BATAVIA’S STATE OF STREETS
STREET MAINTENANCE PROGRAM REPORT

September 2015
**Purpose**
The purpose of this report is to provide the City Council with information on the City of Batavia’s Street Maintenance Program. Specifically, this report links the street maintenance to the City of Batavia’s projected budget to improve overall maintenance and rehabilitation strategies. This report also assesses the adequacy of current expenditures to meet the maintenance needs recommended by city staff.

**Background**
The City of Batavia’s Public Works Department has the important responsibility of maintaining a very significant and valuable asset—the City’s street network. Roads are vital to our community. Roads allow goods to be transported around the city and ensure people can safely get to work, school, the stores as well as visit friends and family. They are essential to the economic prosperity of the city and to the everyday lives of the thousands of people who use them. Ensuring the road network functions efficiently and safely is therefore a priority for the City of Batavia. The City is currently preserving approximately 117 centerline miles of streets (1,988,000 Square Yards) averaging 29 feet in width. **The replacement value of the city street system is approximately – $200 million based on today’s cost to reconstruction.**

Over the last three decades, the street network has aged and grown. Since 1990, the city has added approximately 50 percent more residents to the City. According to census, the City of Batavia had 17,076 residents in 1990 and currently has 26,318. To accommodate the population...
growth, City street system almost doubled in size during last 25 years. As these new roads are approaching their end of service life, they will require major resurfacing or reconstruction in addition to the streets that were resurfaced in the same period. As a result, the maintenance of the existing streets has become increasingly challenging and costly. The graph above illustrates that in last 20 years (1995 to 2015), the city has been resurfacing approximately 69,000 square yards of streets on a yearly basis. Typical resurfacing on city streets performs satisfactorily on an average for 20 years. Resurfacing on heavily traffic streets such as Wilson Street will need resurfacing more frequently 20 years. Whereas, resurfacing on a typical cul-de-sac may be extended to 25 years. Hence, to resurface city streets on an average every 20 years, the City should have resurfaced approximately 100,000 square yards of streets every year. However, due to less than required resurfacing over last 20 years, the City now has a backlog of 620,000 square yards of streets that needs immediate attention such as resurfacing, reconstruction, or some extensive maintenance work. The cost of just resurfacing alone for these backlogged streets is around $13 million dollars. On the other hand, to get back to 20 year resurfacing life cycle, the City needs to start resurfacing approximately 100,000 square yards of pavement starting in 2016. This change will cost the City approximately $2 million dollars annually instead of $1.1 million that city is currently funding to maintain the street network.

The Engineering division will take proactive steps towards the implementation of tools that would help the department provide the best possible street conditions under these demanding circumstances. The implementation of a Pavement Management System (PMS) is an example of one such tool. The PMS is one tool the Engineering Division will use to monitor the condition of the city’s street network. Accurate and current pavement conditions along with pavement work history data provides a very powerful tool for identifying and prioritizing maintenance and rehabilitation needs, preparing long-range pavement repair programs, and estimating repair quantities for any resulting projects. In 2011, the City used IMS® to collect city’s street system data which will be the basis of city’s future pavement management system. The data collected at that time was not implemented completely and now getting old. Hence, staff will be utilizing that data to develop a new pavement management system which will be easily retrievable.

This report is prepared to provide an overview of the pavement inventory data and maintenance and rehabilitation plan that Engineering Division will be implementing. This report is subdivided into the following modules:

- **Pavement Management Database Development**
  This portion of the report details the structure of the pavement database. Included are the details of how the information is obtained as well as specific information regarding the rating system used in collecting the pavement condition data.

- **Pavement Inventory and Condition**
  This section of the report presents the current inventory data of the citywide pavement system. The existing pavement condition data as well as the pavement performance model are also described in this section.
• **Maintenance Program Plan Development**
  
  This section presents the results from the development of a preliminary list of maintenance and rehabilitation needs identified by the pavement management system.

**Pavement Management Database Development**

Developing the pavement management database is critical to the creation of a successful pavement management system because it is the first step to ensuring the efficient storage and retrieval of network inventory information for reports, maps, and analysis. With the appropriate roadways selected for inclusion in the database, the streets are divided into sections for database entry. Also, inventories will be performed to define the physical characteristics of the streets being managed.

The objectives of this task are to obtain the existing structure, age, physical dimensions, physical locations, and other characteristics of the streets being evaluated. During this activity, employees of the city will obtain available information on the street network. The first decision that was made with respect to network inventory was which pavements should be included in the pavement management system. The city elected to include all roadway sections within the city planning boundary.

