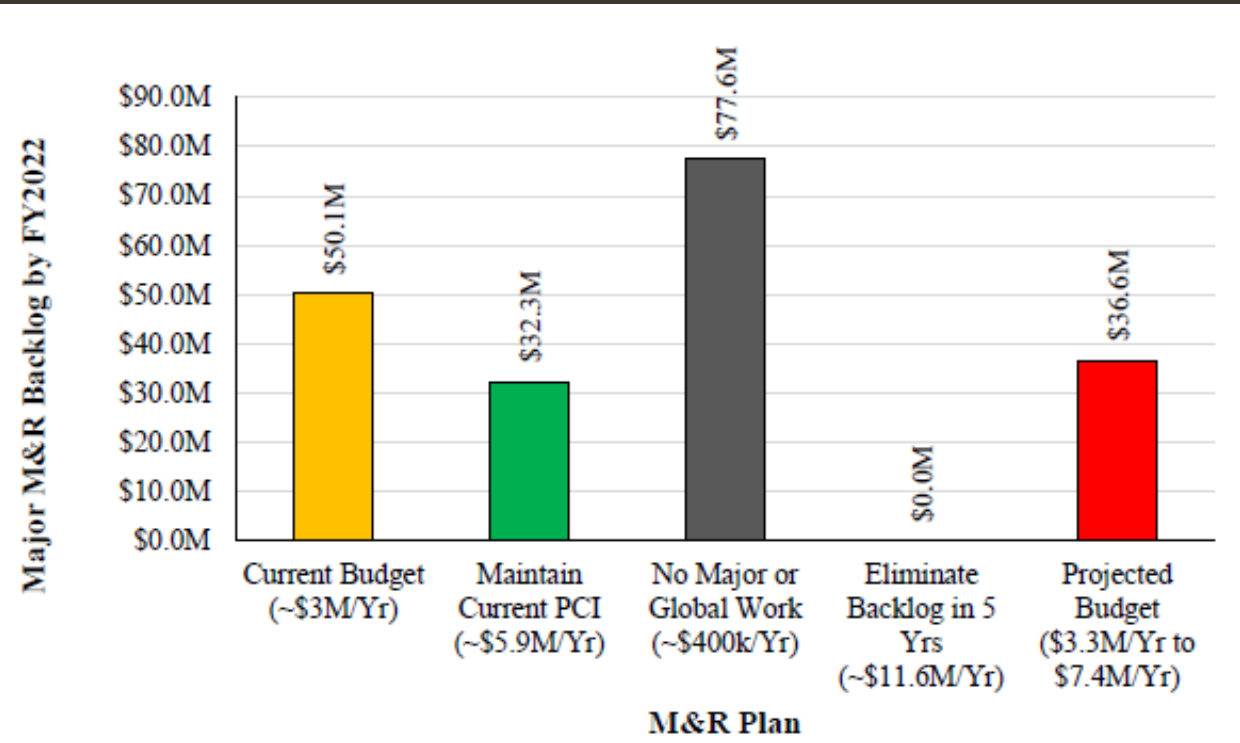


Figure 20 Effect of Budget on Roadway Pavement Major M&R Backlog

Financial Planning

5 Year Budget Scenario Analysis Summary

- The Eliminate Backlog in 5 Year scenario has the lowest annualized cost at \$11.4M/YR
- A budget of \$5.9M/YR is required to maintain the current PCI of 77, anything less and the PCI will fall over the 5 year period.
- The proposed budget of ramping up street maintenance funding from \$2.9M to \$7M over a 5 year period will still show a slight decline in PCI due to timing of funding allocation.

Future Implementation Steps

Steps Moving Forward

- Staff will further review and prioritize future street improvement projects
- Staff will review current paving specifications and standards to look for improvements
- Staff will review other communities pavement management programs for potential solutions
- Staff will bring recommendations back to Council this winter for further discussion