

# City of Bothell Pavement Management Program State of the Streets Report



Northwest Management Systems  
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City of Bothell™

## **Purpose**

The purpose of this report is to assist policy makers in utilizing the results of the City of Bothell's Pavement Management System (PMS). Specifically, this report links the PMS recommended repair program costs to Bothell's current and projected budget to improve overall maintenance and rehabilitation strategies. This report assesses the adequacy of current and projected revenues to meet the maintenance needs recommended by the PMS program. It also maximizes the return from expenditures in the following methods:

- Implementation of a multi-year road rehabilitation and maintenance program,
- Development of a preventative maintenance program; and
- Selection of the most cost effective repairs.

This report assists the City of Bothell with identifying maintenance priorities specific to the needs of the city. This study examines the overall condition of the road network and highlights options for improving the current network-level Pavement Condition Index (PCI). These options are developed by conducting speculative analyses using the City of Bothell's PMS database. By varying the budget amounts available for pavement maintenance and repair, different funding strategies are introduced which can impact the city's roads over the next six years.

## **Pavement Condition (2016)**

The Pavement Condition Index, or PCI, is a measurement of pavement grade or condition and ranges from 0 to 100. A newly constructed road would have a PCI of 100, while a failed road would have a PCI of 25 or less. Bothell's current average Pavement Condition Index is 69, placing it in the top of the "Good" Condition Category, with Arterials at 71 and Locals at 66.

## **Present Cost to Repair the Road Network Decision Tree**

The City of Bothell's Pavement Management System (PMS) is designed to achieve an optimal network PCI in the low 80's, which is in the "Excellent Condition" category. In other words, the system will recommend maintenance treatments in an attempt to bring all of the roads in Bothell to an "Excellent Condition", with the majority of the roads falling into the low 80's PCI range. The current goal of the Bothell program is to bring the overall average PCI for Arterials to 80.

59% of Bothell's roads have a PCI between 70 and 100, which are in the "Excellent to Very Good Condition" category. Why then, does it cost so much to repair the city's roads, and why bother improving them?

The cost to maintain and repair pavement depends on its current PCI. In the "Excellent to Very Good Category", it costs very little to apply a preventive maintenance treatment such as Crack Sealing, spot patching or slurry seals for local streets, which can extend the life of a pavement by correcting minor faults and reducing further deterioration. Treatments of this sort are applied before pavement deterioration has become severe.

26% of the city's road network falls into the “Good Condition” category. Pavements in this range show some form of distress or wear that require more than a life-extending treatment. By this point, a well-designed pavement will have served at least 75% of its life and the quality of the pavement has dropped by about 40%. The road surface may require a 2” Mill and Fill Overlay, or on local streets a slurry seal, that may include some patching.

The remaining 15% of Bothell’s road network falls into the “Fair to Poor Condition” or “Very Poor Condition” PCI ranges. These pavements are near the end of their service lives and often exhibit severe forms of distress such as potholes, extensive cracking, etc. At this stage, a roadway usually requires either a 2” Mill and Fill Overlay with patching or reconstruction depending on condition. The costs for these treatments range from about \$40 per sq. yd. to \$100 per sq. yd.

**Decision Tree for the City of Bothell (2017)**

<b>PCI Range</b>	<b>Treatment</b>	<b>Cost Per Sq. Yd.</b>
<b>70 – 100*</b>	Spot Patching, Crack Seals or Slurry Seals	\$3 to \$5.50
<b>69 – 50**</b>	Slurry or Chip Seals	\$5.50 to \$9
<b>69 – 50</b>	2” Mill and Fill Overlay or Slurry Seal with patching	\$10 - \$42
<b>49 – 25</b>	2” Mill and Fill Overlay with patching	\$42 - \$65
<b>24 – 0**</b>	Reconstruction	\$95 - \$100

\*Spot Patching or Crack Sealing can be both applied in this Range. Slurry Seals will only be applied on Local Streets.

\*\* Slurry Seals will be applied on Local Streets, while Chip Seals will be applied on Arterials and Collectors.

\*\*\*Some local streets might be candidates for thin overlay with patching at this PCI range. Extensive sub-base and structural analysis would need to be performed on these candidates to ensure that the correct treatment is being selected

To provide more detail to street condition and respective repairs the photos below provide examples of pavement deficiencies from streets and the appropriate repair methods.

## Preventive Maintenance



### **Crack Seal or Slurry Seal- The Street has a PCI of 85.**

This pavement is generally in good condition and would benefit from crack sealing to prevent water from entering the sub base and causing further deterioration.