**Rating Procedure**

A Condition survey of the city streets is conducted annually. Each year the pavements of approximately one-third of the city streets are evaluated. Based upon the resources of the city and the intended use of the pavement management system, the rating method chosen for the city provides a simple numeric number which is widely known as Pavement Condition Index (PCI). The PCI was developed to provide engineers with a numerical indication of overall pavement condition. The PCI number is a number from 0 (failed) to 10 (excellent). After driving the entire length of the section, staff determines the predominant severity of each distress present and then assigns the PCI number. In general terms, pavements above a PCI of 6 to 7 that are not exhibiting significant load-related distress will benefit from preventive maintenance actions, such as crack sealing and surface treatments. Pavement with a PCI of 4 to 6 may require major rehabilitation, such as overlay. Often, when the PCI is less than 4, reconstruction is the only viable alternative due to substantial damage to the pavement structure. The following figure shows a series of pavement photographs with associated PCI values.

Street defects can occur due to the two main distress mechanisms—load and climate. Load-related distresses indicate that the pavement is not strong enough to support the loading or traffic conditions. In that case, the pavement must be made stronger, and total reconstruction or thick overlays are required. Distresses caused by climate indicate that the pavement has dried out or has been damaged by environmental factors. Repairs for these problems are usually less expensive; techniques include thin overlays, sand seals, or crack repair.
<table>
<thead>
<tr>
<th>Typical Pavement Surface</th>
<th>PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Typical Pavement Surface Image" /></td>
<td>10</td>
</tr>
<tr>
<td><img src="image2" alt="Typical Pavement Surface Image" /></td>
<td>6</td>
</tr>
<tr>
<td><img src="image3" alt="Typical Pavement Surface Image" /></td>
<td>5</td>
</tr>
<tr>
<td><img src="image4" alt="Typical Pavement Surface Image" /></td>
<td>2</td>
</tr>
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</table>
**Pavement Inventory and Condition**  
The pavement area in the City of Batavia street database is approximately 2 million square yards. Figure 1 shows the area of pavement that will be evaluated by functional classification: arterial, major collector, minor collector, and local streets.

![Pie chart showing pavement classification](image)

Figure 1: Street Classification by functional classification

**Existing Pavement Condition**  
In 2011, an extensive condition data collection was conducted by an outside consultant. Based on that condition data and recent inspections by City staff, Batavia’s street system has a PCI of 5.6. Simply put, City of Batavia’s street condition is “Below Average” Condition. To make the City streets an “average” condition of PCI 6, the system will require extensive maintenance. Unless proactive maintenance is done, more streets will fall from “Below Average” condition to “poor” condition. Once a street moves into the “poor” category, sometimes reconstruction is the only viable option. It should be noted that reconstruction cost is at least 3-5 times the cost of resurfacing a street depending on extend of scope. Hence, in coming years, the City will need to provide increased funding to preserve the $200 million investment that the City has already made.
Table 1: Summary of street network

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Centerline-Miles</th>
<th>Lane-Miles</th>
<th>No. of Management Sections</th>
<th>% of Total Pavement Area</th>
<th>Average Pavement Condition Index (PCI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial</td>
<td>7</td>
<td>17</td>
<td>17</td>
<td>6%</td>
<td>5.6</td>
</tr>
<tr>
<td>Major Collector</td>
<td>10</td>
<td>25</td>
<td>40</td>
<td>9%</td>
<td>6.8</td>
</tr>
<tr>
<td>Minor Collector</td>
<td>12</td>
<td>29</td>
<td>31</td>
<td>10%</td>
<td>3.9</td>
</tr>
<tr>
<td>Local Streets</td>
<td>88</td>
<td>211</td>
<td>609</td>
<td>75%</td>
<td>5.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>117</strong></td>
<td><strong>282</strong></td>
<td><strong>697</strong></td>
<td><strong>100%</strong></td>
<td><strong>5.6</strong></td>
</tr>
</tbody>
</table>

Figure 2 shows Batavia street conditions in terms of poor, fair, marginal, good, very good and excellent. Further, the type of maintenance or rehabilitation that is generally recommended on the respective pavements based on their condition is identified. In this figure, preventive maintenance refers to activities such as patching, crack sealing, and surface treatments.
Pavement Performance Model
Pavement management involves forecasting needs based on pavement performance predictions. By determining the rate at which the condition will change over time, a meaningful life cycle cost analysis can be performed to compare the cost of preventive maintenance versus rehabilitation activities. In addition to identifying the most economical type of repair, the optimal time for applying treatments can be estimated. Typically, the optimal repair time is the point at which a gradual rate of deterioration begins to increase at a much faster rate. It is critical to identify this point in time to avoid higher maintenance and rehabilitation costs caused by excessive deterioration.

Many methods of predicting conditions are available, but the method that is used for the City’s analysis involved organizing the pavement network into “one single family”. The future performance of an individual section can then be predicted by using a section’s condition information relative to the curve. A performance curve for the overall index is developed for use in reporting the overall condition of the street network and for use in prioritizing maintenance and rehabilitation projects.

![Figure 3: Pavement Prediction model for the streets of Batavia](image)

### MAINTENANCE PLAN DEVELOPMENT

#### Treatment Types
The city’s current street maintenance practices vary from project to project. Historically the City of Batavia’s street program consists of several categories of work intended to address a variety of maintenance considerations on a number of different pavement types, ages and conditions. These programs generally fall into three major forms of work, 1) preventive maintenance, 2) resurfacing and 3) reconstruction. The method selected to be utilized on individual portions or sections of street within the city are tailored to implement the most cost effective treatment...
which will gain the greatest enhancement and extension of the useful life of the pavement. Generally, preventive maintenance keeps the “good roads in good condition” and provides safer roads to the motoring public. Preventive maintenance also reduces the number of crashes and negative customer feedback such as potholes. Both the rehabilitation and renovation program such as resurfacing provide better ride quality and eliminate safety issues along the streets.

The following is a brief summary of each of the programs involved in the street maintenance program, the phases of work involved in each of these programs, and discussion on the positive benefits gained by using a particular technique.

PREVENTIVE MAINTENANCE TYPE PROJECTS:
Joint and Crack Sealing Program
The Joint and Crack Sealing Program involves the cleaning and sealing of any cracks, voids or joints in the street pavement two inches (2”) in width or less, with an asphalt cement reinforced by polypropylene fibers. A companion contract to this work is the cleaning and sealing of selected pavements, utilizing a rubberized crackfilling product. The use of the rubberized product allows greater flexibility in managing cracks and joints on sections of pavement which experience a high degree of vehicular turning movement or pedestrian traffic. Crackfilling is a very cost effective measure and is performed routinely to keep water from getting into the pavement. It helps keep the pavement in good condition and interrupts the propagation of cracking.

Micro-Surfacing Program
Micro-Surfacing involves the installation of a thin, latex modified, asphalt wearing course. This product provides greater flexibility toward addressing pavement defects on streets where conventional overlays would not be cost effective at this time. This method is also beneficial on pavements which require work due to surface imperfections, without causing excessive build up of additional material on the pavement cross section.

Bituminous Patching Program
This program provides various size and depths of finish contracted patches on selected asphalt streets. This strategy is used on streets that have a moderate condition rating due to isolated defects but are otherwise good pavements. These streets do not warrant resurfacing but can be substantially up-graded by patching the problem areas and then possibly rejuvenating and/or crackfilling. Additional life expectancy and a better ride will result from this maintenance strategy.

Preservative Rejuvenating Agent Program
The Preservative Rejuvenating Agent Program involves the application of a sprayed on petroleum base product which provides an environmental seal of existing asphalt pavements in order to improve the durability and thus achieve longer service life between more extensive rehabilitation projects. The function of the rejuvenating agent is to replace the volatile components of the asphalt cement that are lost during the manufacturing process of the aggregate asphalt mixture and through the normal aging and oxidation processes caused by nature.

Restorative Rejuvenating Agent Program
The Restorative Rejuvenating Agent Program involves the surface application of a sprayed on, restorative rejuvenating agent intended to provide an environmental seal of the asphalt surface
and to also fill surface voids that have developed as part of the roadway's aging process. It is a petroleum base product that replaces the volatile components of the asphalt which are lost during normal aging process but also includes the application of sand at a critical point in the application technique which allows the sand to become incorporated into the product and thus the roadway itself. It is this action that fills small cracks in the pavement when conditions warrant.

Concrete Street Repair Program
This program rehabilitates concrete streets by the full depth removal/replacement of failed concrete panels. Also included in this project are various associated items of work including removal and replacement of some driveway aprons, curbs and gutters, sidewalks, the adjustment or replacement of utility frames and lids as necessary, along with traffic control and protection and the restoration of the parkways.

Bituminous Seal Coat Program
The Bituminous Seal Coat Program consists of application of an emulsified asphalt product which is then covered by small diameter aggregate. Generally speaking, this program is the old tar and chip work performed on rural type or low traffic pavement cross sections. This program also includes grading, base repair, sweeping and the traffic control.

RESURFACING TYPE PROJECTS:
Mill and Overlay Program
Mill and Overlay Program involve the rehabilitation of streets by grinding off the top layer of pavement and relaying a new asphalt surface. Also included in this work is segmental repair of curbs and gutters, patching of the existing asphalt base, the adjustment or replacement of utility frames and lids, along with traffic control and protection and restoration.

The second type of project in this category involves the renovation of concrete streets. In this work an existing concrete street which is experiencing surface distress is overlaid with asphalt, thereby using the existing concrete as a base. This project takes advantage of the strength of the existing concrete while providing an improved riding surface. Also included in that work are replacements of driveway aprons, sidewalk, the adjustment or replacement of utility frames and lids, traffic control and protection and parkway restoration.