## Overlay & Reconstruction



### **Overlay – This Street has a PCI of 64**

This pavement is in good condition with a few areas of alligator cracking that should be structurally patched before it is resurfaced with a 2" Mill and Fill overlay.



**Overlay – This Street has a PCI of 42**

This pavement is in very poor condition with areas of alligator cracking that should be structurally patched before it is resurfaced with a 2 inch Mill and Fill overlay with patching.



**Reconstruction – The Street has a PCI of 17**



### **Reconstruction – The Street has a PCI of 17 (Close Up View)**

This pavement is in very poor condition with severe alligator cracking, potholes, and areas of settlement. This street should be rubblized, regraded, and reconstructed with new sub base material and asphalt pavement.

## **Future Expenditures for Pavement Maintenance**

It is estimated that the City of Bothell will spend \$3 million a year or \$60 Million on pavement rehabilitation and reconstruction during the next twenty years (2017 - 2036), assuming current funding levels. Spending on Arterials will be \$53.6 Million, with Locals getting \$6.4 Million

## **Impacts of Projected Funding Levels**

With the existing budget over the next twenty-year period, the condition of the network deteriorates, with the average PCI decreasing from 69 to 56. Arterials will increase to 80, while Local streets will decrease to 36. The amount of "deferred" maintenance increases from \$23.9 million to \$79.4 million.

Deferred maintenance consists of pavement maintenance that is needed, but which cannot be allocated due to lack of funding. Shrinking budgets have forced many Puget Sound Area cities and counties to defer much-needed road maintenance. By deferring maintenance, not only does the frequency of citizens' complaints about the condition of the network increase, but the cost to repair these roads rises as well.

## **Budget Needs**

Based on the principle that it costs less to maintain roads in the "Excellent to Very Good Condition" than to repair those that are in the "Fair to Poor Condition", the City of Bothell' Pavement Management System strives to develop a maintenance strategy that

will first improve the overall condition of the network to an optimal PCI level. This PCI level is dependent upon the City's maintenance and rehabilitation policies as delineated in the predetermined preventative maintenance and rehabilitation decision trees. Bothell's decision trees are described in more detail on page 3. These decision trees systematically assign a specific treatment dependent on the PCI and types of distress found on the pavement. For Bothell, this optimum PCI level is in the 80's. Although the average PCI for the city is 69, which is in the top of the "Good Condition" category, a portion of the network suffers from load-related distresses.

The first step in developing a cost-effective Maintenance and Rehabilitation (M&R) strategy is to determine, assuming unlimited revenues, the M&R "needs" of Bothell's road network. Using the PMS analysis module, maintenance needs over the next twenty years were estimated at over \$126.6 million if Bothell follows the strategy recommended by the PMS program to increase the average network PCI to 80. If however, no maintenance is applied over the next twenty years, already distressed roads will continue to deteriorate, and the network PCI will drop to 26. The results of the budget needs analysis are summarized in the table below.

**Table 2 - Summary of Results from Budget Needs Analysis (\$ Millions)**

Year	2017 -2021	2022-2026	2027 - 2031	2032 -2036
Annual PCI with Treatment	69 81 82 83 83	82 82 81 80 83	82 81 81 80 80	80 80 81 81 80
Annual PCI without Treatment	69 67 65 63 61	58 56 54 52 49	47 45 42 40 37	35 33 30 28 26
Budget Needs (\$) for each of a five year period.	\$60.9	\$20.8	\$13.2	\$31.7

Table 2 (above) shows the level of expenditures required to raise Bothell' pavement condition to an optimal network PCI of 80 and eliminate the current maintenance backlog. The results of the budget needs analysis represent the ideal funding strategy recommended by the City of Bothell's PMS. Of the \$126.6 million in M&R needs shown, \$39.8 million is earmarked for preventative maintenance or life-extending treatments, while \$86.8 million is allocated for light and heavy rehabilitation and reconstruction treatments.

## Budget Scenarios

Having determined the maintenance needs of the city's road network, the next step in developing a cost-effective maintenance and rehabilitation strategy is to conduct a what-if analysis. Using the PMS budget analysis module, the impacts of two budget "scenarios" can be evaluated. The program projects the effects of the different scenarios on pavement condition (PCI) and deferred maintenance (backlog). By examining the effects on these indicators, the advantages and disadvantages of different funding levels and maintenance strategies become clear. The following two scenarios were run for the purposes of this report:

**Scenario 1 (\$126.6 million over 20 years) All Streets Program - Bring PCI to 80 in 20 years** - The budget for each year is identified in the budget needs analysis. This scenario will allow the city to reasonably improve the condition of the network to a PCI of 80, assuming that existing repair and renovation practices as described in the maintenance and rehabilitation decision trees are utilized.