Several other techniques such as white topping (concrete overlay on asphalt street) or HSO (Heat Scarify and Overlay) can be utilized to renovate asphalt streets.

RECONSTRUCTIVE TYPE PROJECTS:

Street Reconstruction Program
The Street Reconstruction Program includes the reconstruction of streets that are beyond preventative, rehabilitative or renovation type maintenance operations. The program involves a comprehensive study and redesign, which are more extensive and costly and have greater impact on traffic, residents and business.
The work involved in this program involves major reconstruction of streets using two general methods. The first method, involves the complete removal and replacement of the existing curbs and gutters, driveway aprons, service walks, carriage walks and selected public sidewalk. Also included in this work is the grinding, removal and patching of the existing asphalt surface, the adjustment or replacement of utility frames and lids and the construction of a new asphalt surface, traffic control and protection and restoration.

The second method involves the preservation of the existing curbs and gutters, except for selected replacement of isolated, deteriorated sections and the complete removal and replacement of the pavement structure located between these curbs. Also included in that work are replacements of driveway aprons, sidewalk, the adjustment or replacement of utility frames and lids, along with traffic control and protection and parkway restoration.

**Street Maintenance Plan Development**

Based on the principle that it costs less to maintain roads in good condition than bad, the city staff will strive to develop a maintenance strategy that will first improve the overall condition of the network, and then sustain it at that level. Engineering will implement a 20-year pavement maintenance strategy which starts with a new surface or construction. Preventive maintenance such as crack sealing and patching are performed throughout this maintenance cycle. The pavement condition is evaluated near the end of the 20 year surface life cycle to determine which new surface treatment will be appropriate. If the pavement is suitable, it may be microsurfaced which can extend the pavement life 5 years. When a pavement surface has deteriorated beyond the point of preventive maintenance and rehabilitation, the surface will then need to be replaced or overlaid, beginning a new cycle. The future practice will be to resurface most of the streets every 20 years. In general, the arterial streets such as Main Street or Wilson Street may require resurfacing every 12-15 years. Arterial streets experience the majority of heavy traffic; hence the condition deteriorates faster than that of collector or local streets. As a result, the surface of an arterial street needs to be replaced every 15 years. Collector streets are typically resurfaced every 15-18 years whereas the local streets and cul-de-sacs are resurfaced every 20-25 years.

The City of Batavia streets that have not been resurfaced since 1995 are now eligible for new surface or reconstruction. In addition, the significant numbers of streets which were resurfaced in last twenty years (1995-2015) will require preventive maintenance on a regular basis. Also,
these streets will be reaching the end of the maintenance cycle and need to be resurfaced soon. As a result, more than the usual number of streets needs to be resurfaced or reconstructed in future years.

**RECOMMENDATION**
The City of Batavia has a substantial investment in the street network as evidenced by the replacement cost of approximately $150 million. If sufficient funding is not available for street maintenance, the average condition of the street network is expected to decrease, and the deferred maintenance backlog will increase. A higher backlog will result in increased future costs as more capital intensive treatments (such as reconstruction) will be necessary where less expensive treatments (such as resurfacing, microsurfacing or overlays) are currently feasible.

In light of a backlogged list of streets to resurface while trying to maintain streets in the “average PCI of 6.0” condition, engineering staff evaluated the existing street maintenance strategy and future maintenance costs. Based on a 20 year maintenance strategy, staff recommends the following to the City Council:

- The street maintenance budget need to be increased to $2.65 million dollars annually starting Fiscal Year 2016

  - $2 million will be used to resurface eligible streets every 20 years
  - $650,000 will be used to clear the backlogged streets over the next 20 years

Some of these budget may be supplemented through federal funding through Suraface Transportation Program (STP). For example, currently three major routes in the City is funded for resurfacing, Main Street and Prairie streets are receiving federal grants for reconstruction. The outlined budget requirement option will eventually save money by avoiding costly options such as reconstruction. This will achieve the following objectives:

- Allow the city to improve pavements in the “Average PCI of 6 or above” from the current condition of “below average”
- Reduce the percentage of pavements in the “poor” category
- Maintain an acceptable level of service of the city street network

Without the budget increase, the resurfacing and reconstruction of some streets will be deferred. This will result in three things:

1. Reduced level of service to the City’s residents and businesses
2. Increased future repair cost as deterioration of the pavement base and subbase will continue
3. Will increase the cost of spot repairs such as potholes during and after the winter season

**CONCLUSION**
Public Works is constantly exploring outside funding option and applying for grants while implementing new construction methods, techniques and utilizing products which can meet the challenges of maintaining safe, and ridable street surfaces in the city. Each year brings greater
challenges and new opportunities which are always met with a positive attitude and recognition of our responsibilities to the transportation needs of the community.