**Scenario 2 (\$60 million over 20 years) Current Budget** - The current budget program would maintain spending at \$3,000,000 per year and focus those funds primarily on arterial pavements. Remaining funds would go toward local streets. \$53.6 Million will be devoted to Arterial Streets, while the remainder \$6.4 will be utilized on Locals

### Discussion and Recommendations

Figure 1 (below) illustrates the change in PCI over time for the two budget scenarios. Note that Scenario 1, which represents the ideal funding strategy, ultimately achieves a PCI of 80 after six years. By comparison, Bothell' projected current budget, Scenario 2 results in a drop in PCI to 56.

**Figure 1 Pavement Condition Index per Scenario by Year**

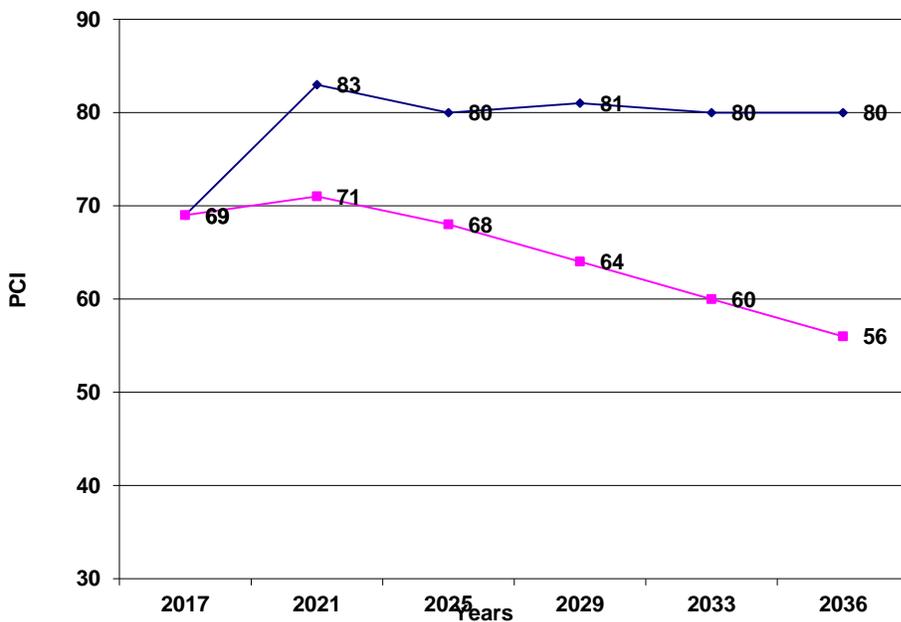
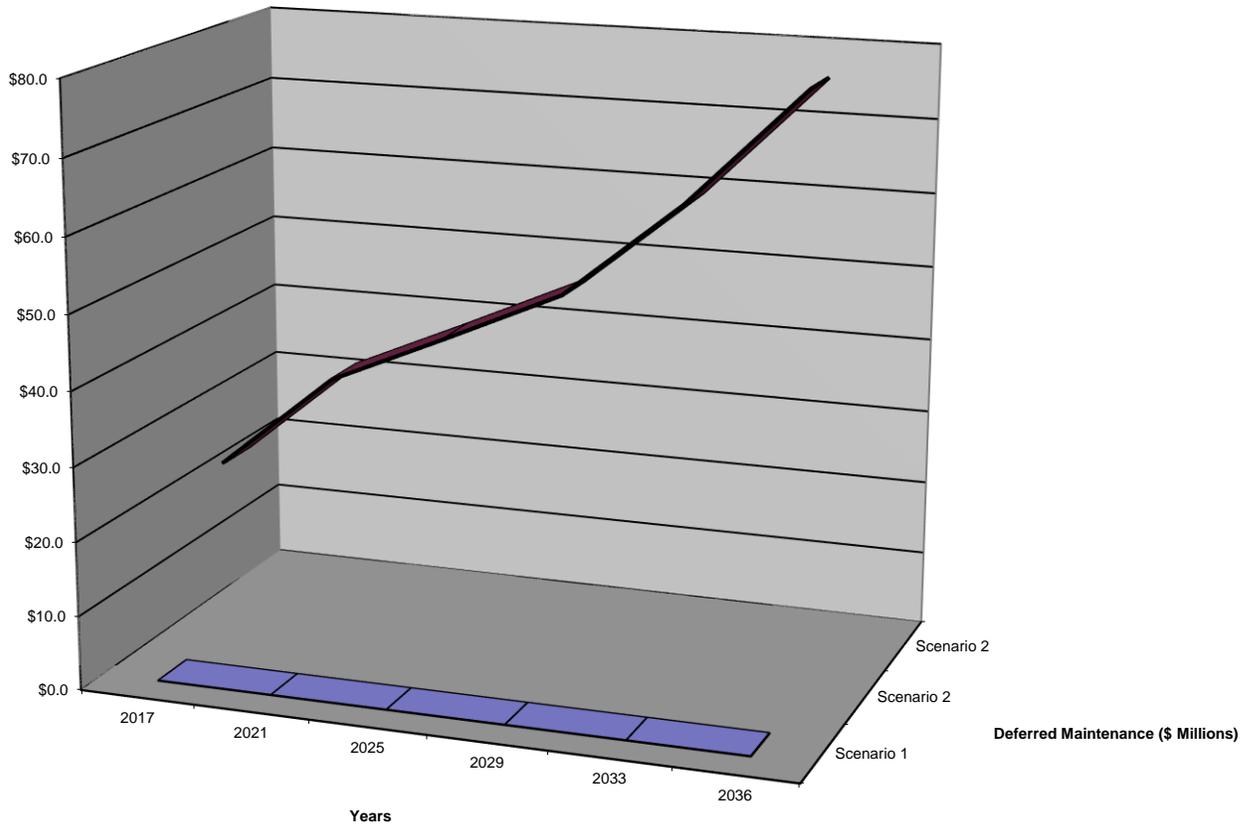


Figure 2 illustrates the change in deferred maintenance over time for the two budget scenarios. Note that Scenario 1 has no backlog of maintenance. The entire backlog for Scenario 2 is found in the Local Streets. There is no backlog for the Arterial streets at the end of the 20 year period.

**Figure 2 Deferred Maintenance per Scenario by Year**



Figures 1 and 2 illustrate that Bothell's projected budget as outlined in Scenario 2, though increased by the passage of the voter initiative, is still insufficient to preserve the local street network at its current condition. In addition, the increase in deferred maintenance will result in higher costs to repair the local streets in the future.

## **Summary**

In summary, the City of Bothell has a substantial investment in their roadway network. Overall, 59% of the City's network is in the "Excellent to Very Good Condition" category. However, the remaining 41% of the streets require a significant amount of money to bring them into the "Excellent to Very Good Condition" category. With Bothell' projected budget of \$60 million for the next twenty years, the average PCI of the network is expected to decrease, with a steadily increasing deferred maintenance backlog. The high maintenance backlog will result in increased future costs because revenue intensive treatments (reconstruction) will unfortunately be necessary when less expensive feasible treatments (crack, slurry or chip seals or overlays) could have prevented further deterioration.

## **Recommendations**

It is recommended that the City of Bothell continue to increase funding for street maintenance and implement more rigorous preventative maintenance strategies. With the passage of the voter initiative in November 2016, the City has begun to adopt a more proactive response to the growing pavement maintenance need. The PMS results show that total expenditures of \$60 million over the next twenty years will result in the City dropping an overall PCI from the current 69 to 56. Arterials will increase to 80, while Locals will drop to 36. This is an improvement from prior years because of the additional investment of \$34 million dollars over 20 years that is devoted to pavement maintenance by the passage of the voter initiative. This is the current Budget Option. However, the result of this scenario continues to show a decreasing PCI on Local Streets and an increasing deferred maintenance cost. The staff proposed scenario from last year's report was adopted by the City. This scenario allowed the City to increase revenue to pavement maintenance and adopt a preventative maintenance program, which will save the City from spending money on more costly rehabilitation treatments in the future.

The City of Bothell has made an important investment in its street network with the passage of the voter initiative in November 2016. This additional revenue will be spent on fixing the aging streets, while also implementing a cost saving preventative maintenance program. However, the City still has an unmet need for pavement rehabilitation and maintenance over the next twenty years on local streets. A down payment has been made to improve the streets in Bothell. This needs to be applauded. Going forward, the City needs to continue to find additional revenue to supplement the down payment that was passed by the voters in November 2016.